EXAMINATION OF EFFECTS OF EXPANDING CITIES ON PERI-URBAN AGRICULTURAL AREAS: IMPLICATIONS ON FARMERS' LIVELIHOODS IN QARABULLI DISTRICT IN THE EASTERN PART OF TRIPOLI – LIBYA

By

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Abstract

Many countries in the southern hemisphere are still in the process of developing. In North Africa to be specific, the development process is bringing about various degrees of land use and land cover changes which are having various levels of impact on people's lives both in urban and peri-urban areas among others. The core causes of these changes vary, but literature indicates that the process of urbanization is the main cause since as cities and town areas urbanization, deforestation, soil erosion and the sale of land by rural farmers are encouraged. Implications of land use and land cover changes are broad and vary across geographies. It is the variations of the impact of such changes that motivated this researcher to conduct this research with the aim of analyzing effects of urbanization and expanding cities on the surrounding agricultural area. The research zeroed in on trying to understand how peri urban farmers and their livelihoods are being impacted by various land use and land cover changes that are emerging from the expansion of Tripoli, the capital of Libya.

This study examined the impact, both positive and negative, that the expansion of Tripoli has had on the livelihoods of these rural households in Qarabulli. It further sought to identify the way affected farmers and households cope and react to the various changes the expansion of Tripoli is exposing them to. The research also looked at the context in which the poor rural households pursue livelihoods, and discussed factors that make their livelihoods vulnerable. The forms of capitals, named livelihood assets, available to the rural households are also examined. The livelihood outcomes of the farmers, the strategies and the coping measures employed by affected peri urban farmers are identified and discussed.

Through the utilization of a mixed methods research approach, a mix of qualitative and quantitative data were collected, and analyzed. Data collection was done in two stages. The first stage looked at land use and land cover changes through a critical analysis of land degradation and this was done using Remote Sensing and GIS techniques. Image

Classification, multi-temporal Landsat TM, and ETM+ imagery were used to determine and detect land use and land cover changes during the periods 1986 to 2009. The second stage of the research data collection process, collected qualitative data using Participatory Rural Appraisal (PRA) methods to explore farmers' experiences and feelings on how the land use changes are impacting their livelihoods.

Through the use of Remote Sensing and GIS techniques, the study area is divided into four categories: urban area, forest land, irrigated farmland and bare land. Land use and land cover changes during the years 1986 and 2009 were noted and analyzed based on satellite images. The study found that throughout 1986 up to 2009, the size of land classified originally as urban area changed from the original size of 4,997 hectares to 9,653 hectares while within the same time span, land originally classified as forest land reduced in size by 1,793 hectares. Further to these changes, land classified as bare land increased in size by 2,353 ha while the original size of land classified as irrigated farmland reduced by nearly 2,204 hectares. These observed changes are significant, hence pose a growing threat to agricultural land in Libya which could impact food production and water quantity and quality thus potentially destabilizing food sufficiency and sustainability of the whole nation.

Key findings concerned the identification of water quality and quantity as the main challenges faced the agricultural sector. As a way of managing this problem, the farmers asked for a speedy intervention of the Libyan government through greater regulation and investment in the agricultural sector.

Further to the land use and land cover changes that were noted through the use and analysis of the satellite images, the study also noted that livelihoods of rural farmers in the periphery of Tripoli are threatened by the expansion of the city. The expansion, which is the core reason why the images are displaying the various changes noted, confirm that land originally used for agriculture has changed its use and is now used as urban land

where urban settlements and associated infrastructure have been constructed thus making farmers lose the land on which rural households activities were being conducted.

The study also found that there are both positive and negative outcomes to the rural households when cities like Tripoli expand. The expansion of Tripoli enabled some of the affected households to access new livelihoods through migration and securing of alternative sources of income in the urban area. On the other hand, the loss of land by the farmers means that there is shortage of land for agriculture. Coupled with poor water and soil qualities, the direct consequences of reduced farming activities have been low food production at household level which has negatively affected rural people's livelihoods.

The study is the first of its kind to be conducted in Libya and among others differs from other studies conducted on urbanization and livelihoods area in Libya because of the nature of study methods. No study prior to this has ever employed a combination of Participatory Rural Appraisal (PRA) strategies, Remote Sensing (RS) and Geographical Information Systems (GIS) approaches in one study that sought to better understand the impact of land use and land cover changes on livelihoods of peri-urban farmers.

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List of abbreviations and acronyms

CAADP	Comprehensive Africa Agriculture Development Programme
DFID	Department for International Development
ERDAS	Earth Resources Data Analysis System
ETM+	Enhanced Thematic Mapper plus
FAO	Food and Agriculture Organization
FGM	Female Genital Mutilation
Fig	Figure
GCP	Ground control points
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
LPC	Libyan Planning Council
LULC	Land Use/ Land Cover
MMA	Mixed Method Approach
MMRA	Multi-Methodology Research Approach
MRM	Multiple Research Methodology
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organizations
PRA	Participatory Rural Appraisal
PUA	Peri-Urban Agriculture
PUI	Peri-urban Interface
RMS	Root Mean Square error
RRA	Rapid Rural Appraisal
RS	Remote Sensing satellites
SAVI	Soil Adjusted Vegetation Index
SLA	Sustainable Livelihoods Approach

SLF	Sustainable Livelihood Framework
SLF	Sustainable Livelihoods Framework
TM	Thematic Mapper
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNCHS	United Nations Centre for Human Settlements
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFPA	United Nations Fund for Population Activities
WHO	World Health Organization

Chapter 1: INTRODUCTION

1.1 Background and rationale of the study.

The United Nations' (UN) (2014) World Urbanization Prospects reveals that 54 percent of the global population now lives in urban areas compared to 30 percent in 1930. The period between 1950 and 2010 is stated as the time when the world experienced the most rapid urbanisation increase rates of 24 percent globally (UN, 2012). However, although the global picture presents a 24 percent global increase in urbanisation, there are substantial variances in the levels of urbanization between and within countries and regions across the globe.

The UN (2014:1) further indicates that "continuing urbanization and overall growth of the world's population is projected to add about 2.5 billion people to the urban population by 2050 (see details for selected regions in Figure 1 below), with nearly 90 percent of the increase concentrated in Asia and Africa". Further to this, the global average number of people living in urban areas is expected to exceed 66 percent by 2050 (Satterthwaite et al., 2010 and UN, 2014).

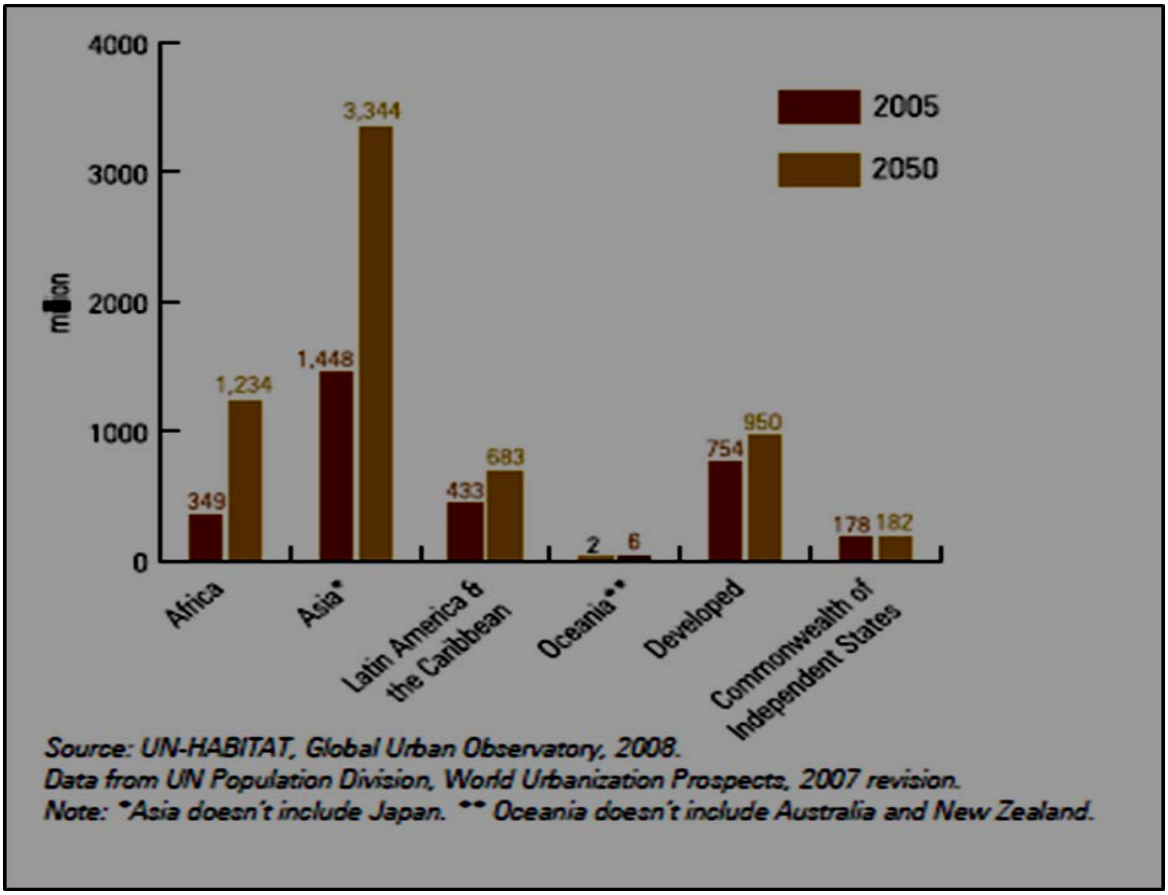

Figure 1: Urban population (millions) by region, 2005 and 2050

Although urbanisation is referred to as a global phenomenon that often dominates development discussions, there are different geographical, political and socio-economic factors that are behind the rapid increase of urbanisation.

Urbanisation is not a new process. Developed countries first experienced the phenomenon during the industrial revolution period, and while the process is still on-going in developed countries, it has over the last half a century, gained momentum especially in Asia and Africa (UN, 2012). Songsore (2009) and Thuo (2010) argue that while the initial causes of urbanisation in developed countries were economic in nature, the story is different in developing countries. Songsore (2009) and Thuo (2010) opine

that demographic factors such as high population growth rates and high poverty levels in rural areas are behind the current rapid increase of urbanisation in Africa and Asia where rural-urban migration and natural increases of population within cities and towns in these continents are the core reasons why Africa and Asia are currently experiencing rapid urbanisation.

Gwebu (2004) reveals that Africa's urbanisation rate is the highest on the globe growing at an average of 4.4 percent each year. Additionally, Thuo (2010) indicates that in the year 2000, around 38% of Africa's population lived in urban areas, and the proportion is expected to increase to more than 87 percent by the year 2030 (Mohan et al., 2011; World Bank, 2014). Figure 2 shows that the majority of Middle East and North African countries already have more than 50 percent of their population living in urban or peri-urban zones (World Bank, 2014).

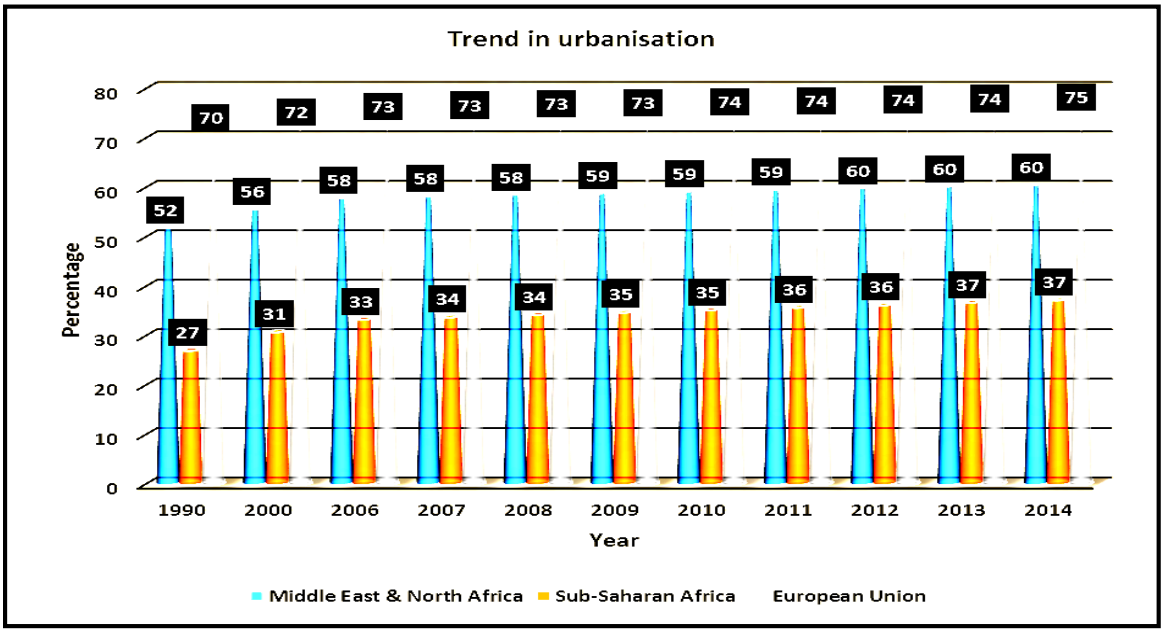

Figure 2: Urbanisation trend in selected regions.

Source: Researcher's creation using World Bank Database - Global Indicators, (2013) (Link: http://www.tradingeconomics.com/libya/urban-population-wb-data.html)

There are already a number of countries within the African continent which are or have already hit the predicted 2030 levels (Figure 3).

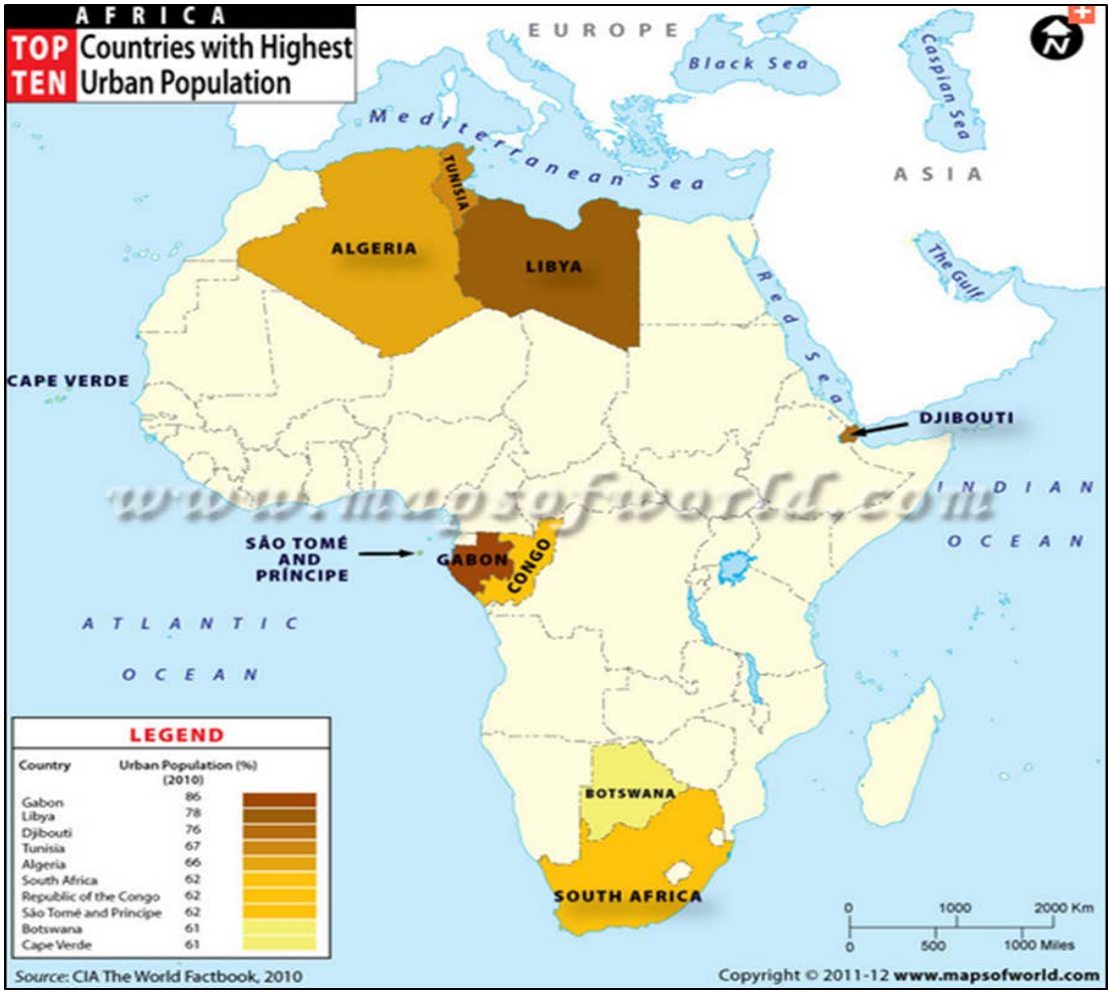

Figure 3: African countries with the highest urban population.

Source: As indicated in the Figure.

Gabon has 86 percent of its population living in urban areas making it the African country with the highest proportion of urban dwellers. Libya comes second with 78 percent of its population living in urban areas.

Although literature indicates a consensus that globally the rate of urbanisation is growing, development experts, researchers and scholars are divided on how the process impacts natural resources' management, people's livelihoods and the availability and accessibility of land for agricultural purposes. It is the opinion of Aberra and King (2005) that rapid urban growth, like that experienced in Gabon, Libya and other African countries produces damaging consequences on both the natural environment and people's livelihoods especially for those living in and around the peripheries of urban areas who depend on agriculture as their only source of livelihood. Aberra and King (2005) argue further that since urbanisation comes with infrastructure development, urban growth entails that there is an encroachment of land previously used or reserved for agricultural production which affects food production.

A 2007 United Nations Population Fund (UNFPA) report indicates that because urban areas are situated within rich agricultural areas that are also rich in biodiversity, urban expansion tends to eat into productive land available for agriculture in addition to causing damage to ecosystems (UNFPA, 2007). Because of the negative impact urbanisation and city expansion can have on ecosystems, such as changes in land use/ land cover, loss of natural habitats, pollution and degradation of natural resources, growing urban populations are creating environmental management challenges that hugely contribute to climate change and, in turn, contribute to the devastating effects associated with climate change on people's lives and livelihoods.

Apart from reducing the amount of land available for agriculture, Owusu and Agyei, (2007) and Gantsho (2008) contend that the expansion of urban zones to accommodate the increasing urban population causes rural land prices to escalate. The authors argue that as the urban population increases, the demand for land grows and using market economic rules, the higher the demand the higher the prices, the increase in land costs increases the inequality gap between the poor and the rich, since only the rich are able to own and access land when land prices go up. This, as Owusu and Agyei, (2007) and

Gantsho (2008) argue, affects the livelihoods of poor households as they cannot even access loans from lending institutions where land is used as collateral. Gantsho (2008) and Thuo (2010) add that urbanisation apart from creating strong demand for housing also leads to the development of slums that pose health risks to people's lives, and often creates spaces where criminal activity can thrive. Naab et al., (2013:257) further argue that "growth in the urban population goes with no equivalent growth in land supply" hence pressure exerted by urbanisation deprives other sectors (including agriculture) of necessary land, because preference goes to land for the residential, industry and commercial needs that dominate urban development. Tacoli (2004) concludes that this usually impacts disproportionately on the poorest.

Edusah (2008) and Mandere et al., (2010) argue that urbanisation, while causing many of the problems discussed above, can also be beneficial to rural populations. They argue that amenities and facilities like schools, hospitals and banks that are built as part of the urbanisation process, also help to offer a better life to rural population. Apart from offering rural people access to urban-like amenities and services, urbanisation creates job opportunities and trading opportunities which not only raise levels of economic activities but contribute significantly to levels of household income (Aberra and King, 2005 and Adu-Ampong et al., 2008). Further to this, Mandere et al., (2010) states that urbanisation helps in the economic development of a country since rural talented individuals in sports, business and entertainment are presented with the opportunity to showcase and market their talents to a wider community, which generates increased household income. Adu-Ampong et al (2008) argues further that such exposure of talent helps people to diversify their livelihood sources since urbanisation provides alternative sources of livelihood.

Although studies have been conducted on urbanisation in Africa in recent years, a lot of these studies only focused on examining causes and general effects of urbanisation on rural socio-economic and ecological systems. Little or no attention has been paid to

studying the effects of urbanisation on agricultural areas that lie in the periphery of urban zones, and even fewer have explored the impacts on rural farmers' livelihoods.

This study will provide a fresh perspective on causes and effects of urbanisation in African countries, using Libya as a case study. The research will also explore and identify ways through which affected rural farmers cope with changes in land use and land quality that come along with urbanisation. This research will also contribute to the literature on the relationship between urbanisation and sustainable livelihoods in Africa and beyond. However, additionally the originality of this study lies in the empirical knowledge generated through this research on the following aspects:

1) Covering this particular area of Qurabolli, no one has done such research in this location before.
2) Blending Remote Sensing (RS) with social science investigations of people and their livelihoods; PRA was a method used to highlight issues that have hitherto been ignored because of use of more mainstream methods.
3) Using the Sustainable Livelihoods Framework (SLF) to conceptualize the consequences of urbanization on people's livelihoods.

The study will be grounded on a "Sustainable Livelihoods Framework (SLF)" (DFID, 1999), which will help in expounding how urbanisation contributes and affects people's vulnerability, levels of poverty and well-being. Although there is evidence that urbanisation is taking place in Libya at a very fast rate, little has been written about the effects of such a rapid process on the livelihoods of farmers who live in the periphery of urban centers. This study is one of the first studies that will provide empirical evidence regarding land use changes in Libya. The study will aim to provide evidence on the exact nature of land use change experienced in peri-urban settings in Libya and the manner in which people are responding to the pressures that come along with such changes.

1.2 Statement of the problem

Literature reveals that urbanisation in Africa is manifesting through outward expansion of urban zones as well as internal congestion of populations and structures within urban zones (Cobbinah et al., 2015). Yang (2006), Seto et al., (2012) and Cobbinah et al., (2015:66) argue that "African cities have been characterized by massive and uncontrolled spatial expansion, technically termed as urban sprawl". Recent studies of cities in Africa including those conducted by Cobbinah & Amoako (2012), Amoateng, Cobbinah, and Owusu-Adade (2013) conclude that urban sprawl results in unsustainable land management where land in peripheral urban areas is converted to other uses as in farmland being turned into non-farm land use.

Angel et al., (2005) found that all cities in Africa are expanding twice as fast as the population is doing.

Country	City	1994 (km^2)	2008 (km^2)	Expansion per year ($km^2\ yr^{-1}$)	% increase
South Africa	Johannesburg	1372.0	1645.0	19.5	19.9
Egypt	Cairo	244.8	740.7	35.4	202.6
Kenya	Nairobi	235.0	684.0	32.1	191.1
Nigeria	Lagos	396.8	610.2	15.2	53.8
Zimbabwe	Harare	118.6	302.7	13.2	155.2
Sierra Leone	Freetown	52.6	65.4	0.9	24.5
Ghana	Takoradi	14.1	51.3	2.7	262.9

Table 1: Explains expansion of Urbanisation of some selected cities in Africa (1994–2008).
Source: Adapted from Cobbinah et al., (2015:67) citing Kasuku (2008), Nwokoro and Dekolo (2012), Aduah and Baffoe (2013), Afifi, Elsemary, and Wahab (2013) and Kamusoko, Gamba, and Murakami (2013).

Despite there being socio-economic benefits associated with urbanisation processes, urban sprawl in Africa, according to Angel et al., (2005) and Cobbinah and Amoako (2012), is not only responsible for the lateral expansion of urban environments but also has adverse impacts that transcend into the urban boundaries. Cobbinah et al., (2015:67), Angel et al., (2005), Watson (2009) and Intergovernmental Panel on Climate Change (IPCC) (2013) further attribute people's increased dependence on fuel driven vehicles and machines and "high levels of air pollution, energy use, and greenhouse gases emission" to rapid urban expansion and its contribution to global climate changes.

Cobbinah et al., (2015:67) say that in most African countries, physical expansion of urban areas due to urbanisation is putting enormous pressure on urban planning systems and practices leading to "encroachment on and conversion of wetlands and other water bodies, open spaces and farmlands within and outside the urban environment into residential and other uses, as well as emergence of informal settlements or slums."

Angel et al., (2005), Watson (2009) Amoako and Cobbinah (2011) and Seto et al., (2012) argue that urbanisation of African cities is characterized by "fragmentation of landscapes, destruction of wildlife and aquatic habitat and reduction in biodiversity." It is further suggested by Aberra and King (2005), Congedo and Macchi (2015) and Edusah (2008) that increased encroachment of agricultural land for housing in African countries causes massive and irreparable environmental damage which exposes indigenous rural communities to all aspects of vulnerabilities including pollution, changes in water quality and quantity and climate change, thus creating dire effects on people's lives in peri-urban zones.

Urban dwellers can also suffer from the effects of urban expansions with many communities undergoing significant social and cultural changes (Edusah, 2008). According to Aberra and King (2005) and Edusah (2008) both rural and urban populations have, because of rapid urbanisation processes, been recomposed in such a

way that the nature of people's lives and existing power structures changed and led to the development of new lifestyles and class systems and individualism.

Specifically, for rural communities in some African countries, Aberra and King (2005) opine that urbanisation has dissolved community solidarity leading to the erosion of common values and traditions that African communities in rural areas are known for sharing and valuing. Additionally, a study conducted by Ubink (2006) in nine peri-urban areas in Ghana's Kumasi revealed that although inhabitants of peri-urban areas are compensated for the loss of agricultural land during city expansion, the monetary compensation is never enough to make up for the changes in rural people's livelihoods, especially when the lack of readily available alternative sources of livelihood for the displaced people is taken into consideration.

In Libya peri-urban zones have been identified by Devan (2011) as challenging areas for inhabitants as they are exposed to a mix of effects and benefits of rapid urbanisation processes. As argued by Cobbinah et al., (2015), increasing levels of urbanization are quickly outpacing the ability of the Libyan government and its associated departments to effectively plan and manage the basic needs of urban populations, especially the poor (Devan,2011). The Libyan Bureau of Statistics (2010) indicates that urbanisation in the country is putting pressure on the demand for energy in urban and peri-urban areas and has projected that demand will be more than double in the coming years and that demand for water will rise by 30 percent. The Libyan Bureau of Statistics (2010) and Devan (2011) agree that around 8 to 20 percent of arable land used as agricultural land will be lost to accommodate the ever-expanding urban areas. Findlay (2007) argues that although considerable attention has been paid to socio-economic problems that come with urbanisation in North African countries, little or no research has been explicitly conducted to examine the effects of expanding cities on the agricultural areas in peri-urban zones. This is the focus of this study. Once an analysis of land use change has been

achieved, the impact on the livelihoods of farmers and their coping strategies will be explored.

1.3 Research aims and objectives

Focusing on the eastern part of Tripoli, the capital of Libya, the study will specifically aim at achieving the following six (6) objectives:

i. Identify land use/land cover changes emerging from recent urbanisation processes in the eastern part of Tripoli.
ii. Identify the nature of lands that have experienced the most change due to urbanization.
iii. Identify factors associated with urbanization processes that are driving land use changes.
iv. Examine effects of urbanisation on farmers' livelihoods including the relationship between land conversion, degradation and desertification and how these are affected by urbanisation.
v. Investigate and highlight challenges that farmers in peri-urban areas are facing when responding to land use changes caused by the urbanisation process.
vi. Investigate how peri-urban farmers are solving challenges they face in peri urban areas and why they choose these.

1.4 Research Structure

This thesis has 8 further chapters. **Chapter 2** discusses and reviews literature on the key concepts underpinning this research, including urbanisation. **Chapter 3** covers conceptualization of farmers' livelihoods. The literature in this chapter details livelihood strategies and the sustainable livelihoods framework that is underpinning the framework of this research. The chapter incorporates findings from previous studies on the topic, but

also captures theories and major themes which will act as background for the discussion of research findings in later chapters. This chapter ends with literature that captures the linkages between urbanisation and agricultural livelihoods.

Chapter 4 provides the contextual background of Libya, the research study area and it includes details on the country's physical, socio-cultural and economic environment, as well as Libya's progress on urbanisation and the impacts of that process on peoples' livelihoods**. Chapter 5** outlines the overall research methodology adopted by the researcher, which will be used when working towards the research goal and objectives. This chapter also justifies why some research methods and tools have been adopted and used in this research. The chapter provides a discussion on the various methods used in the research such as the Remote Sensing and Geographical Information Systems that were used in collecting and analyzing quantitative data. It also provides a discussion on the theory and practice of Participatory Rural Appraisal and discusses the methods that have been applied in the collection of the qualitative data. **Chapter 6** (stage one) presents the key research findings regarding changes occurring in land cover and usage in Libya, by using RS and GIS. **Chapter 7** (stage two) discusses the changes experienced by peri-urban farmers, regarding their agricultural livelihoods, due to the process of urbanisation. The coping strategies that farmers in the study area are adapting in responding to changes, are then presented and discussed.

Chapter 8 analyses and discusses key research findings with regard to the theories and policies covered within the literature review chapter. **Chapter 9**, the study conclusion, highlights key findings and discusses their significance. It contains policy recommendations for the area studied, but also considers the broader implications of the research findings. The limitations of the study are also considered in this chapter.

Chapter 2: THE URBANISATION PROCESS

2.1 Introduction

This chapter presents a review of literature on urbanisation. Additionally, the chapter highlights findings from previous studies, theories and major themes on urbanisation from a global viewpoint which will help in putting this research study in perspective.

2.2 Urbanisation

The distribution of human population on the earth's surface has always been in response to either opportunities or challenges that different territories have provided to people (UN, 2008). The availability of arable land was the biggest determinant of the place where most people settled since agriculture was the core business. However, as communities came together to trade, complex settlements and then cities began to grow. These urban areas subsequently became the centres of government, production, trade, knowledge and innovation.

More recently factors indicated below are attracting more young people from rural communities to migrate into cities and urban areas for better opportunities as discussed in the following lines:

- **Growth of industries** in urban areas are heavily contributing to urbanisation and population growth in cities. Mondal (2010) points out that in India, like many developing countries, increased industrialisation is motivating young people to move to industrial areas in search for employment thus contributing to population growth of towns and cities.
- **Social factors** including the desire to access social amenities that are only available in urban areas is another factor leading to urbanisation. Because of investments that countries are making in infrastructure development in urban

areas, many people from rural areas feel compelled to migrate to urban areas since they are attracted by the facilities that come with city infrastructure development, particularly the perceived better standard of living and better educational opportunities (Mondal, 2010).

- **Employment opportunities:** Many people in rural areas depend on agriculture for their livelihoods, climate change and frequent occurrences of drought and other natural calamities force rural people to look for alternative strategies - one of which being migration to the cities (UN, 2008).
- **Modernization:** Urban areas are usually characterized by sophisticated technology, better infrastructure, modern means of communication and transportation, and the existence of excellent medical and education facilities. People from rural areas migrate to urban areas as it is assumed that the availability of such modern facilities promises a more comfortable life (Mondal, 2010).

With the above push and pull factors in mind, the United Nations (UN) predicted that between 2007 and 2050, the global urban population will increase by an additional 3.1 billion people-this Figure will comprise of 1.8 billion in Asia and close to one billion in Africa (UN, 2008).

Urbanisation is slowly emerging as a major subject within the development sector, forcing Brown et al., (2010) to refer to the process as the dominant demographic trend of recent times. Urbanisation is now a popular subject on the agenda of many development workshops/seminars and two positions seem to be emerging concerning the impact of the process on people. Some commentators including the United Nations (2012) and Gollin et al., (2013) argue that urbanisation is a positive change for people living in both urban and peri-urban areas, while others like Glaeser et al., (1999) and Mondal (2010) argue otherwise, indicating that urbanisation has many negative consequences, especially on farmers' livelihoods in peri-urban and rural areas. To understand better, this debate and

the urbanisation process, the next section explores what urbanisation is and what drives it.

2.2.1 Urbanisation definition

Although there seems to be a consensus in the literature that urbanisation is the growth or increase in the proportion of a country's population that is living in urban areas, Thomas (2008) reveals that there is a debate among researchers and scholars on what actually constitutes an urban area. The term 'urban' has no specific definition and authors like Owusu (2005), Woods (2007) and Songsore (2009) have indicated that the term could mean political status, demographic attributes, economic variables and socio-cultural behaviours. The three authors also indicate that in some countries, the term urban area definition is based on the number of people living in a particular location. Owusu (2005), Woods (2007) and Songsore (2009) regard an area with 2,500 people as an urban zone in the United States of America, while it is just 300 people in Iceland, 30,000 in Japan and 5000 in Ghana. However, Trzyna (2007) argues that the use of population size and density when classifying urban and non-urban areas is problematic since it presents no universal definition of what an urban area actually is. Gantsho (2008) argues that urban areas are better defined by means of land use types. Based on Gantsho's (2008) argument, an urban area is an area that is characterized by non-agricultural industries, whose social, economic and institutional activities are predominantly based on the manufacture, production, distribution or provision of goods and services and some form of extraction of natural resources in unprocessed form or value adding processes of agricultural products. Concurring with Gantsho (2008), Ibrahim (2010) looks at urban centres and cities in general as places of human settlements where a high proportion of the population lives in built up areas and engages in non-agricultural activities.

A good example that highlights the confusion that comes with the use of population data and certain characteristics of such an area as definition of urbanization, is provided by

Denis and Bayat (2002) who refer to a 1996 National Population Census conducted in Egypt where some areas had populations of more than ten thousand with people involved in non-farm occupation, but these areas were never classified as urban. Frey and Zimmer (2001), suggest another way of defining urban areas is by considering functions that a particular area performs over other areas surrounding it. The two authors noted that economically, "activities taking place in the urban areas include manufacturing (secondary) and services (tertiary) and of late, research and development (quaternary) activities". They add that an additional functionality feature for urban areas is that more than fifty percent of the employed population works outside primary sectors; largely the agricultural sector (Frey and Zimmer, 2001). These two authors state that urban areas function as administrative centres for areas peripheral to them.

2.2.2 Global trend of the urbanization process

Many countries across the world began to experience a rise in the number of people living in urban areas after the end of World War Two. In particular, countries in Europe, North America and Oceania saw the urban population growing up to 50 percent of the national population while those in Latin America and the Caribbean achieved urbanisation rates of approximately 40 percent (UN, 2012). Although most countries in Asia and Africa were also urbanizing, the rates of urbanisation increase were much lower and the process slower with the majority of countries; having rates of less than 20 percent.

As can be seen in Figure 4 below, globally, countries have historically had a higher proportion of the population living in rural areas. This trend changed around 2009 when the world saw a shift in the ratio between rural and urban populations as a higher percentage of people now live in urban areas (UN, 2012).

While concurring with the UN Human Settlement Programe data (Figure 4), the UN (2011) states that although all countries are experiencing rapid growth, the rate of

urbanisation has been declining for European and North American countries as indicated in Figure 4 below.

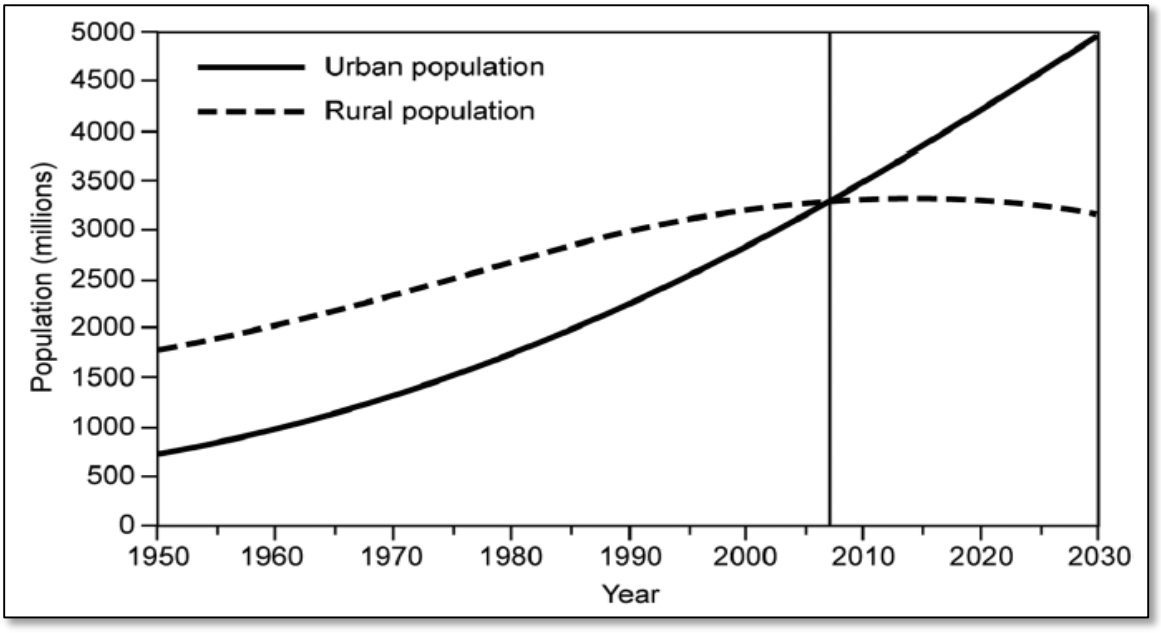

Figure 4: Global trend of urbanisation

Source: UN Department of Economic and Social Affairs/Population Division
World Urbanization Prospects: (The 2007 Revision).

An analysis of urbanisation trends at the continental level reveals that except for Africa and Asia, the rest of the continents were by the year 2000 close to reaching the 80 to 20 percent urban to rural population ratios, which the UN calls urbanisation saturation point see Figure 5 below.

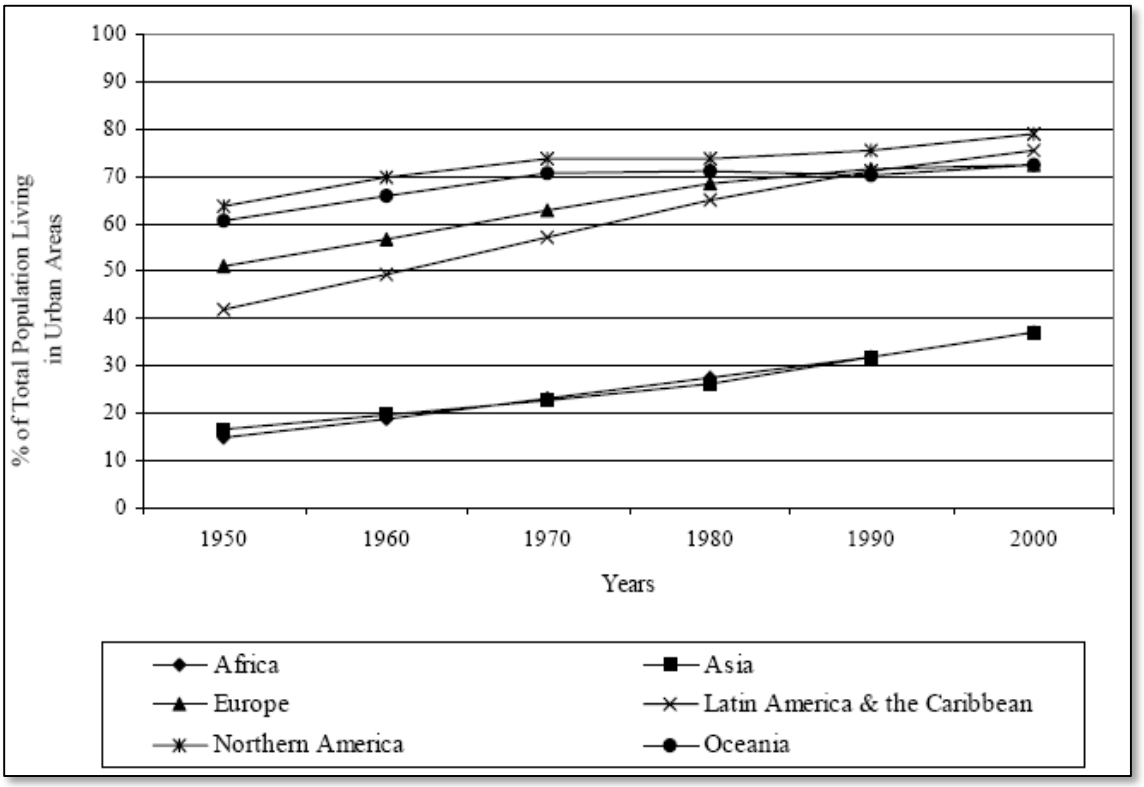

Figure 5: Continental levels of urbanization (1950 – 2000)

Source: United Nations (2002)

Figure 6 below shows that Asia and Africa are the only continents that will witness a rapid increase in urban population of more than 20 % between the year 1950 and 2050.

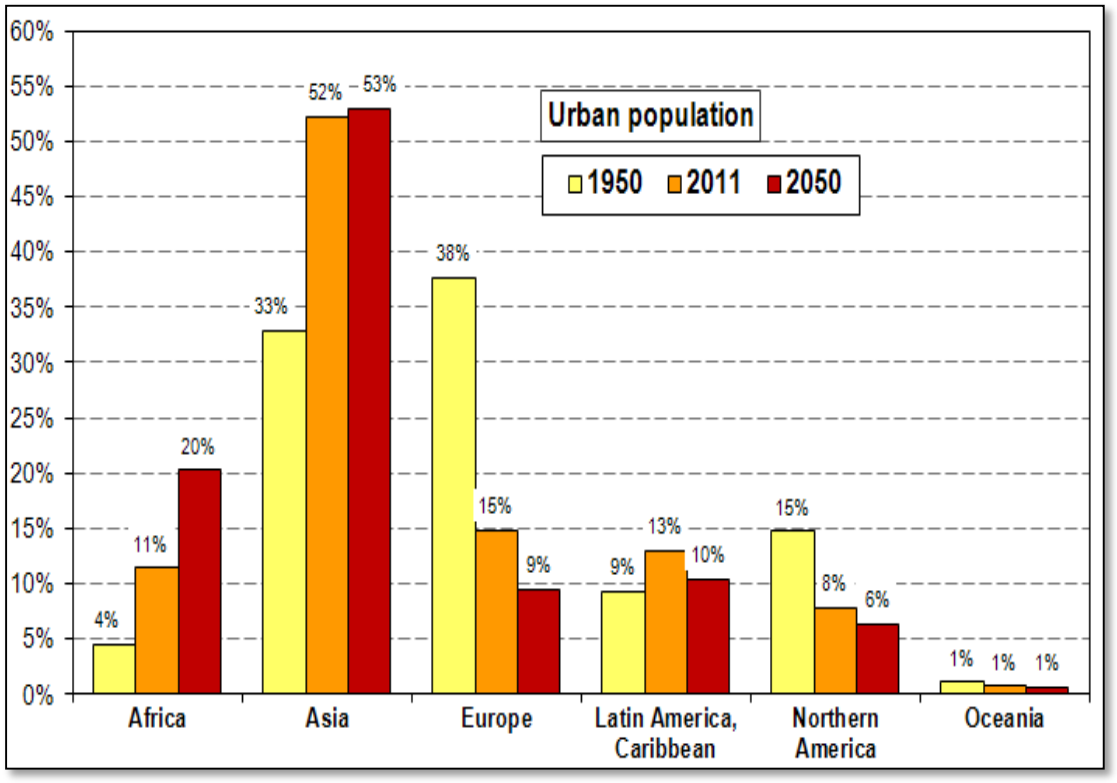

Figure 6: Urban population growth at continental level 1950 to 2050

Source: United Nations (2012)

From around the 1980s the pace of urbanisation transformation has been comparatively greater in developing countries especially those in Asia and Africa. Amis (2000) comments that African countries have, since the 1950s, been urbanising at very slow rates but the rate of urbanisation started to increase rapidly in the 1980s. While only around 10 percent of Africans were living in urban areas around the 1960s, the proportion of Africans residing in cities rose to 27% in 1980.

Several factors are deemed to be influential regarding the manner by which countries urbanise. One factor is infrastructural development. New infrastructure that comes along with urbanisation provides potential business opportunities for migrants from rural areas and consequently serves as a significant motivation to rural people to migrate to urban

areas (Sanidad-Leones, 2006). For example, in Bangalore in India, an unprecedented rate of urbanisation occurred because of development activities that were implemented in the city including road construction and the building of both residential and office complexes. The jobs created by the development motivated a lot of people from surrounding rural areas to move to the city and this helped increase the population of the city (Sanidad-Leones, 2006).

However, rapid population increases like that experienced in Bangalore city in India come with many negative aspects including unemployment as the increase in job seekers is often not met by the job providers. In addition to this, since there are more job seekers than jobs this leads to a decrease in real wages as many employers are assured of labour availability on the market due to uncontrolled migration (Sanidad-Leones, 2006).

2.2.3 Development theories associated with the urbanisation process

Lall et al., (2006) argue that urbanization involves not only the movement of people from rural to urban areas but additionally, as people move into urban areas, they are forced to change occupations from farm-based occupations to new occupations within the business, trade, service and profession sectors. Further to the changes in occupation, new entrants into urban areas are also expected to adopt new 'urban like' attitudes, beliefs, values and patterns of behaviour (Lall et al., 2006). This adoption often leads to the abandonment of things that were considered vital to rural communities like family ties and belief in community strength (Lall et al., 2006).

The process of urbanisation is often and better explained using a set of development theories that link development to the process of urbanisation. Three common theories of development that dominate the debate and will now be discussed are the following.

The Theory of Modernization (Fox, 2012) was developed around the mid-20th century. This theory posits that through the introduction of new ideas and modern methods of

production (including utilisation of advanced technology during production), underdeveloped countries or areas within countries experience economic growth which leads to development (Dutt, 2001 and Fox, 2012). According to Fox (2012), the theory examines individual entities and factors that are used in measuring economic development that a nation is experiencing plus the associated social and political by-products. It is further presented by Dutt (2001) that classical economists who are proponents of this theory argue that there cannot be urbanisation without industrialization and that industrialization is the foundation on which urbanisation is built.

Modernization theory states that the more industrialized an area becomes the more likely it is to become an urban area. This is because areas that are more urbanized do not rely on agriculture as the engine for growth and hence release surplus rural labour that previously was engaged in agriculture to work in industries located within the borders of the new urban area (Dutt, 2001 and Fox, 2012). Fox (2012) further explains that when states are on the modernization road, its inhabitants are automatically motivated to engage in systematic and transformative changes where their traditional values and beliefs are changed to modern ones that are seen as befitting the urban areas where they now live. Apart from arguing that there should be migration into urban areas for urbanisation to take place, the theory also looks at advancements in the utilisation of technology and industrialisation as the key engines of growth (Kasarda and Crenshaw, 1991 and Dutt, 2001).

According to Lenski and Nolan (1984;1985) and Kasarda and Crenshaw (1991:481), while acknowledging that social organizations do create innovations and technology, modernization theorists believe that “technology is fundamentally more important than a society’s social organization hence it is the application of technology that is the prime engine of social change”. Based on this belief modernization theorists argue that technology and industrialization are engines of development and their application in urban areas facilitates the development of institutions and structures such as schools,

hospitals with advanced health services, industrial sites, entertainment arenas and mass media. The modernization theorists argue that these elements act as pull factors to people living in rural areas, which encourages them to migrate into urban areas in search of better ways of living (Bradshaw, 1987 and Satterthwaite and Tacoli, 2003).

The Dependency Theory was originally developed in Latin America to counter flaws prevalent in the modernization theory. The Dependency theory assumes that development, especially in developing countries like those in Africa and Asia, is a by-product of the growth and expansion processes that countries in Europe have undergone and/or are going through (Bradshaw, 1987). Unlike the modernization theory, the dependency theory stresses the importance of historical processes as being vital when explaining development changes countries have experienced. The dependency theory also places emphasis on development including processes of urbanisation in developing countries that are a result of dependence on external economic forces that emanate or are shared or adopted by or from developed countries (Kasarda and Crenshaw, 1991). The argument put forward by proponents of the dependency theory is that developed countries, in particular, those that lie in the global north, use the developing countries as suppliers of raw materials for industries that are based in the developed countries.

According to Bradshaw (1987) these relationships between developed and developing countries results in foreign investment by companies from developed countries that engage in large-scale modernized agricultural production and this displaces peasant farmers in the rural areas who, having no other forms of occupation, migrate to urban areas in search of alternative livelihoods (Firebaugh,1979 and Bradshaw, 1987). Further to displacement of rural farmers due to modernization of agriculture, the theory also indicates that the change in agricultural production entails large foreign investments in capital-intensive manufacturing in the urban areas which often produces a multiplier effect as businesses, relevant institutions and structures that provided support services

emerge. This further enhances the allure of the urban areas to rural inhabitants who then migrate to urban areas (Dutt and Noble, 2003).

The Urban Bias Theory, unlike the first two theories, shifts the emphasis of urban development from an economic perspective to a political perspective (Libton, 1977 and Fox, 2012). Proponents of the theory argue that policies that are developed through political means are deliberately twisted to favor urban areas and their inhabitants, while imposing the direct negative consequences of such policies on those that live in rural areas. These biased policies force people to leave rural areas for urban areas so that they also benefit from facilities that are created through the utilization of the biased policies that favor urban areas and its people.

Supporters of the urban bias theory state that, as the name suggests, the theory deliberately operates in a biased way by developing biased policies that allegedly overtax rural citizens who have similar incomes compared to urban dwellers. For instance, Fox (2012) opines that state controlled marketing institutions buy agricultural produce from the farmers in rural areas at very low prices yet a few months later the same institutions re-sell the produce to the same farmers but at existing market rates which are often two-fold or more than the price the produce was sold at. The profits therein realized are used in urban areas in supporting such facilities as hospitals, markets schools, and libraries that help create higher and better standards of living in urban areas, again, acting as motivation to rural dwellers to migrate to urban areas (Bradshaw ,1987; Fox 2012).

2.2.4 Factors that facilitate urbanisation

Although the rate of urbanisation has recently been slowing down (see Figure 7 below) because of the prevailing high urban population in most countries, the number of people that are moving from rural to urban areas is still growing (United Nations, 2000 and Dyson, 2011).

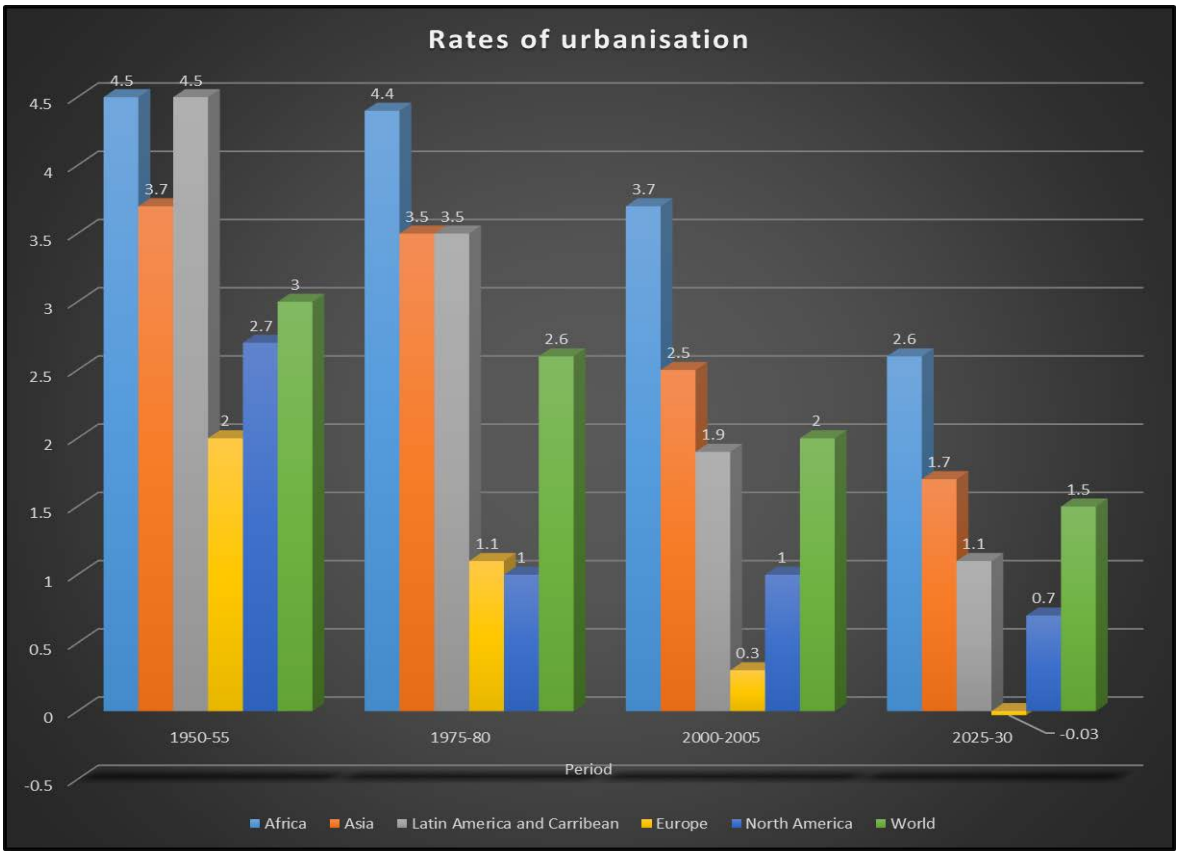

Figure 7: Rate of Urbanisation - regional and global levels.

Source: Author's creation using data from United Nations (2000).

Literature from the 1960s reveals that factors facilitating the urbanisation processes can best be classified into two groups; Push and Pull factors (Dyson, 2011). Dyson (2011) further indicates that Pull factors are those positive factors that entice people who originally are in rural areas to migrate to urban areas while Push factors are often negative factors that make life in rural areas uncomfortable and hence motivate people to migrate to urban areas as they seek alternative means of survival and a change in their standards of living.

Aluko (2010) concurs with this analysis and indicates that people migrate from rural areas because they are either pushed away by the hardships in the rural environment or

are pulled by benefits that are assumed to be only available in urban areas or its immediate surroundings - the peri-urban zones. Mondal (2010) further opines that there is a causal relationship between services and amenities available in urban areas, which act as pull factors like prospects for plentiful and more stable jobs, and the absence of land in the rural and peri-urban areas which act as push factors so people migrate to larger cities, leading to uncontrolled urbanization. Mondal (2010) argues that urbanisation on its own is not a problem but that uncontrolled urbanisation is what really poses the challenges of unemployment, inadequacy of infrastructure/services, environmentally unwanted effects and unpleasant illegal and immoral behaviours such as prostitution and robbery.

It needs to be mentioned that apart from pull and push factors that are highlighted in detail in the paragraphs below, natural population growth within cities is also responsible for increased urban populations and this is discussed in detail later in this thesis.

A significant push factor for urban migration is poverty. According to Dutt (2001), poverty is tough to define but can better be referred to as a situation where fundamental human needs of household members are not met. Dutt (2001) writes that in many countries poverty levels among rural population are growing despite several efforts and interventions conducted by local and international institutions. Rural poverty is aggravated by different circumstances like drought, seasonal changes in food prices and lack of adequate land on which to undertake agriculture-often the main source of livelihood in rural areas in developing countries (Graaff, 2003). Graaff (2003) argues that poverty is one critical factor responsible for pushing people out of rural areas but also notes that rural poverty often contributes to seasonal migration to urban areas especially during lean agricultural periods.

The scarcity of jobs plus dwindling benefits from the agriculture sector are strong push factors for rural youths (Bhatta, 2010). Bhatta (2010) and Jedwab et al., (2014) concur that development changes experienced in urban areas resulting from globalization,

information and technology breakthroughs have widened the nature of services and industries people can work in. This makes many rural inhabitants, especially youths, regard traditional agricultural based livelihoods as not only low-paying and laborious but also naturally risky especially with changes coming regarding global climatic conditions. A research study conducted by Boadi et al., (2005:470) reveals that “unprofitable agriculture due to its small scale-nature, unstable world market price for agriculture produce, reduced soil fertility, limited government investment and inadequate access to fertilizer, contributed to the migration of rural farmers to urban areas in Ghana, Gambia and Tanzania.”

Further to the above, disinterest in taking agriculture as a source of livelihood also comes from the fact that agricultural products have in recent times been fetching low prices in both local and global markets such that it has become even more profitable in the long term for farmers to sell their land than to continue farming. According to Jedwab et al., (2014), once the land is sold, the next available option is migration into urban areas to seek new modes of livelihoods. In addition to this, growth of urban cities makes farmers in rural areas lose parts of their farmlands to provide space for the construction of infrastructure that urban centres demand and this loss of land also pushes people into urban areas (Nelson 1990 and Zhang et al., 2007).

The examples provided in the table below further illustrate how big the challenge of loss of farmland is in some selected countries.

Period	Country	Description of the land lost
2000 - 2025	United States of America	An estimated 7 million hectares of farmland and a similar amount of environmentally sensitive land will have been lost to urban zones extension
1996 - 2002	China	Cultivated land reduced to 125.93 million hectares resulting in displacement of 50 million farmers.
1985 - 2000	Hochiminh city alone -Vietnam.	800 thousand hectares transformed into non-agricultural land use
1983-1993	Indonesia	Land for agricultural usage reduced from 6.4 million to around 5.5 million hectares.
1955 - 1985.	India	1.5 million hectares of land (mostly agricultural) were consumed by urban growth in various cities within the indicated period
1985 -2000	India	800 thousand ha of agricultural land converted to non-farm usage.
1952 - 2002	ndonesia	Agricultural land lost to accommodate growing cities estimated at 1.35 million Feddan (about 546,325 ha)
1990 - 2010	Sudan	Around 6.4 million ha

Table 2: Loss of farmland in selected countries

Source: Various authors including Shahab (2000), Tran Thi Van (2006), Pauchard et al., (2006), United Nations Environment Programmers (2007), FAO (2010) and Siciliano (2012).

The loss of agricultural land can be either a voluntary decision, through the selling of land, or it could be that smallholder land owners are forced by governments to sell up in order to create areas for urban expansion. Barrios, Bertinelli and Strobl (2006); Da Mata et al., (2007), and Henderson, Storeygard and Deichmann (2013) and Jedwab et al., (2014) concur that rural poverty due to land pressure or natural disasters causes rural migrants to flock to cities.

Sometimes it can be specific circumstances that force migration, for example, two thirds of the population of Addis Ababa, the capital of Ethiopia was made up of temporary refugees from rural areas surrounding the capital during the 1984 drought disaster (Cobbinah et al., 2015). In Mali, the hard reality of dwelling in rural areas has driven many people to urban areas, which has exacerbated urban poverty (FAO, 2008), and in Kenya the consequences of desertification contributed to the constant flow of rural poor to urban Nairobi (National Geographic, 2005). Other factors can also explain rural-urban migration such as lack of infrastructures namely roads, water and electricity supplies motivate rural populations to migrate to urban zones. Similarly, a strong push factor for urban migration is the availability of inadequate education and health facilities in rural areas, plus the lack of land tenure security that is typical in rural areas in many developing countries (Jedwab et al., 2014).

The lack of entertainment and recreational facilities can also motivate people in rural areas to move into cities (Gollin et al., 2013). People in rural areas are often starved of entertainment due to poverty and a lack of recreational facilities, hence for many youths, moving to urban areas gives them an opportunity to showcase their talent and thus motivates them to move into urban areas.

Studies conducted in some African countries by Stren and Halfani (2001), Clapham (2006) and Iliffe (2007), Cobbinah et al., (2015) found that insecurity and socio-political conflicts have also acted as drivers of urban in-migration as they have been responsible

for increased internal displacements of rural populations thus creating an influx of refugees in cities and urban areas. According to study reports, “prevalence of political and ecological crises such as drought and civil wars, coupled with some harmful socio-cultural practices such as Female Genital Mutilation (FGM) have contributed to rural–urban migration considerably in recent years” (Cobbinah et al., 2015:65). Cobbinah et al., (2015) cite Free Town, the capital of Sierra Leone as one example where civil strife led to massive in-migration as the city’s population increased by over 217% during the 1991 to 2001 civil war period. People were running away from the war that was fiercer in rural areas. The influx of more than one million refugees from Syria, Afghanistan Iraq and Kosovo to countries in Europe further demonstrates that conflict induced out-migration is still happening in modern times and contributing to the growth of population in urban areas where security is better than in rural areas. In Syria, climate change related droughts have also contributed to urban migration (Henderson, 2009). Other similar examples have been observed in Kinshasa, the capital of the Democratic Republic of the Congo (DRC) and in Karachi in Pakistan (Bloom et al., 2008).

Ades and Glaeser (1995), Davis and Henderson (2003), Majumdar, Mani and Mukand, (2004) and Jedwab et al., (2014) affirm the fact that urban zones act as socio-economic, political and administrative centres. Governments tend to adopt and implement urban-biased policies in countries that export natural resources resulting in the resource rents being spent on urban goods and services. This, according to Jedwab et al., (2014) not only increases urban wages for workers but also improves the nature of goods and services that people access in urban areas - again acting as pull factors for people from rural areas. Jedwab et al., (2014:1) further state that “as long as the expected urban real wage is higher than the rural real wage the higher wages associated with urban jobs over rural ones will always act as an urban pull factor to many people living in rural areas”.

Gugler (1997) and Sajor (2003) agree that better education and health services, often only available in urban areas, offer a guaranteed prospect for a better life. It is for this reason

Sajor (2003) argues that people are forced to move to cities where their children will have the opportunity to access better education and health services as a way of ensuring that the future of their children is guaranteed to be better than that of their parents.

Changes in urban populations are also a result of natural population increases (Arteetey-Attoh, 2001 and Konadu- Agyemang, 2001). Konadu- Agyemang (2001) estimates that in the majority of urban areas in African and Asian developing countries, around 40 to 50% of population growth is due to natural increase. This argument is similar to that presented by the United Nations Department of Economic and Social Affairs (UNDESA, 1985) citing empirical data provided by Preston (1979) and Rogers and Williamson (1982) approximately 60% of urban growth is attributed to natural population increase within the urban centres.

Konadu-Agyemang (2001) argues that because great strides have been made in improving medical technology, there has been a drastic fall in mortality rates in developing countries which has helped to increase life expectancy. Coupled with high fertility rates, increased life expectancy has contributed to growth in the population of the urban area (Konadu-Agyemang, 2001 and Cohen, 2006). Wertz (1973) states that urban centres are primary recipients of new and advanced medical facilities, scientific techniques as well as medical expertise that contributes to better and healthier lives and reduces mortality rates. As indicated above, most of the people who migrate to urban areas are young and this, plus higher fertility rates and the excellent health services that urban areas offer to citizens, means that more people are naturally added to urban populations in addition to in-migration.

To accommodate this ever-growing urban population, urban boundaries are altered as part of urban growth processes and such extensions encroach into peripheral areas which change the environment of these areas and also influence the nature of people's livelihoods in these areas (Arteetey-Attoh, 2001 and Konadu-Agyemang, 2001).

A summary of the drivers and pressures of and on urbanisation are presented in the model below. Chief among the push factors is poverty that is so high in rural areas while prospects for a better well-paying job in the non-agricultural sector seem to be the key motivation why people migrate into urban areas.

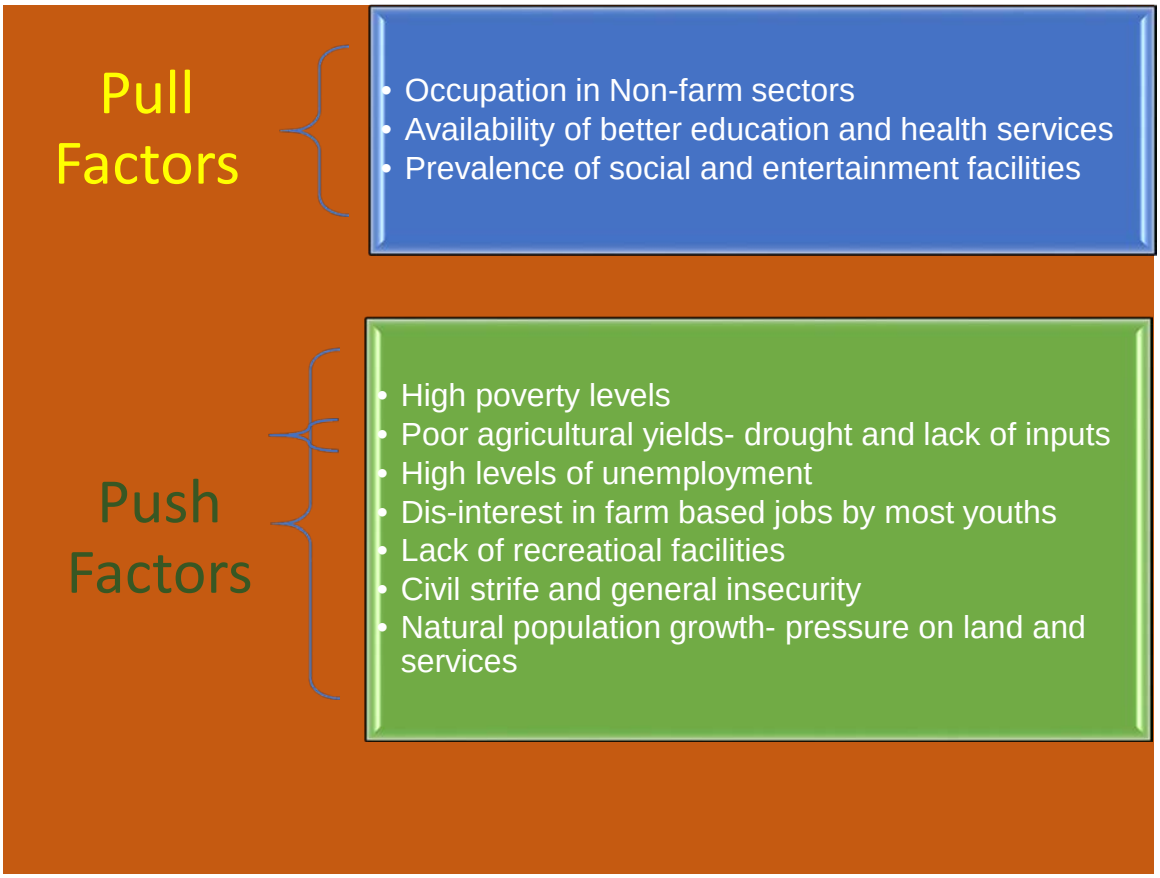

Figure 8: Summary of Pull and Push factor responsible for rural to urban migration.

Source: Author's creation.

2.2.5 Positive and adverse effects of Urbanisation

Urban, peri-urban and rural areas co-exist and what happens in one zone has an impact on other zones (Aberra and King, 2005). Co-existence and interactions of these areas have formed the core of many research works and diverse opinions and findings have emerged over the years.

The literature presents a consensus that urbanisation forms the greatest linkage between urban and rural areas as it is characterized by population shift from rural to urban environments (United Nations, 2008 and Henderson et al. (2009). Tegegne et al. (2000) and Eyob (2010) concur that the process of urbanization and the subsequent urban growth, are now being looked at as modern ways of life through which a variety of opportunities and interventions are made available to households, and this contributes profoundly to the socio-economic growth and development not only of families but communities and countries at large.

Development practitioners, scholars and researchers differ on the effects that the process of urbanisation produces on the developmental, demographic, environmental and social situation in cities and their peripheral villages (UNFPA, 2007 and Edusah, 2008). Satterthwaite and Tacoli (2003) write that social, political and economic links that exist between rural and urban areas have been a general subject for research and discussions leading to the emergence of diverse opinions on the nature of the interaction prevalent between events in urban areas and areas peripheral to them. Aberra and King (2005) indicate that prevailing development relationships between rural and urban areas can either be beneficial or detrimental to inhabitants of both areas as it can extend the inequality gap existing between the haves and have-nots and it can increase levels of vulnerability for people with the least amount of assets and potential.

The process of urbanisation involves the expansion of urban boundaries into rural areas which in the process, directly and indirectly, has an impact on rural households through

exposure to new challenges and opportunities (Thuo, 2013). While acknowledging that urbanisation has a mix of effects on both urban and rural areas, it is the view of Henderson et al., (2009) that how a household is affected by the process is a product of the household's socio-economic standing and geographical location.

Further to this, Davila et al., (2008) concur that rural-urban linkages are spatially and socially differentiated in a sense that livelihoods and living standards of people in both urban and rural areas can be negatively or positively affected by the process of urbanisation. Henderson et al., (2009) opines that although the impact of urbanisation is often based on a household's socio-economic standing and geographical location, the impact can be culturally and socially traumatic, especially for rural people if the process is not planned and managed well. Melesse, (2005) and Gete, (2007) have documented a number of effects of urbanization in covering such areas as forests and soil degradation, water pollution, and above all a huge decline in agricultural production, agricultural community displacement, and squatter settlement. The sections below look into some of these areas.

2.2.6 Agriculture, land use/land change and Urbanisation

Apart from being the source of food for both urban and rural inhabitants, the agricultural sector in many developing countries is the only source of livelihood for many rural people and one of the largest contributors to the economies of many developing nations (Cervantes et al., 2010). Jun Jie Wu (2008) looks at land as one of the three major factors of agricultural production. He argues that agriculture is only possible where land is available and conducive for agricultural output and cites among others, quality, quantity and land tenure as some of the factors on which actual production within the agricultural sector is based. However, the increasing pressures from urbanisation and development create a desire in many to engage in non-farm occupational employment. According to

Aberra and King (2005) this has gradually been squeezing rural people out of farm lands thus making farming less important with regard to the livelihoods of rural communities.

Eyob (2010) writing specifically about urbanisation and how it affects farmers' livelihoods in Ethiopia. He indicates that families that purely rely on agriculture as a source of livelihood look at land as both the physical and natural capital on which their lives depend. It is through land that households can provide and access services such as health and education for family members. Eyob (2010) indicates that this means any factor that creates a negative consequence on the land owned by poor and peasant farmers negatively affects entire lives of household members. Satterthwaite et al., (2010) further point out that urban expansion imposes changes in the way agricultural land is utilised, the most common being the loss of farmland to accommodate non-agricultural usage like space for construction of infrastructures that come along with urbanisation. In addition to change of land use, Lei and Bin (2008) and Satterthwaite et al., (2010) indicate that urbanisation also increases the value of land in rural and peri-urban zones which acts as a motivation for rural peasant farmers to sell their farmland, a major decision given that land represents the major and often only asset possessed by people in rural areas, which affects food availability and accessibility at both household and national levels.

While the impact of urbanisation on peri-urban areas and their associated livelihoods can be both positive and negative, Alaci (2010) argues that when well-planned and managed, urbanisation serves as a positive development factor. Satterthwaite and Tacoli (2003) and Alaci (2010) add that benefits of well-planned and managed urbanisation processes include high demand for agricultural produce by the growing population in adjacent urban areas. Furthermore, well managed and planned urbanisation supports peri-urban people's access to developed extension services for peri-urban farmers due to reduced proximity from relevant authorities and above all urbanisation provides opportunities to peri-urban dwellers to venture into non-farm employment.

However, despite the presence of the above benefits, UN-HABITAT, (2010) argues that unguided urbanization, which is common in most developing countries, negatively affects the natural environment and livelihoods in peri-urban areas. Concurring with Li Jiang et al., (2014) UN-HABITAT, (2010) states that effects of unguided urbanisation are visible in changes occurring in land use, water resources management, waste dumping, and the increased competition that emerges between agricultural and residential use of natural resources. Such negative effects result in increased levels of household poverty and damage to the peri-urban environment (Marshall et al., 2009).

There have been studies elsewhere that have examined both positive and negative effects of urbanisation on the livelihoods of people living in the periphery of urban areas. One such study analyzed the impact of urbanisation on household and community livelihoods and was conducted using a combination of qualitative and quantitative approaches in the peri urban areas of the Ho Chi Minh City in Vietnam (Tho, 2006). The study revealed that youths in the study area were less engaged in agriculture as they had diversified towards non-agriculture activities. Further to this, Lei and Bin (2008) and Thuo (2010) remark that selling of farmland by peri-urban dwellers deepens levels of vulnerability for households in terms of hunger and poverty. As the number of farmers reduces in peri-urban areas, the cost of food goes up because the number of producers is reduced since farmers are displaced or have no land on which to do agriculture.

Furthermore, when creating the space for infrastructure that urban areas demand, land for agriculture is converted to new uses thus affecting agricultural productivity, leading to low food production. This, coupled with the increase in the number of people working in non-agricultural sectors, can lead to an increase in the cost of food (Thuo, 2010). Plantinga et al., (2002) caution that the impact on rural poverty of the selling or leasing of land to urban dwellers depends on how the proceeds from such exercises are distributed and used by the rural population. Plantinga et al., (2002) explain that in places where land is very concentrated, thus owned by a few in the rural area, leasing or selling of farmland

may mean a restriction on employment for the landless population. Additionally, if the available land owned by a few is sold and used for non-agricultural enterprises (such as construction of residential houses and offices) this only offers temporary employment to rural people, and the rural people will, in the long run, be without a source of income. This scenario illustrates how selling of land can worsen poverty levels for households that are in those areas adjacent to urban centres (Cali and Menon, 2009).

Despite these negative effects, UNFPA (2007) indicate the emergence and extension of urban boundaries can bring in greater potential for poverty reduction for rural communities than other activities in rural areas. Urban areas are by their make-up places that are characterized by multiple economic activities that offer people more options for generating income than simply agriculture. Cali and Menon (2009) indicate that urbanisation also helps in increasing agricultural land prices in areas that are in close distance to urban areas. In this situation, there is always a high demand for agricultural land for residential purposes which generates increased income for rural people who own large masses of land through sale or lease or through the use of the land owned as collateral when accessing credit facilities.

Together with Aberra and King (2005), Edusah (2008) argues that although valuable agricultural land might be lost in the context of urbanisation, the emergence of urban areas in previously rural areas creates a diversity of livelihoods that people can depend on as job opportunities are created in various sectors are only found in urban areas. This means that although there might be loss of arable farmland at household level, rural households can still be food secure through their ability to buy foods using funds realized from employment (Aberra and King, 2005). In addition, rural inhabitants who might have lost land through urbanisation may engage in small-scale businesses that might bring in more regular income at the household level than generated from agriculture that is often a-once-in-a-year income generating venture (Aberra and King, 2005).

Cali and Menon (2009) point out that urbanisation and agriculture in rural areas can also be linked by the changes in rural labour supply that accompany the urbanisation process. In that rural-urban migration reduces the rural labour supply within the agricultural sector which may increase labourers' wages. Quoting Jha (2008) Cali and Menon (2009) reveal that evidence gathered from rural areas in India that have witnessed high out-migration being associated with higher wages within the agricultural sector as very few labourers are available forcing demand for them to go up automatically raising the associated wages.

It can therefore be concluded that since land is the major factor for crop and animal production, which are the mainstay of peri-urban livelihoods, anything that reduces availability of land contributes significantly to increase vulnerability of people's livelihoods. Urbanisation as a process seems to be doing just that.

2.2.7 Income/ Poverty and urbanisation

Cali and Menon (2009) argue that poverty levels and the nature of economic activities are positively impacted by growth of urban areas regardless of whether the growth of the urban area is has something to do with increase in population size- when more people migrate into urban areas or growth in terms of the income that people living in urban areas are associated with. They argue that areas that are close to urban centres have better opportunities to engage in the production of perishable agricultural products such as fruits, vegetables, and dairy, which have a readily available market. This view is similar to that of Sasaki and Box (2003) who argued that people living in rural areas far from urban areas can rarely engage in the production of perishable products because of their perishability and their high transportation costs.

David et al., (2010) additionally indicate that urbanisation increases demand for agricultural products in urban areas because urban dwellers cannot grow their own food.

Ellis (2000) adds that this demand means that rural/peri-urban farmers are provided with the opportunity to supply their agricultural products to meet the urban demand thus making more money. Evidence of such occurrence is in the results of studies conducted by Parthasarathy Rao et al., (2004) and Thanh et al. (2008) that reveal how urban areas in India and Vietnam demonstrated a high demand for high value fruits and vegetables and that farmers in adjacent rural areas were able to generate higher economic profits as a result.

Additional economic benefits resulting from the movement of rural people into urban areas that help fight poverty, also emanate from remittances in the form of money and other items that migrants to urban areas send back to relatives and friends left behind in their rural environment (Ellis, 2000). Ellis (2000:3) found that studies conducted by various researchers in developing countries tended to show that "the majority of rural-urban migrants, (between 80% and 90%) send remittances home although the remittance amounts vary in proportions and frequency as they are dependent on the nature of income one is getting in the urban area". This according to Cali and Menon (2009) means that higher rates of urbanisation are associated with larger remittance flows to the rural places of origin of the immigrants which positively help in "reducing resource constraints for rural households as well as providing a form of insurance against adverse shocks as this new and slightly reliable source of income is uncorrelated with risk factors prevalent in agriculture" (Stark, 1980:136) and Stark and Lucas, 1988).

Tettey (2005) and McGranahan and Satterthwaite (2014) agree that apart from increasing the number of people living in the cities, urbanization also creates a pool of readily available human resource for a country's business sector that might lead to growth in industrial productions thus firing up a nation's economic growth. The authors add that a well-supported business sector is a good foundation on which the economy can be based. However, the authors caution that it needs to be noted that urbanisation also comes along with numerous problems and challenges such as poor waste management, high

environmental degradation, scarcity of farmland and high rates of prostitution, crime and unemployment in the urban area.

2.2.8 Environment and urbanisation

Urbanisation also impacts the ecological environment, and this is another contentious area for researchers and development analysts. Thuo (2010) argues that urban growth in rural areas has extensive consequences for the natural environment. Davila (2002), Ubink (2006) and Edusah (2008) have established that poorly managed and poorly planned urbanisation processes produce damaging effects on indigenous peri-urban dwellers whose livelihoods depend on natural resources, thus making them victims, largely because of the loss of farmland to non-agricultural uses. The increased population results in increased demand for agricultural products which increases pressure on farmers to produce more, a process referred to as over-cultivation by (UNCCD, 2006 and United Nations, 2007). The UNCCD (2006) and United Nations (2007) jointly indicate that over-cultivation of farmland forces farmers to use poor farming methods which encourage soil erosion that negatively impacts the environment.

Craul (1985) argues that changes in land use and land cover are necessary and essential for economic development and social progress, but is quick to note that such changes come at a cost to mankind. The conversion of farmland and forest land into urban areas create environmental challenges that have long-lasting impacts on the livelihoods of not just rural farmers but even urban dwellers. Table 3 below presents some of the environmental challenges that are a product of urbanisation through changes that are made on land use and land cover.

Urbanisation induced environmental challenges
Soil erosion
Air and Water pollution – leading to climate change
Waste management
Desertification

Table 3: **Environmental challenges, a product of urbanisation.**

Source: Author's creation

As indicated, one key environmental challenge attributed to changes in land use and land cover is soil erosion. According to Craul (1985) soil erosion globally affects 40 percent of the world's agricultural land. This impact both the quality and quantity of agricultural outputs and investments. Troeh et al., (1991) and Rakodi (2002) add that land use changes like construction works, which often involve excavation of land often leave the ground bare thus exposing the naked ground to agents of erosion. Further to this, Rakodi (2002) points out that infrastructure such as roads and drainage systems increase the rate of soil erosion because in addition to removing the natural vegetation cover during the construction phase, embankments that support roads and drainage systems speed up water flow that increases top soil loss.

Defined as the physical displacement of soil by wind, water, air and gravity by Santamarta-Cerezal et al. (2013), soil erosion represents a form of soil degradation that affects among others soil compaction, reduces organic matter content in the soil and thus making soils have poor internal drainage patterns. This not only affects the soil structure

but also the nature of plants and crops that can grow in the affected soil (Santamarta, 2013). Although soil erosion is a naturally occurring process, dependent on various factors including the amount and intensity of precipitation that land is exposed to, average temperatures, seasonality, wind speed and storm frequency (Troeh et al., 1991). Intensive use of land also may accelerate the rate of soil erosion (Santamarta-Cerezal et al., 2013).

There are on-site and off-site environmental consequences that come out of soil erosion. The removal of fertile soil (Lawal et al., 2011), reduces the quality of soil which results in loss of the nutrient-rich upper layer that contains the critical nutrients plant utilized for their growth. Additionally, Hu et al., (2001) and Lawal et al., (2011) state that soil erosion also contributes to reduce water holding capacity of soils, forcing water to run-off even on level grounds, which leads to increased sedimentation and pollution of water and available water sources. In addition to upsetting the natural ecosystem, increased sedimentation and pollution of water poses a potential health hazard to human beings as contamination and siltation of water sources also affects drinking water supply systems in both urban and rural areas.

Urbanisation also contributes to soil erosion through increased and accelerated surface runoff in urban areas. Gumindoga et al., (2014) while investigating the hydrological impacts of urbanization of two catchments in Harare, Zimbabwe discovered that increases in water runoff caused a lot of soil erosion in the study area and this coincided with the decrease in forest area and an increase in urban area. It was concluded by Gumindoga et al., (2014:12568) that:

> "A significant impact of urbanization on hydrological regimes is the increase of impervious surfaces, which cause increased streamflow volumes due to the reduction in soil infiltration capacity. As such,

> urbanized surfaces are likely to generate more runoff than areas, which are densely covered with vegetation especially woodlands".

Gumindoga et al., (2014) further explains that because urban areas have more paved and roofed surfaces, these surfaces reduce the area over which precipitation can infiltrate the soil, and the lack of infiltration into the soil results in increased overland flow thus contributing to quick runoff and streamflow. The researchers also concluded that "clearance of woodlands and forests to pave the way for infrastructure that comes with urbanization significantly alters streamflow regimes hence urbanization probably is the main cause for the streamflow increases" (Gumindoga et al., 2014:12568).

It is the view of Gong et al., (2012) that urbanisation also affects the quality of the urban environment through air and water pollution that then contributes to disease prevalence in both urban and rural areas. Additionally, the rise of urban areas entails an increase in the number of motor vehicles available in a particular location that is associated with an increase in traffic-related accidents that pose a major public health threat. Following the utilization of a variety of PRA methods, Gebre and Rooijen (2009) found that peri-urban communities look at river and spring water as important assets for both domestic and irrigation water sources. However, respondents in the study also indicated that due to frequent and inappropriate solid and liquid waste disposal, the water sources are being polluted at a fast rate such that some water sources have become unusable as they have been found to be creating health problems for people and their livestock thus impacting on people's livelihood.

Related to the above, a 2014 report by the United Nations Department of Economic and Social Affairs (UNDESA, 2014) indicates that the provision of water and sanitation services to growing urban settlements, peri-urban and slum areas, often areas that are heavily populated and that have sub-standard housing with very poor living conditions, presents critical challenges. The report further highlights that increased demand for water

from the growing population in urban and peri-urban places added stress on already stretched resources thus reducing water quality as responsible authorities cannot manage to fully meet the demands of the residents.

Waste management is another environmental challenge that urbanisation seems to be promoting (Appiah et al., 2014). According to (UNDESA, 2014) and Appiah (2014) solid waste management in many towns and cities is inefficient or non-existent as there is no proper collection, transfer, recycling and disposal mechanisms. Because of this, industrial waste among other forms of wastes is allowed to flow into rivers that are used for domestic and agricultural purposes thus causing critical health risks to household members in peri-urban areas who use river water for irrigation and domestic use. It needs no highlighting that an unhealthy household cannot fully utilize the human capital as sick members can hardly participate in the pursuance of a livelihood.

Urbanisation is also responsible for desertification, a key environmental challenge. According to the United Nations Convention to Combat Desertification (UNCCD) (UNCCD, 2005:6) desertification is the “degradation of land and vegetation, soil erosion and the loss of topsoil and fertile land in arid, semi-arid and dry sub-humid areas, caused primarily by human activities and climatic variations”. According to David and Nicholas, (1994) and Fukuhara et al., (1997), the term desertification is not only limited to land surrounding deserts but also to large food-producing areas in semi-arid and sub-humid regions. The rising human usage of desert shrub lands for dwelling, agricultural purposes, industrial and recreational use would directly affect the size of an arid land area that would consequently grow (Okin, et al., 2001).

Around half of the states in the world have experienced desertification and its impacts to a varied extent and intensity linked to arid climatic conditions (Gao and Liu, 2010). Bunning and Ndiaye (2009) reveal that desertification affects approximately 20 percent of the world, affecting the livelihoods of over 850 million people. However, the precise

extent of desertification is difficult to estimate, because few comprehensive assessments have been conducted so far. Globally the worst affected areas are found in the Sudano–Sahelian region, Africa south of the Sudano–Sahelian region and the Andean, South America region, where approximately 21 million hectares of land are rendered almost unusable annually (UNEP, 1999). Abahussain et al., (2002) add that desertification also destroys an additional 200,000 square kilometres of productive land every year and the effect is more pronounced in poor countries where people depend exclusively on food produced within agricultural areas that are slowly becoming desert land.

Asma, Ali et al, (2002) and James, (2003) indicate that human activities are the sole cause of desertification either directly or as the by-product of human activities that are leading to climate change. Some of the ways of and types of human activities that facilitate desertification are in Figure 9 below.

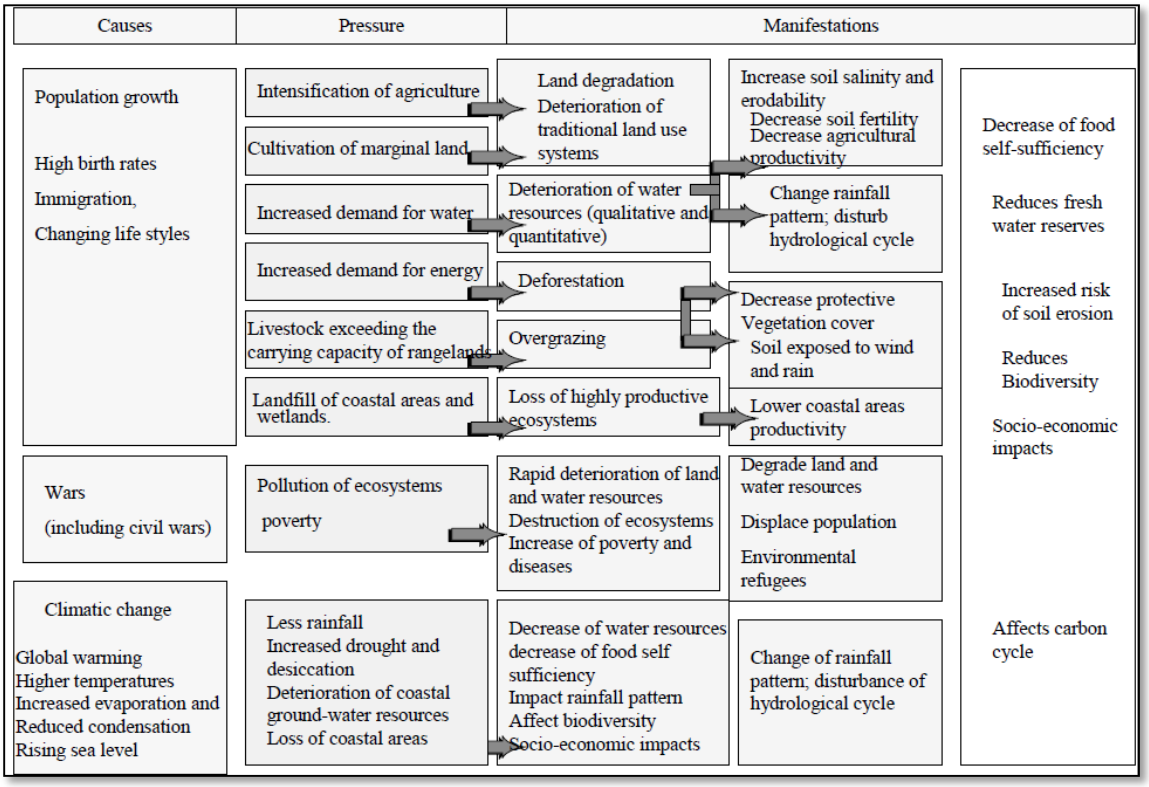

Figure 9: Classification of the causes of desertification

Source: Asma, Ali (2002)

Figure 9 reveals that the increase in population, through prevailing high birth-rates, immigration, changes in people's life styles and climatic changes are putting pressure on a number of areas. Areas most affected include the agricultural sector where people, out of desperation, cultivate on marginal lands, over use available water, pollute water sources which leads to land degradation, deforestation, decrease of water resources and changes in land use system. The table further indicates that the pressure and damage the factors cause leads to salinization of water, decreased soil fertility and contributes to changing climatic conditions. These potentially bring about decreased food production and poor nutritional levels for household members.

Urban development is not decreasing and governments must design and implement proper policies and guidance on how the process can better be managed (Cao et al., 2007). Good policies that governments might devise should be aimed at helping reduce damages associated with urbanisation, like soil erosion, through policies of planting of trees and other forms of vegetation especially in the peri-urban areas so that the roots of these plants can hold the soil in place. In addition to this, growing of cover crops on the agricultural land in off-season can minimize erosion caused by wind and water and the construction of surface runoff barriers such as edgings made of bricks can also help reduce the amount of surface runoff which is the main carrier of fertile top soils.

2.2.9 Public health and urbanisation

Gong et al., (2012:1) write that rapid urbanisation has important consequences for public health and argue that "the growing disease burden in urban areas attributable to nutrition and lifestyle choices is a major public health challenge, as are troubling disparities in health-care access, vaccination coverage, and accidents and injuries".

Urbanisation is also responsible for posing some "substantial health risks as people are exposed to air pollution, occupational chemicals, traffic related accidents, and dietary risks that come with people's change in diets and physical activities" Gong et al., (2012:1). They also acknowledge that urbanised areas can have added health benefits as urban populations often "have better access to health services and education and higher incomes than do their rural counterparts." It is argued that these stated factors enable urban dwellers to lead healthier lives as through education, urban people are able to know and live lives that help in disease prevention, good eating habits and are able to quickly notice signs and symptoms of diseases. The better and higher income often found in urban areas also means that people in urban areas are better placed to pay for specialist treatment.

2.2.10 Social-cultural life style and urbanisation

According to Narrain and Nischal (2007), one of the internal products of the process of urbanisation is the re-composition of populations in both urban and adjacent areas. This re-composition involves amending; modifying, adopting and discarding some previously agreed social norms and values. Narrain and Nischal (2007) also look at urbanisation as a process that is responsible for social compression or the intensification of people's values and beliefs, a process that has both positive and negative consequences on people's socio-cultural life and lifestyles.

With urban places being the meeting point of a variety of cultures from various localities, urbanisation can help improve people's awareness of their culture and national heritage. Additionally, Iaquinta and Drescher (2000) indicate that urbanisation brings into one zone people from diverse backgrounds of rural smallholder farmers, informal settlers, business persons, urban middle class and the elite with varied views, perceptions, practices and interests who are forced to co-exist in the same territory and that brings conflict amongst this diverse population.

Secondly, as urban areas become congested due to the inflow of rural people, it is not just the physical structures that change but also people's attitudes, beliefs and ways of living. The emergence of a life of individualism, a lifestyle common in urban settings, may result in a loss of respect for one another, drug abuse, prostitution and 'loafing' among young members of urban societies (Narrain and Nischal, 2007). They add that due to in-migration into urban areas, migrants may become distant in their association with rural based social gatherings with the youth preferring urban entertainment over rural social events.

It needs to be noted that traditional forms of social networks, where there is a lot of dependence on one's friends and relatives acts as the greatest social capital in rural areas. To affirm this, Brook and Dávila's (2000) study in India confirmed that extended families

that had closely related members, who were living in the vicinity of one another played a vital role in providing opportunities and contacts for other family members. Urbanisation, therefore, may weaken cohesion among urban dwellers as people's co-existence may entail that members do not have common local customs and norms (Thuo, 2010).

However, urbanisation is not wholly destructive of people's socio-cultural lifestyles as positives also exist. For example, urban residents are offered opportunities to move away from lifestyles that revolve around agriculture and mining and may find employment in more professional occupations that offer people a better life and space for career growth. Working in the service sector, be it in administrative or managerial positions, changes people's lifestyles as they have the potential to earn more and lead a better life than they could have been doing in rural areas. According to Thuo (2010), urbanisation provides new and effective communal space where urban dwellers can still mingle and feel a sense of belonging, for example, through joining religious groupings where the traditional settings allow members to support each other in times of need. For those employed in various sectors within the urban setup, work mates also form a new set of relations that one can call on when the need for assistance arises, and the same applies to youths who are still in school.

Urbanisation is clearly a two-sided phenomenon. The urbanisation process can bring positive benefits such as increased chances for people in peri-urban areas to secure well-paid jobs, gain knowledge, live in better houses, and be able to access education and health services and the generation of ready markets for agricultural products. However, the process also places enormous pressure on natural resources and the provision of social services and infrastructure by governments, and can lead to the loss of cultural values that pull people together in peri-urban and rural communities.

2.2.11 Positive Impacts of Urbanization through developing market for farm produce

Urbanization has been touted as one of the universal parameters for the development of the economy. Especially, it has been seen that urbanization plays an important role in development of industries and services. In order to make this urbanization sustainable, it is important that urbanization is actively supported by agriculture. This is also considered as one of the perceived benefits of urbanization. Research shows that lower quality of agricultural products along with shortage of agricultural products, have led to multiple urban dwellers to undernutrition. Hence, this definitely provides an opportunity to the agriculturists, to create a market of their product in the urban centers. There has been always an increasing demand for agriculture products in the urban centers, owing to ever increasing urban population (Satterthwaite, et al., 2010). It has been found that, globally major proportion of urban population is surviving with lower income group, and this has directly affected their health, specifically their nutrition. It was deemed that nutritional status is at great risk, due to price surge of the staple foods (Cohen & Garrett, 2009). Globally, it was found that in the year of 2008 for the first time the urban population has exceeded the rural population and that meant more demand of agro based products in the urban areas. Another, important transition which might have been ignored, is that the population employed in industries and services were more than the population who were involved in agriculture. There are certain implications of urbanization on agriculture and farm production. Most of these implications are positive. In order to understand this, one has to start with the core implications of urbanization. One of the important facts in this case is that urbanization leads to loss of agricultural land since some portion of agricultural land is acquired to facilitate urbanization and is used for nonagricultural purposes. However, rather than classifying this as a negative implication, it can be said that it is part of the urbanization process. The loss of the agricultural land to the spatial expansion of urbanization process is a normal process. Most of the time this fact is exaggerated in the context of the urbanization, when the fact is only one percent of

agricultural land gets absorbed in the urbanization process (Schneider et al. 2009). On the other hand, a lesser proportion of agricultural land in urban areas will lead to more intensive production of agricultural production, and efficient usage of agricultural land (Bentinck, 2000). Even though evidence gathered in from research demonstrates that urban population is less concentrated around the cultivable lands in the urban areas. Similarly, lack of adequate agro products might have also led to dietary changes, where most of the urban dwellers indulge in a higher proportion of meat consumption, and lesser proportion of consumption of agricultural products. However, few scholars have rejected this logic, and contributed the higher consumption of meat to luxurious life style and higher income (Stage et al., 2010). Owing to absence of appropriate data, it will be difficult to conclude the reason of higher consumption of meat in urban areas.

It has been observed that most of the existing research points towards the negative consequences of the urbanization. One of the main reasons behind this is that the evolution of urbanization is considered as a process evolved from non-food procedures. At the same time, urbanization is said to have developed demands for agricultural products, and for the products which are considered of higher value that bring definite benefits to the farmers. The demand and supply of the urban agricultural products in the urban areas are solely managed by rural urban linkage. The capacity of the food producers which are eventually the agriculturists, play an important part in adapting the changes in the urban era (Tiffen 2003; Hoang et al. 2005).

Often it is thought that the nonagricultural income plays an important part in reducing the rural poverty (Deshingkar, 2006). However, it has been seen that farmers do earn handsomely, by selling farm produce in the urban areas. This is an aspect which is ignored in most of the research, which has been done in this context. From this phenomenon, it is very clear that there is a definite market for farm produce in the urban areas, and this should be deemed as one of the perceived benefits of urbanization. It has

been found that in Africa earnings from the non-farm sectors and the urban areas, play an important part in funding the innovation as well as intensifying of the farming process (Tiffen, 2003). This phenomenon works best, in those areas which have better connectivity to the urban centers. In certain cases, it has been found that local traders procure the farm produce, and process them locally in the urban areas, and sell them in the urban market. This is a much more specialized approach (Hoang et al. 2008).

In the context of rural urban linkages, it has been found that urbanization brings drastic climate changes in the urban areas and as a result the urban agricultural productivity gets reduced. This also effects the price as well as availability of agricultural products, produced in the urban areas. This is another scenario where the urban dwellers have to rely on the farm produce of the rural areas.

From this discussion, it can be clearly concluded that in spite of widespread urban bias, urban centers are the significant markets of farm produce, which are produced in the rural areas. This can be considered as one of the benefits of urbanization.

2.2.12. Urbanisation and planning

Watson (2009:151) found that despite urbanisation being a long-standing process, many "towns and cities are dealing with crises that are compounded by rapid population growth, particularly in peri-urban areas; lack of access to shelter, infrastructure and services by predominantly poor populations; weak local governments and serious environmental issues". The emergence of newer issues such as climate change, resource and energy depletion, food insecurity and the recent global financial meltdown have made it even more difficult for governments to manage urbanisation. UN-Habitat (2010) suggests that there is need for effective and efficient reform in the manner governments manage their urban planning systems. Current systems seem to be part of the problem as

evaluation of many urban planning systems have revealed that to some extent the systems seem to "promote social and spatial exclusion, are anti-poor, and are doing little to secure environmental sustainability" (Watson, 2009:151).

Planning of the urbanisation process can, in the opinion of UN-Habitat (2010), help reduce some of the challenges and improve the positives that come along with urbanisation and how each set of factors affects the livelihoods of people in peri-urban areas. While acknowledging that countries in the global South, "have formal planning systems modelled on those from other parts of the world, these systems are inserted into particular institutional contexts and their ability to influence land management in cities and towns is circumscribed by a wide range of local, national and international forces" (Watson, 2009:157). Because of this, Watson (2009:156) argues that urban planning processes should, therefore, consider "factors that are shaping the socio-spatial aspects of cities, and the institutional structures that attempt to manage them while recognizing prevailing demographic and environmental challenges by factoring them into planning systems".

A study that examined the land use changes in China in Beijing, revealed that land development was the most significant factor that was stimulating peri-urbanisation in Beijing. According to Zhou and Ma (2000), in the period 2000–2008, Beijing experienced rapid transformation of land due to the process of peri-urbanisation where land use for settlements and industrial development increased by 420 square kilometres, and land use for new transport infrastructures had a growth of 48 square kilometres in the peri-urban region. The report adds that great losses were realized in agricultural land where 212 square kilometres of arable land, 66 square kilometres of land used for gardens and 114 square kilometers of forest were lost due to city expansion (Zhou and Ma, 2000).

It is important to understand all these pressures in each context and the stakeholders who are affected. Also, it is important to fully understand the livelihood strategies of those experiencing land use change. The next section explores this in detail.

2.2.13. Conclusion

From the above discussion, it can be concluded that urbanization was the result of complex settlements and trade, which eventually led to formation of cities. Urbanization instigated the movement of rural populations to the urban centers, especially youths, owing to better employment, an opportunity which was a result of industrial growth. Rural populations also move to urban centers, with the perception of modernization as well. Keeping this fact in mind, UN has already projected that there will be a massive rise in the urban population by 2050. From this discussion, it is very clear that researchers consider urbanization as one of the core parameters of development. Most of the scholars as well as researchers have categorized the urban areas as those with huge urban populations, while some of them considered urban areas as those based on strong economic and political hold. Modern economists do believe that urbanization can be broadly associated with the presence of nonagricultural industries. In other words, nonfarm occupation forms the key highlight of urbanization. It has been seen that there has been massive increase in urbanization at global level with Europe and North America being the most urbanized regions, while Asia and Africa the least. As per the UN reports, the European and North American regions are in the process of reaching the saturation points in urbanization, while least urbanized regions of Africa and Asia will be under massive urbanization spree by 2050. Research scholars conclude that, key infrastructural development leads to massive urbanization. This has been already established in the previous research, and the city of Bangalore in India is a live example of the same.

A key conclusion which can be drawn in this regard is, urbanization propels the rural dwellers to undergo massive development in order to get them adjusted in urban areas.

One of the key developments, which rural dweller undergoes is occupational change. Since urbanization is mainly based on non-agricultural jobs, a rural dweller has to transform himself from undertaking agricultural jobs to nonagricultural jobs. This includes both industries and services. Moreover, a rural dweller has to make certain adjustments in order to adapt urban life. He has to adopt urban values, attitudes and beliefs. This transformation or development is justified by the modernization theory, which mentions that industrialization is the base of any form of urbanization, and as a result rural dweller have to undergo massive transformation pertaining to their occupation. The modernization theory also underpins the usage of technology, primarily in industries, which in turns helps in the creation of jobs. However, technology is used in all aspects of urbanization including healthcare and education. Apart from modernization, dependency is another attribute which leads to urbanization. In this case the developing nations depend on the economically developed nation, which ultimately drives the urbanization. While the urban bias theory underlines the political development as a core factor of urbanization, it can be concluded from the urbanization theories-keeping the previous research in mind- that urbanization is a mix of technology, dependency and political importance. Any urban center today is industrialized because of modern technology, while at the same time they became economically dependent on the developed nations, who make massive investments in these industries. The economic development of the region, also leads to being political stronghold of the region.

When it comes to the factors leading to urbanization, from these studies, it can safely be concluded that push factors; mainly poverty because of draught, loss of land and unemployment, have forced the majority of the rural dwellers to move to urban areas. On the other hand, pull factors such as employment opportunities, modern urban life, and better facilities have attracted many rural dwellers to the urban areas. Also, from the above-mentioned studies (Jedwab et al., 2014), it is very clear that majority of rural youth are not in favor of pursuing agriculture as their profession, owing to involved risks and

lower income levels. In the context of urban-rural linkage, urbanization provides multiple opportunities of development for individual families and for the community as a whole. From the viewpoint of the scholars, the above studies (Bhatta, 2010 and Jedwab et al., 2014) elaborate that urban rural linkage is capable of developing social, political and economic links. Previous studies also conclude that urban rural linkage is beneficial for both, the urban as well as rural dwellers. However, in certain cases it can create a gap based on inequality that has been developed on the basis of wealth and capabilities. Nevertheless, scholars believe that the effects of urbanization are mixed on both urban and rural areas, where both have their own merits and demerits. It has to be noted that urbanization increases spatially and in this process, it engrosses rural regions owing to its expansion. In this case, the rural households generally have certain challenges in adapting to the urban environment.

From the discussion, it was concluded that agriculture has been the sole occupation of the rural dwellers for long time, and the wellbeing of the rural dwellers directly depended on the land usage. It could be said that urbanization has brought a lot of changes in the usage of agricultural land. Primarily, farmers' rural areas are affected with loss of land due to land grab issue owing to spatial expansion of urbanization. At the same time, many farmers sell their lands willingly in order to earn higher profit, since land value becomes quite high in the context of urbanization. On the contrary, it has been found that absence of agricultural land in urban areas, creates an effective market for farm products in the urban centers. This could be deemed as one of the positive impacts of urbanization in the rural areas, but this can be achieved only when the process of urbanization is completely managed. This will also help in reducing rural poverty. In spite of this, in a longer run it will create a shortage of agricultural land and agricultural labour, which will have direct impact on the food production. In this case, lower availability of agricultural labor, would also mean higher wages for the existing labour. This is a normal phenomenon, wherever there is a shortage of resources, the wages go high. There is a definite advantage for the

dwellers of the peri urban areas, as they have a set market for the perishable goods. This will help in increasing their income, and reducing their poverty. While rural dwellers who stay pretty far from the urban centers, might not be able to utilize this market owing to high transportation cost and the perishable nature of goods. In this case, rural poverty reduces with the help of two distinct ways. In the first way, rural farmers earn more by selling their farm produce in the urban markets, where there will be a high demand due to lower proportion of agricultural lands. Secondly, rural dwellers who work in urban centers, will send back money to their families, which will alleviate the level of poverty.

There is no doubt that urbanization impacts the environment, and this becomes worse when the urbanization is not planned properly. Some of the common environmental impacts are soil erosion, deforestation, air & water population. Moreover, these kinds of environmental impacts sudden climate changes, which in turn effects the dwellers in rural as well as peri-urban areas. Also, there is reduced fertility in the soil, which reduces the agricultural productivity. This also leads to desertification, which is another form of environmental negative impact of urbanization. It has been found in the literature review that these kinds of environmental impacts get worse with poor waste management. Management of solid wastes including the industrial wastes, is still a big challenge in the absence of proper waste disposal & recycling mechanisms. It has been seen that these kind of environmental hazards, lead to widespread diseases amongst the urban dwellers. The environmental hazards can be definitely managed and reduced, if the process of urbanization is planned and structured. Even though the quality of life is effected with the presence of environmental pollution, it can be said that urban dwellers have better access to healthcare facilities.

On the social front, the review of literature concluded that rural dwellers have to go through the process of transformation and adaptation, in order to adopt urban norms and values. This is also termed as compression of original values, which might affect the

lifestyle of the dwellers. Urbanization also helps in developing a cosmopolitan culture, as people from different cultures and regions meet at one place. However, over liking the urban culture might lead to disassociation of one's own culture. Hence, it can be said that the effect of urbanization on social life of dwellers could be a mixed one.

From the discussion, it can be concluded that urbanization has perceived benefits, when it is planned properly. However, unplanned urbanization can lead to overurbanization. Overurbanization often leads to unemployment, housing deficit and environmental issues. Most of the time overurbanization might occur due to sudden growth in population. Most of the countries have tackled the problem of overurbanization by developing the peri urban areas.

Chapter 3: CONCEPTUALIZING FARMERS' LIVELIHOODS.

3.1 Livelihoods unpacked

A livelihood according to DFID (1999:1) comprises the "capabilities, assets and activities required for a means of living." This definition correlates with that provided by Chambers and Conway (1992:6) who indicated that "a livelihood comprises the capabilities, assets, including both material and social resources and activities required for a means of living".

The United Nations Development Programme (UNDP, 2005) notes that for households to effectively respond to opportunities or constraints that the process of urbanisation brings to peri-urban areas, they need to be able to exercise choice and access opportunities using resources that are at their disposal. Such resources are a product of the quality and quantity of assets that individuals, households and communities can ably mobilize and utilize (UNDP, 2005).

Peri-urban areas are also called 'rurban space, outskirts or the hinterland and are places that lie between urban and rural areas. There is evidence that these areas are neither urban nor rural but represent the rural-urban transition zone and possess a mix of urban and rural characteristics. The livelihoods that people in these areas depend on are mixed and diverse in nature. Cinner and Bodin (2010) indicate that diverse livelihood portfolios are a common occurrence in peri-urban areas and are a critical component of household economies in both developed and developing nations (Iaquinta and Drescher, 2000 and Cinner and Bodin, 2010).

Narrain and Nischal (2007) argue that the continuous interaction between urban and rural areas, taking place in peri-urban areas, means that inhabitants of peri-urban areas are often exposed to a wide range of livelihood options. Some populations are faced with

choices between earning a living on a farm through an agricultural livelihood or through non-farm based types of livelihood that might include salaried work or engagement in informal economic activities trading, or both. Cinner and Bodin (2010) point out that the decision made by individual households within peri-urban areas are influenced by the sociocultural, economic, political and environmental factors that a particular household is exposed to.

Cinner and Bodin (2010) and Narrain and Nischal (2007) declare that the process of urbanisation is influenced by the three key factors of human fertility, human mortality and migration. Narrain and Nischal (2007) further state that the process of urbanisation is a two-edged phenomenon, with the potential to improve or worsen livelihood conditions for peri-urban dwellers. It is for this reason that as households try to work on changes that come with urbanisation, regardless of them being positive or negative, households in peri-urban areas have to adopt a set of behaviours, referred to as Livelihood Strategies, that household members use when responding to opportunities or constraints that come along with urbanisation (UNDP, 2005).

3.1.1 Types of livelihood strategies

Alinovi et al., (2010) hint that the way a household copes with and withstands economic and social shocks depends on options available to household members. This ability is a reflection of the household's capabilities, assets, material and social resources as well as the set of economic and other social activities household members engage in. The range of activities that households employ when working around challenges faced is referred to as a Livelihood Strategy.

A livelihood strategy is therefore defined as "the way these options are arranged and selected by a particular household" (Alinovi et al., 2010:12). Farrington et al., (2002) reveal that the selection of a specific type of livelihood strategy normally aims to spread a

household's risk through the enhancement of the household's income levels or a reduction of expenditure.

Brook and Dávila (2000) and Farrington et al., (2002) group livelihood strategies into two main categories;

- **Coping strategies:** which are livelihood strategies that households temporarily adopt as a short-term response to prevailing specific shocks or changes in household circumstances. Ellis (2000) indicates that actions like switching to cultivation of drought-resistant crops or reliance on external food aid are some examples of coping strategies that households might employ when responding to shocks in the short term.

- **Adaptive strategies:** long-term changes in behavior patterns that a particular household develops and implements as a long-term solution to reacting and managing shocks or changes that a household faces.

Brook and Dávila (2000) note that households will often adopt and apply both types of strategies as they try to take advantage of existing opportunities or mitigate shocks. In addition to the above strategy, literature also identifies three broad types of livelihood strategies that are common among people in peri-urban and rural areas namely; agricultural livelihood strategy, livelihood diversification strategy and migration. Households also adopt one or a combination of multiple strategies depending on the intensity of the shock the family faces, their anticipation of a shock, and the availability of opportunities to household members (Farrington et al., 2002). Ellis (2000) states that regardless of the nature of livelihood strategies households might be utilizing, the strategies often times change when the external environment on which people have little control changes. Despite this Ellis (2000) also notes that sometime it does happen that strategies that have been classified as unsustainable and unproductive in nature continue

being pursued by communities or households because traditionally the strategy has emerged as a habit having been passed on as a coping strategy from one generation to the next.

While agriculture as a livelihood strategy is covered in detail below, it needs to be mentioned that households in peri-urban areas might use temporary or permanent migration, as a strategy that can help improve family wealth. Livelihood diversification, which entails broadening of farm income generating activities at household level, may also be a coping strategy that can be adopted by a household in response to shocks or opportunities that emerge as a result of increased urbanisation.

In order to fully understand how city expansion through urbanisation impacts the surrounding agricultural area, and its inhabitants, this thesis will consider the sustainable livelihood framework that has come to dominate theory and practice.

3.1.2 Sustainable Livelihood Frameworks

Chambers and Conway (1992) write that a livelihood can be classified as sustainable or unsustainable. A livelihood is classified as "sustainable" when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets without undermining the available natural resource base (Chambers and Conway 1992). Chambers and Conway (1992) further propose that for livelihoods to be sustainable then efforts need to be made in reduce people's vulnerability to external events.

Soussan et al., (2003) indicate that livelihoods in urban, rural and peri-urban areas are influenced by the availability of resources and opportunities that are either external to households, like political and socio-economic factors, and also internal factors such as education levels and the nature of the relationships that family members have with the wider community. The capabilities and assets that a household is exposed to form the central theme in the understanding of livelihoods through the now famous Sustainable

Livelihoods Approach (SLA), also known as the Sustainable Livelihood Framework (SLF). While there are a number of Sustainable Livelihoods Frameworks (SLFs), two most common SLFs were developed by the United Kingdom's Department for International Development (DFID) and the International Fund for Agricultural Development (IFAD).

According to DFID (1999), the Sustainable Livelihoods Framework presents factors that affect people's livelihoods and considers typical relationships that exist between and among factors. It is a vital planning tool for new development activities but also plays a critical role in the assessment of any contributions livelihood sustainability may have on existing activities. UNDP (2005) asserts that the sustainable livelihoods frameworks is a tool for the analysis of people's livelihoods and their sustainability in order to provide "a common conceptual approach to examining ways through which researchers would analyse livelihood strategies of households or individuals."

Further to the above, the SLF is viewed as a "people-centred approach" which helps in analyzing how livelihoods are affected by external and internal factors (DFID, 1999:1). It highlights key structures and factors that affect livelihoods, the relative importance of each prevalent factor and how the factors interconnect. Extending this further, Ashley and Hussein (1999), Bebbington (1999), Bennett et al., (1999), Zoomers (1999) and Ashley (2002) concur that the framework is people-centred and does help reveal how poor rural households draw on a wide range of livelihood assets and livelihood strategies they follow when pursuing desired livelihood outcomes.

In addition to providing an entry point through which practical support can be provided to concerned households, additional roles played by the SLF include:

- ✓ Acting as a checklist of critical issues.
- ✓ Drawing attention to core influences and processes.

- ✓ Revealing how the various factors that are incorporated in the framework interact in multiple ways.

From the above narration of the SLF, the research adopts the DFID Sustainable Livelihood Framework as its conceptual framework. The DFID SLF will help the researcher identify the vulnerability context in which farmers in peri-urban areas in Libya's Qarabulli district are operating. Furthermore, the SLF will help in the identification of livelihood assets and exploration of coping strategies farmers have employed.

Figure 10 below presents the DFID Sustainable Framework with all its key components. A detailed discussion of each component of the framework follows in subsequent paragraphs.

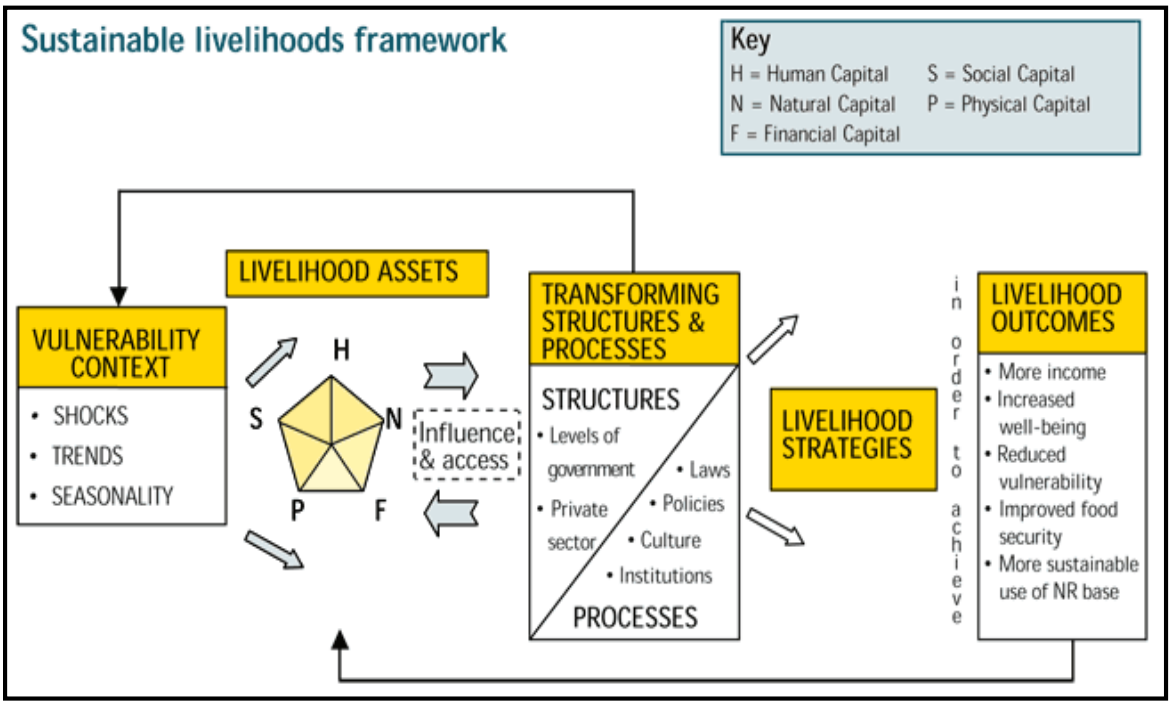

Figure 10: The DFID developed Sustainable Livelihoods Framework

Source: **DFID (1999).**

Note: The arrows in the above framework denote existence of a variety of different types of relationships, all of which are highly dynamic and none of these arrows imply direct causality but rather some of them do imply certain level of influence on the factors they are related to (DFID, 1999).

At the centre of the Sustainable Livelihood Framework are the Assets, also called Capital (Carney, 1998) on which households or individuals draw to build their livelihoods. Access and the utilisation of these assets are influenced by the Vulnerability Context, which are the sources of insecurity to which poor people and their assets are vulnerable. Access to and use of assets is further influenced by policies, organizations and relationships between individuals, organizations and authority. The strategies which individuals and households adopt produce outcomes, which are defined in terms of greater or less wellbeing. The sections below further expound the various components of the framework.

The DFID Sustainable Livelihoods Framework provides a common ground for comparing the unquantifiable impacts, allowing researchers to understand better "development impact" as perceived by the local population being studied (Ashley & Hussein 1999; 52). The SLF also offers the opportunity to merge a variety of approaches when examining issues related to urbanisation, land and land tenure and how such issues shape and affect livelihoods in both rural and peri-urban areas.

The SLF is praised as an analytical tool for development since it uses a holistic approach that helps to explain the range of resources and capabilities that might be used by peri-urban dwellers in building livelihood strategies and outcomes. Being a people-centered approach, the SLF is applicable to a range of different scales that can aid in the examination of livelihood outcomes for individuals' households and nations.

Table 4 below isolates the five key components of the SLF that the researcher will be linking the study findings to.

Key Feature	Component	Summary
Vulnerability Context	Three examples of vulnerability context in which households operate include Shocks, Trends and Seasonality.	Vulnerability frames the external environment over which people have limited or no control. People's livelihoods, the choices they can make plus the types of assets people can rely on are affected by shocks, trends, and seasonality.
Livelihood Assets	There are five major assets that households rely on in addition to working towards an identified livelihood namely Human, Natural, Financial, Social and Physical asset.	These are a range of assets that are fundamental to the poor in their pursuit of a variety of positive livelihood outcomes.
Transforming Structures and Processes	Structures and Processes	Structures involve the private and public sectors, whereas processes consist of policy, laws, institutions and culture.
Livelihood Strategies	Key strategies that are most visible in rural populations are Sequencing, Clustering and Diversification of whatever livelihoods a household is engaged in.	Livelihood strategies encompass the range and combination of choices and activities employed to generate positive livelihood outcomes.
Livelihood Outcomes	Examples include; Increased well-being, Reduced vulnerability, Empowerment, More income and the management of prevailing resources in a sustainable manner.	Livelihood outcomes are the achievements of various livelihood strategies. Outcomes are the pathway to assessing livelihood sustainability. Livelihood outcomes assist with understanding the various motivations and priorities that people possess.

Table 4: Five Key Features of the Sustainable Livelihoods Framework

Source: Author's creation -using information from Scoones (1998), DFID (1999), and Shen *et al*., (2008).

The sections below expounded further the five key components of the DFID Sustainable Livelihoods Framework.

3.3.1.1 Vulnerability Context

Chambers (1989:1) defines vulnerability as "exposure to contingencies and stress, and the difficulty people are faced with when coping with them". Vulnerability according to Chambers (1989:1) has two sides; "an external side that is full of risks, shocks and stress to which an individual is subject; and an internal one which is defenselessness due to the fact that there is lack of means to cope with the stresses without suffering a damaging loss". DFID (1999) and Alinovi et al., (2010) add that the vulnerability context within which indigenous peri-urban households pursue their livelihoods includes economic or resource trends and shocks that may include conflict, economic shocks and natural shocks. Such factors might include seasonal fluctuation in prices of commodities and products sold to urban areas, health issues and availability of employment opportunities.

Chambers (1989) further states that for poor households in rural and peri-urban areas, the vulnerability that they are exposed to are often a product of the interaction between internal livelihood components and external influences that often are outside people's direct control as they are dependent on wider policies, institutions and processes. DFID (2000) stresses that internal and external factors have a direct impact on the nature of assets and options available to people that can help them pursue beneficial livelihood strategies.

It is the opinion of Winters, et al., (2001) that the context in which rural households operate affect the nature of livelihoods' and livelihood outcomes people can achieve. Winters, et al., (2001) add that apart from internal and external forces highlighted above, other critical forces that greatly influence the context in which households operate in peri urban areas are human and natural forces. Human forces include market forces and operations (policies/laws) of a state. While weather patterns, deforestation, erosion and

agricultural pests or diseases are natural forces/factors which often are independent of household decisions but affect living standards of rural and peri urban dwellers (Winters, et al., 2001). Further to this, Moser (1998) and ODI (2000) add that a household's vulnerability level is directly linked to the net assets the affected household has access to, but also the rate at which an affected community or household can effectively convert available assets into consumable outcomes. DFID (2000) explains externalities, as the shocks, trends and seasonality that affect levels of vulnerability. ODI (2000) points out that shocks are associated with the ability of livelihoods to cope while trends are associated with the adaptability of livelihoods.

Poor people have limited control over factors that make up their external environment. In peri-urban areas, the vulnerability context includes the individual and household ability to mitigate the impact of shocks and trends which worsen/improve a household's vulnerability levels.

Dercon (2002) categorizes livelihood shocks into two; individual household-specific shocks that include illness and death of a household member, and shocks that impact larger sections of population, such as weather adversity and market fluctuation. Dercon (2002) adds that apart from causing economic and financial damages through the loss of income or asset, shocks also cause pain, grief and depression and these too, increase a household's vulnerability.

3.3.1.2 Livelihood Assets

Oduro et al., (2015) defines livelihood assets as all those resources that individuals and households have at their disposal which they can draw upon when formulating household livelihoods. DFID (1999) and Ellis (2000) call livelihood assets the building blocks of any sustainable livelihood. Ellis (2000) further argues that it is through the access to or the hope of getting access to these assets that households are able to participate in production, the labour market and exchange with other households.

The DFID SLF (DFID, 1999) puts more attention on the variety of assets that households can have access to through ownership or links with other people within the community they live in, which can contribute to making a household's livelihood sustainable. Knutsson (2006) argues that by building assets, individuals and families develop their capacity to cope with the challenges they face and to meet their needs on a sustained basis.

Authors and researchers like Babington (1999) and Ellis (2000) argue that in rural and peri-urban communities, a household's decision on the nature of the livelihood and livelihood strategy they will utilise when working towards a desired livelihood outcome is based on the conditions of the households' assets. This statement marries with what Giddens (1979) indicates. He argues that livelihood assets are also critical as they act as safeguard mechanisms that predict a household's ability to respond to risk and fragility. Furthermore, Barrera, et al., (2007) add that when farmers lack assets or have no access to natural and physical assets, chances of such farmers participating in activities that could have contributed to an improved well-being are minimized. In addition to this, narrow asset bases for households not only slow the rate of livelihood intensification or diversification by the concerned household but more so heavily limits the household's ability to intensify or diversify its livelihood (Barrera, et al., 2007).

Additionally, Moser's (1998:6) assessment of vulnerability concluded that:

> "Vulnerability is therefore closely linked to asset ownership...The means of resistance are the assets and entitlements that individuals, households, or communities can mobilise and manage in the face of hardship...The more assets people have, the less vulnerable they are, and the greater the erosion of people's assets, the greater their insecurity."

Extending the discussion on the link between assets and levels of vulnerability, IFAD (2001) hints that livelihood assets lie at the core of any livelihood research since analysis of livelihood assets helps clarify how rural people call upon a range of different assets and activities as they seek to sustain and improve their wellbeing. It is argued by Ellis (2000) that households and individuals will have different and varying degrees of access to assets which automatically means that there will always be different portfolios of assets. However, Ellis (2000:42) quickly notes that "not only do fewer assets equate to greater vulnerability, but lower potential for substitution between assets and activities makes livelihoods even more vulnerable."

Ellis (2000) concluded that individuals and households even in the same locality will consequently respond in different ways to a given livelihood shocks, seasonality and trends. Ellis (2000) opines that assets that can readily be liquidated and used to purchase more appropriate assets provide greater livelihood flexibility in addition to helping in mitigating the effects of shocks and trends. It must be noted that apart from influencing asset portfolios, a household's response and adaptation to shocks and trends is a product of other intra-household dimensions such as the sex of the decision maker, age and one's health status (Laier et al., 1996).

A study on flood and health shocks of Amazonian peasant households in Peru found that coping responses/strategies for poor households are influenced by, among others, local environment and the nature of asset holdings (Takasaki et al., 2006). Specifically, Takasaki et al., (2006) highlighted that in trying to cope with crop losses due to floods, peasant households in Peru intensified fishing through labour adjustment. Another study conducted by Takasaki et al., (2010:3), also conducted in Peru revealed that "households with high asset levels are more likely to sell accumulated assets and use savings to cope with income loss while for poor households, the lack of asset and saving restrain them from doing the same but instead find work in off-farm employment to compensate for income loss". Research, conducted in Bangladesh by Rashid et al., (2006: 19) revealed

that the strategy and action a household ventures into when responding to shocks will also depend on the households "characteristics, most importantly the diversity and stability of household income sources, household assets and the education of the household head".

Rakodi (2002), and Oduro et al., (2015) point out that livelihood assets, also called livelihood capital can further be divided into five main sets as shown in Figure 11 below.

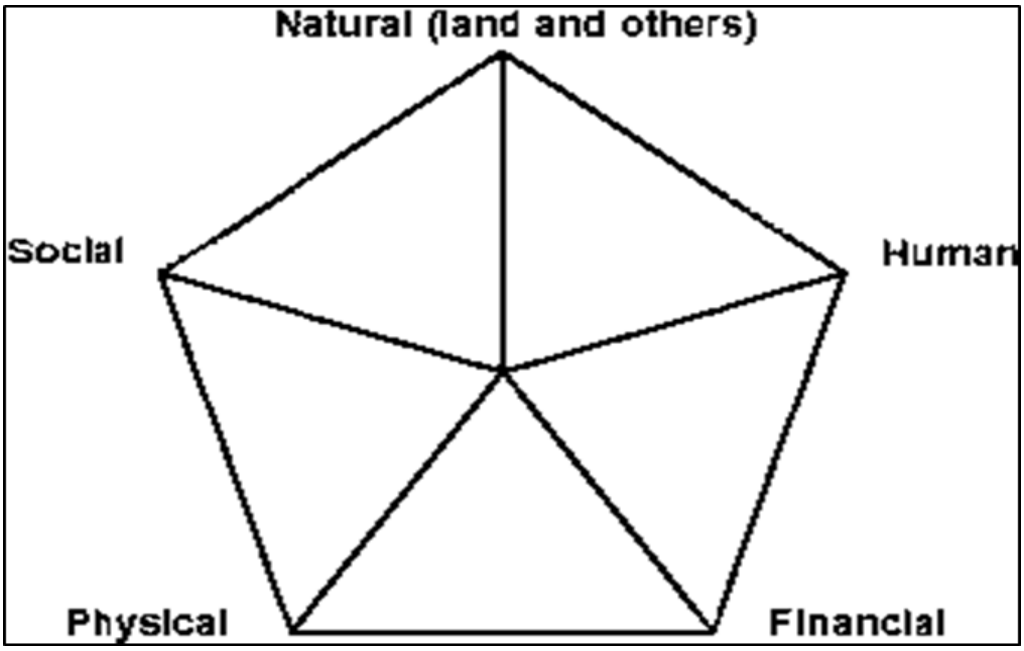

Figure 11: The Livelihood Asset Pentagon.
Source: **Oduro et al., (2015).**

The sections below further discuss each of the assets presented in the Livelihood pentagon in Figure 11 above.

Natural capital: This refers to the natural resources, either privately owned by individuals or public, community owned. This may include "land, forestry, water and mineral resources that can be consumed directly, sold or converted to consumable or

merchantable products" (Scoones (1998) and Meikle, Ramasut and Walker (2001) cited in Oduro et al., 2015:82).

DFID (1999) and Oduro et al., (2015) suggest that the process of urbanisation illustrates how natural capital and households' vulnerability context are linked. The intense competition for peri-urban resources (often natural resources like land, water and air) destroys or reduces the amount of natural capital that peri-urban households have at their disposal thus leading to an increase in the levels of vulnerability of concerned households. It becomes clear that with the speed at which areas are being urbanized, the loss of agricultural land will have a significant impact on the ability of peri-urban households and farmers to maintain their livelihoods.

Research conducted in China by Guangdong et al., (2014) found that cultivated land especially in rural and peri-urban areas is the most critical natural asset that forms the fundamental part of a livelihood in rural communities. This entails that there is a strong desire for peri-urban and rural communities to jealously guard against any efforts that would lead to loss of agricultural land as a way of ensuring that households are food secure.

Social capital: These are "Rules, norms, obligations, reciprocity and trust embedded in social relations, social structures, and society's institutional arrangements" (Oduro et al., 2015:83). In addition to this definition, Carter and Maluccio (2003) look at Social Capital as the rights or claims that individuals derive from being a member of a group and include one's ability to call on friends and relatives for help in times of need. Social capital is a strong basis for the creation of livelihood strategies (Guangdong et al., 2014) as any desire to pursue any form of livelihood strategy demands that people or households draw on their social networks. Affirming this, Carter and Maluccio, (2003) point at the role of social capital as an important element of the coping mechanisms for most poor households.

Dearden, (1999), Bass et al., (2005) and Peredo and Chrisman, (2006) concur that maintaining social cohesiveness by community members and the dependence on social networks at community level is one way through which people in peri-urban area can gain an added advantage when negotiating for farm loans, as belonging to a group does help in reducing risk. Peredo and Chrisman (2006) describe the critical role that social capital, as a collective resource in communities, plays and suggest that "it exists in the relations among people and facilitates their productive activity by providing access to other resources, such as knowledge and capital" (Peredo and Chrisman, 2006: 314). However, Carter and Maluccio (2002) are quick to indicate social capital limits in a community where many households suffer from the shocks in scenarios where more members of the same social network are subjected to the same shock; in this csae the ability to support one another is reduced. Social capital might include one's family connections, cultural groupings, and religious and political affiliations. However, social links which are core to social capital are weakened by urbanization, especially in peri-urban areas; hence urbanisation is a negative factor to asset utilization in rural areas (Farrington et al., 2002).

Unlike Farrington et al., (2002), Oduro et al., (2015) argues that urbanisation is not entirely destructive since living amongst a new set of people in peri-urban areas creates new links outside the family and tribal boundaries and that these facts become a great social asset that people in peri-urban and urban areas can turn to in times of need. Through the exchange of information with colleagues, people might improve their skills and hear of opportunities like jobs and learn more on how to pursue a particular livelihood, thus helping to reduce a household's vulnerability levels (Oduro et al., 2015).

Physical capital: All are "man-made, tangible assets that directly or indirectly contribute to livelihoods, including infrastructure such as roads, electricity, water and markets, as well as private assets like buildings, machinery and equipment (Meikle et al., 2001 and Rakodi, 2002). One unique evidence of areas becoming urbanised is in the emergence of

infrastructure such as roads and buildings that change not only the use of land but also the entire physical environment (DIFD, 1999). Rakodi (2002) opines that basic infrastructure such as affordable transport, adequate water supply and sanitation, affordable energy, and access to communication form the financial platform on which a household would depend when pursuing a livelihood. Much of this infrastructure can be seen as positive contributors to enhance resilience and lowering vulnerability levels of households living in peri-urban areas. For instance, good road networks entail that farmers in both peri-urban and rural areas can transport their farm produce, including perishable ones, to urban markets and be able to increase their financial capital. Secure residential buildings, the provision of reliable, safe and accessible water and sanitation supplies and availability of clean energy sources also offer households in peri-urban areas a chance to maintain disease-free life.

It is argued that access to such infrastructure plays a vital role in poverty reduction (Ellis, 1998). Edusah (2008) and Mandere et al., (2010) contend that the presence of good infrastructure in peri-urban areas not only offers peri-urban dwellers the chance to gain income during the construction phase of such infrastructures but also has long term benefits as infrastructural development creates new economic opportunities and individuals can develop new businesses and other non-farm livelihoods.

Financial capital: These are the financial resources and services that individuals and households can use when pursuing desired livelihood options (Scoones, 1998 and Rakodi, 2002 cited in Oduro et al., 2015). Financial capital denotes the financial resources that people use to achieve their livelihood objectives. Edusah, (2008:82) named two main sources of financial capital, as the available stocks that a household has and regular inflows of money which include personal savings, loans from relatives, friends or moneylenders plus loans accessed from formal credit and financial services. Financial assets in any form, be it cash (money), credit from formal and informal institutions, savings, remittances and economic assets that might include production equipment and

technologies are indispensable for any quest for positive livelihood outcomes (Farrington et al., 2002 and Oduro et al., 2015). While people in rural areas produce most of their basic needs or access them freely from the natural environment, urban life is purely commercialized in a sense that such basic goods and accommodation are either supposed to be bought or rented at rates that are market dependent (Farrington et al., 2002). If an area is undergoing a change from rural to urban, then it can be necessary to re-evaluate how financial capital is achieved.

The process of urbanization, therefore, can increase the vulnerability of peri-urban dwellers as they may be forced to venture into income generating activities through the sale of labour and skills. This can be limiting since many rural dwellers do not have access to education and may only be able to secure poorly paid jobs that can be erratic and unreliable. However, urbanisation can provide peri-urban dwellers with finance opportunities through lending and microfinance institutions. Additionally, the prospects of getting a job are one of the major factors that motivate people to migrate from rural areas hence urbanisation also offers people alternative forms of livelihoods.

Human capital: This encompasses all the "skills, knowledge, and ability to labour and good health plus the physical capability important for the successful pursuit of different livelihood strategies" (Li et al., 2014:339). Oduro et al., (2015) add that human capital does not only include quantity and quality of labour available but also intellectual capabilities and competencies gained through access to education. Individuals and households may utilize human capital through active participation in waged- employment or getting into temporary or permanent business ventures (Oduro et al., 2015). Further to this, Rouse and Ali (2000) reveal that the household size, education levels of household members, skills, and health of both the farmers, and those they work with, which could be household members or hired labour, are also factors that are critical in the utilisation of human capital at household level.

This literature on sustainable livelihoods emphasizes the human capital component of the SLF as the core asset as it is vital in the utilisation and maximization of the other assets owned by households. Human capital includes the "skills, knowledge, ability to work, good health and physical capabilities" that household members possess and can be used in pursuing different livelihood strategies (Li et al., (2014:344). Thus, urbanization has negative and positive implications for human capital.

Research conducted by Li et al., (2014:344) on the "Impact of farmer households' livelihood assets on their options of economic compensation patterns for cultivated land protection in China" discovered that "the total family labour capacity has the most significant influence and capacity that plays a fundamental role in household decision-making". The study also revealed that rural households tend to over rely on the number of people within a household who are contributing to the household's labour needs while neglecting labour quality when making decision on the nature of livelihood to be engaged in and the associated strategies to be employed. This failure to consider quality of labour contributed also affects a household's livelihood.

On the one hand urbanisation can be blamed for the destruction of the natural environment making people more vulnerable and susceptible to air and water borne diseases along with all the other negative issues discussed above. Yet, on the other hand, urbanisation offers people in peri-urban zones new opportunities. These may be for capacity building and the enhancement of skills through the availability of high quality and well-staffed education service provided by institutions and opportunities to share skills, access information and technology.

Additionally, through urbanization, poor peri-urban households may be able to get better access to health services that in turn may help boost people's productivity as people are becoming healthier. Oduro et al., (2015) caution that the human capital works as a key component of the SLF only where people are healthy and possess good levels of

education, vocational and managerial skills, as such characteristics determine the quality as well as the quantity of this form of capital. Furthermore, Adu-Ampong et al., (2008) contend that poor health of household members coupled with a lack of education, a common scenario for most rural households, are major impediments to the attainment of desired livelihood outcomes, hence overcoming these challenges through health and education services might be key to unlocking human potential thus positively impacting livelihood asset management and outcomes.

3.3.1.3 Livelihood Strategies - the classification

Livelihood strategies are according to DFID (1999) and Edusah (2008) various actions that an individual or household adopts as a way of improving or maintaining their current standard of living, or as a method for coping with an unexpected shock.

Ellis (2000:4) adds that livelihood strategies are:

> "the patterns of behaviour adopted by the household as a result of the mediation processes on the household assets and are an intrinsic part of the assets-activities-outcomes cycle through which people and households adapt over time when responding to both opportunities and changing constraints."

Livelihood strategies are classified into various groups by various authors. This thesis makes reference to three classifications that are common. The first classification of livelihood strategies is what Scoones, (1998) put forward, which classifies livelihood strategies into three as below:

- Agricultural intensification.
- Livelihood diversification which includes involvement of rural populations in paid employment and rural micro-enterprises, and

- Migration which covers income generation and remittances made by rural people who have out-migrated to urban areas.

Used as a strategy, agricultural intensification entails that households or communities increase their "dependence on agriculture by intensifying resource use through the application of greater quantities of labour or capital for a given land area, or by bringing more land into cultivation or grazing" **(**Scoones, 1998:9). Livelihood diversification as a strategy means that households "broaden the range of on-farm activities (e.g. adding value to primary products by processing or semi-processing them), or to diversify off-farm activities by taking up new jobs" (Scoones, 1998:9). Lastly, he explains that migration as a livelihood strategy may be voluntary or involuntary and is often considered a critical strategy to secure off-farm employment and among others social, traditional and cultural norms strongly influence who migrates. Swift, (1998) comments that in cases where migration is used as a livelihood strategy, there are number of implications that will emerge which usually affect assets' status for those left behind. Especially in places where land is owned by men and women who are left behind while their husbands/wives migrate out of the community.

Further to the above, Pagiola and Holden (2001:73) look at agriculture as "the greatest human activity that affects the greatest proportion of the earth's surface in addition to being the single biggest user of fresh water". The two researchers further add that through land use and land changes, livelihoods based on agriculture depends on the environment and often shapes the environment, thus confirming the existence of a visible interaction between livelihoods and the environment.

Agriculture in Africa and many other developing countries often supports more than 70% of the population. It is the biggest sector for direct employment and it makes significant contributions to national Gross Domestic Product (GDP). Although the agricultural sector has been the most common livelihood for decades, Tacoli, (2004) and Thuo, (2010) claim

that urbanization has significantly been impacting the agricultural sector in multiple ways in peri-urban areas. It needs to be noted that in peri-urban areas and being ex-rural zones, agriculture in most cases still dominates with the majority of the population still engaged in it as a livelihood (Tacoli, 2004). Tacoli, (2004) and Thuo, (2010) argue that the intrusion into rural zones through urbanisation eats agricultural land, thus reducing the quantity and quality of land on which peri-urban households can grow food. It is the view of Thuo (2010) that urbanisation also increases demand for land usually used or reserved for agriculture which motivates peri-urban farmers to sell farmland, thus making it impossible for the majority of households to practice agriculture on a larger scale, rendering many households vulnerable to hunger and poverty. Kombe, (2005:114) adds that "since levels of poverty are high in most peri-urban areas in African countries households owning land in peri-urban areas are increasingly selling their land in order to meet social and economic obligations".

Marshall et al., (2009:28) defines Peri-Urban Agriculture (PUA) as "all agricultural activities that take place in the peri-urban setting and the livelihoods associated with it, such as fisheries, poultry and goat rearing, horticulture, floriculture, dairy farming, cattle farming and arable farming". Although agriculture can be done on a large scale as in commercial floriculture, Marshall et al., (2009) indicates that in most peri-urban areas in developing countries with high population densities, it is intensive smallholder agriculture that is more prevalent. It is further highlighted by Marshall et al., (2009) that because the majority of household incomes in peri-urban areas (especially for rural households) is spent on food and at times transportation, agriculture conducted in peri-urban areas plays a central role in meeting the needs of such households and helps to ensure that nearby urban areas are supplied with fresh and affordable food that meets the food demands for the ever-growing urban populations.

As previously stated, El-Hefnawi (2005) also affirms that urbanisation brings in competition between urban land uses and agriculture land in peri-urban zones and often

agricultural land is released for urban development. This release puts stress on the agricultural sector as food production and distribution systems fail to produce and supply enough food to the growing population in peri-urban areas. In addition to the reduction in food production, El-Hefnawi (2005) states that the loss of agricultural lands in peri-urban areas also has direct economic impacts on households as it leads to a loss of job opportunities. Citing statistics from Egypt, El-Hefnawi (2005) reveals that the loss of one feddan[1] of land results in a direct loss of one job opportunity and about 0.7 indirect job opportunities. This according to El-Hefnawi (2005) means that if a total of 60,000 feddans are lost to urban use, an estimated 100, 000 job opportunities are also lost from the agricultural sector. It is unlikely that the formal sector in peri urban areas will provide alternative employment.

Agricultural livelihoods are influenced by social, political, economic and environmental contexts and DFID, (1999), Marshall et al., (2009), FAO, (2011) and Oduro et al., (2015) concur that agriculture forms a key part of the livelihoods that poor peri-urban communities pursue, often as the only means of gaining desired household foods, or a source of income through either selling farm produce or as a source of employment for household members as farm labourers.

Marshall et al., (2003) and Marshall et al., (2009) argue that urbanisation puts pressures on poor households to adopt alternative livelihood strategies. This is often difficult in peri-urban areas due to limited political and institutional support for new livelihoods, especially for poor and illiterate household members. Issues related to land tenure, the fragmentation of land holdings, land degradation and the lack of reliable water supply and energy for irrigation pumps are some of the factors that Appiah et al., (2014) cite as threats to peri-urban agriculture. Furthermore, Soini, (2005:21) opines that land degradation is a “direct effect of unsustainable intensification of land use, and

[1] 1 feddan is approximately 60 metre × 70 metres thus 4200 square metres (m2) and equivalent of 0.42 hectares or 1.038 acres (El-Hefnawi, 2005)

agricultural intensification to the environmentally fragile areas where among others cultivation of steep slopes and riverbanks are some of the chief causes".

Appiah et al., (2014) say that urbanisation changes the land ownership and supply system since urban growth entails that individual property rights are created to replace the traditional and communal land-owning systems. This transfers land ownership from customary land owners to rich individuals and the private sector. The acquired land is often put to new uses that have almost nothing to do with the agricultural sector. This change also leads to agricultural land fragmentation and a reduction in the amount of land on which to conduct agriculture, and this in turn, lowers production levels for agricultural activities such as food farming, fishing and the raising of small livestock and poultry (Appiah et al., 2014).

Marcuse (2006) focused on the issue of tenure insecurity. Poor agricultural based households who do not own land are often forced to move into less suitable marginal lands or virgin lands. These can often be difficult to harvest and can be ecologically vulnerable, and be prone to flooding, mudslides and other 'natural' disasters. Closely related to the issue of tenure security for poor households, is the frequent out-migration of male members from poor households.

Research conducted by Olson et al., (2004) revealed an interesting relationship between poverty and out-migration in search of work. The study results indicate that men from households that have fewer assets and opportunities to access available resources are more likely to be either working on off-farm activities in nearby areas or leave behind their families and seek employments in nearby towns. Olson *et al*. (2004) adds that a statistical analysis of such movements revealed that once men from poor households migrate in search of new livelihoods off-the-farm, the households from which the men are tend to remain poor. Olson *et al*. (2004) then concluded that the key driving force of out-migration in peri-urban areas is poverty and not population pressure. Although

population growth is indicated as one of the main causes of poverty in peri urban areas as it puts pressure on and overrides the carrying capacity of available but scarce natural resources, including land and water in peri-urban areas.

Mehta et al., (2007:1) calls water “the lifeblood of ecosystems critical for multiple eco-hydrological functions” and is a fundamental factor in people’s livelihoods. The process of urbanisation brings in changes in the way water is managed and shared in peri-urban communities and can include the formalization of water management where people are asked to pay for accessing water. This clearly will have an impact on the poorer members of society. In rural areas water is considered as a common good, freely accessible and shared by all community members. Urbanisation can put an economic burden on the way people access water which creates challenges to poor households who in many cases are already economically challenged. Further to this, management of water and water sources sometimes entail that large volumes of water may be allocated to urban needs such as hydroelectric generation thus reducing the amount of water left for agricultural production. Failure by smallholder farmers to access enough water for agricultural purposes reduces production levels which negatively affects the nature of livelihoods outcomes that people can attain (Mehta et al., 2007).

The second way in which livelihood strategies have been classified is provided by Ellis (2000) who grouped livelihood strategies into natural resource based activities or non-natural resource based activities where remittances and other financial and materials transferred are shared. This classification is slightly similar to the third classification that Carney (1998) proposed which stated that livelihood strategies are either natural resource based, non- natural resource based, or migration to urban areas. Scones (1998) adds that regardless of the classification one wants to follow, livelihood strategies are not necessarily mutually exclusive as there is still room for trade-offs between strategy option types but also there is room for combining elements of different options.

Scoones, (1998), Rakodi, (2002), and Oduro et al., (2015) add that examples of livelihood strategies include the choice individuals or households make. For example, instead of buying household food supplies, an affected household might decide to grow their own food and raise livestock by utilising available assets at the household's disposal (like land and human capital). Oduro et al., (2015) provides another scenario where members of a household who have employability skills decide not to grow any food but rather engage in waged employment and use the proceeds from such endeavors to procure household food supplies.

Studies conducted by Carter and Maluccio (2002), Hoddinott (2006), Dercon (2007), Heltberg and Lund (2009) found that in trying to respond to shocks, households often dispose of their savings and assets, diversify income sources by engaging in off-farm employment and getting informal credit. Access by a household to assets (whether public or private) which might include electricity, gas, roads and potable water, have been shown to be significant in the way a household would adopt livelihood strategies in rural Ecuador (Lanjouw, 1999).

Similar results were found by Corral and Reardon (2001) in Nicaragua whose study revealed that where households have access to paved roads, the access greatly increases a household's participation in non-farm employment. A study also conducted in rural El Salvador by Lanjouw (2001) concluded that the presence of infrastructure services like banks, road, markets and administrative institutions in a rural area have significant influence on the probability of finding non-farm employment for rural households, thus offering them an opportunity for livelihood diversification.

Additionally, Krantz (2001:25) comments that households that have potential for "greater diversity of livelihood strategies will have a much better and stronger resilience to the shocks, trends and seasonality conditions within the vulnerability context".

3.3.1.4 Livelihood Outcomes

Livelihood Outcomes are described as “the direct effects of the livelihood strategies of individuals and households on their socio-economic wellbeing” Oduro et al., (2015:83). DFID (2000) further indicates that examples of household livelihood outcomes are increased income, and a better, improved and sustained supply of food, both of which lead to an increase in the household’s capacity to meet and sustain their needs.

It is the view of DFID (2000), Mohan et al., (2011) and Oduro et al., (2015) when a household has a well and sustained form of livelihood outcome, some of the livelihood outcomes can also be re-converted into livelihood assets. For instance, a household that managed to acquire more money than it urgently needs may reinvest part of its additional income by purchasing assets like land, houses and machinery that can be used in enhancing the households’ livelihood and help further generate more income which will, in turn, translate into more assets.

3.3.2 External Environment

SLF components are highly affected by the external environment in which they are utilized. By definition, the external environment refers to both direct and indirect consequences on the livelihood outcomes that a household might aim at attaining. Meikle et al., (2001) believe that livelihood strategies and outcomes are not just dependent on livelihood assets or indeed any forms of constraints created within a household’s vulnerability context. They point out to the critical importance of external environments, policies, and the processes in which the assets are used to create or affirm new or existing livelihood outcomes. According to DFID (2000:5) and Chambers and Conway (1991), a household’s external environment might include “trends such as population growth, urban expansion and resource depletion that are often continuous, cumulative and predictable events that directly or indirectly affect livelihood assets and strategies”.

Furthering the argument, DFID (2000) note that any poorly designed and implemented policy often creates and obstructs poor households from using available assets and could lead to increased vulnerability and the lowering of a household's resilience. DFID (2000) states that for peri-urban dwellers to be more resilient to the negative effects of trends, shocks and seasonality, development policy-makers and practitioners need to effectively support people's access to assets through the creation of relevant and critical policies, institutions and processes.

The relationship between assets that a household might hold and the policies that are external to a household is two ways. The nature of assets that households possesses can dictate the nature of policies that governments and international agencies might develop, plus the sort of legal, political and economic institutions required for the implementation of such policies. As a reverse process, existing policies and processes including decision-making rules and socio-economic regulations, might dictate the nature of asset prerequisites for the participation of households in specific kinds of livelihoods (Soussan, 2003).

The ways the above-stated policies and practices are designed, managed, implemented and evaluated, are critical to the success or failure of a household to attain an intended livelihood outcome. Examples of such institutions operating at different levels of government include; the Central Government and all its subunits and departments; local government structures; traditional rulers; local and international agencies. The operations and functions of these institutions on issues like land use planning, education and health service provision, have a massive impact on the attainment and pursuance of particular livelihood strategies for peri-urban households, despite the fact that these institutions operate outside the realms of affected households.

Since the pursuance of any livelihood in peri-urban zones is affected by multiple factors that either help increase or reduce the chances of attaining the desired livelihood

outcomes, Farrington et al., (2002) point out that institutions and policies that guide the functionality of life in peri-urban areas need to focus on poor people if the interventions are to be successful. They also say that the absence of well-functioning structures that can ably design, implement and monitor urbanisation and livelihood strategies would be deemed as an obstacle to sustainable development. Poor structures make it very difficult for the poor to develop assets and acquisitions and would therefore impede people's potential to pursue a certain livelihood strategy.

Just like institutions, DFID (1999) looks at the structures within an SLF as hardware and these include private and public organizations responsible for setting, implementing, monitoring and evaluating policies, legislations, modes of service delivery, and all matters related to functions that affect or are related to livelihoods.

These structures and processes may, depending on how they are applied, occupy the epicenter of sustainable livelihoods, as they act as incentives that help people and households decide on what kind of livelihood strategies to follow or outcomes to aim at. They help in the process of acquiring assets or in some situations act as a conducive platform that would be used by households to transform or substitute one type of asset for another (DFID, 1999 and Farrington et al., 2002).

3.3.3 Critiques of the DFID – Sustainable Livelihood Framework

Bebbington, (1999), Carney, (1999), Murray, (2001), Cahn, (2002) and Knutsson, (2006) have indicated a number of shortfalls that come with the use of the DFID SLF. The first criticism of the SLF is that the SLF does not provide sufficient ground on which local culture, traditional norms and local knowledge can be fully utilized when coming up with livelihood decisions. These authors argue that the SLF fails to recognize what Throsby (1999:6) called cultural capital which is a "set of attitudes, practices, and beliefs that are fundamental to the functioning of society that plays an important role in an individual's decision-making process".

Cahn, (2002) and Knutsson, (2006) argue that the concept of cultural capital can be integrated in the human and social capital and better emphasized in the SLF by placing it within the asset pentagon.

Closely related to the above criticism is the failure by the SLF to fully acknowledge the role played by historical capital, which is a form of capital that is passed on verbally from one generation to another via oral narratives, dances, or traditional ceremonies. Bebbington, (1999) and Knutsson, (2006) believe that historical capital increases people's appreciation for diverse ways that people might adapt when implementing their livelihood strategies. Bebbington, (1999), Murray, (2001) and Knutsson, (2006) additional criticism indicate that for a proper understanding of how people choose and adapt livelihood strategies to vulnerabilities over time, it is crucial that the longitudinal analysis of the events be conducted.

The last criticism of the livelihood framework is provided by Tacoli, (2002) who argues that the framework, in particular, the asset vulnerability model puts too much emphasis on rural based assets making it seem like a framework that is only suitable for those who pursue livelihoods that are either Agro-based or wholly dependent on natural resources. Tacoli, (2002) concludes that the framework is not suitable for analyzing livelihoods that urban and peri-urban households pursue or intend to pursue.

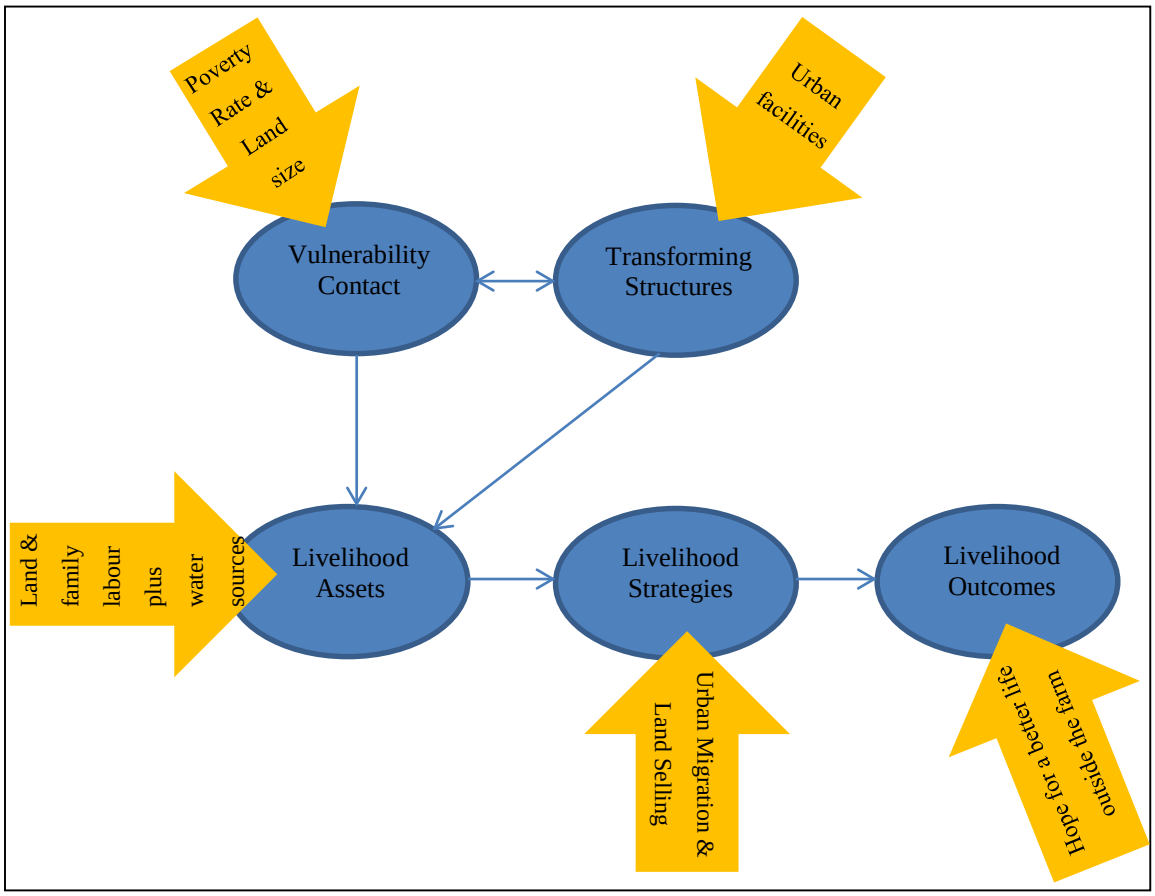

Figure 12: Linkage between Urbanisation and Livelihood Models.

Source: Author's creation.

The model presented in Chapter 2 that pin pointed the pull and push factors is in the above model linked with the simplified livelihood model. As can be seen, land and family labour are the key livelihood assets that peri-urban families possess in addition to water sources. As stated earlier in Chapter 2, literature indicate that majority of rural youths have a negative perception of farm related activities hence prefer migrating to urban area in search of non-farm based jobs. When this happens, the peri-urban farming households are deprived from one of the key asset (family labour) and this leads to reduced farm produce as less land is cultivated. The high poverty levels and dwindling land holding

sizes form the vulnerability context in which peri-urban areas conduct their livelihoods. In-migration to urban area increases household's vulnerability levels in that the reduction of available family labour leads to reduced farm production thus leaving the concerned family with little food and in most cases no more to sell. From the above model, Figure 12, it can be noted that this situation increases the vulnerability levels of concerned households such that any emergence of livelihood shock has a huge negative impact on affected facilities as their coping strategies are not good enough to cushion such families from livelihood shocks including natural disasters.

However, much of livelihoods' assets are affected by into-urban migration, the prospects of a better life and employment in non-farm sectors, which are key factors as explained in Figure 8 (Chapter 2). When migrants secure jobs, some often remit part of their income to their peri-urban relations. When this happens, peri-urban households move to a new level of livelihood as the remittance received is used in setting up new livelihood outcomes.

3.2 Chapter Conclusion

This chapter deeply focusses on the livelihoods of peri-urban areas, which are diverse in nature. In this context the term diverse signifies, the wide range of options of livelihoods available for the inhabitants of the peri urban areas which includes agricultural as well as non-agricultural occupations. The selection of occupation, in this case depends on the livelihood strategies adopted by the peri urban dwellers. Livelihood strategy defines the set of activities pursued by the peri urban households, in order to counter the challenges presented by urbanization. Further, this chapter explains how peri urban dwellers use short term strategies called coping strategies, and long strategies called adaptive strategies, to encounter the challenges. Most of the time these two strategies are used in tandem, in order to mitigate any form of risk. Peri Urban dwellers in order to mitigate the risk, select agriculture as their livelihood, or opt for nonagricultural based occupation, or

migrate to the core urban centers. Their strategy will depend on the existing risks. This includes the external environments as well, which might be sudden climate change or sudden changes in urban market. While existing research show that, the strategy of diversified occupation might help in mitigating immediate risks, permanent or temporary migration might be used for wealth creation.

Further it has been found that a livelihood strategy might be termed as sustainable if it is able to cope with the available challenges, without depletion of its resources. With the thorough discussion, it has been found that sustainable livelihood depends on both, external as well as internal factors to the household. Also, sustainable livelihood could be perceived as a framework, which describes or analyses how these factors impact the livelihoods. As discussed previously, this research will make use of "DFID Sustainable Framework", in order to estimate the vulnerabilities in which the farmers of Qarabulli region are operating. In other words, this will be the conceptual framework of this research. The framework distinctly describes how farmers access the built-up assets or capital, where the access is deeply influenced by vulnerabilities or insecurities. The insecurities in this case are influenced by external as well as internal factors. The framework also showcases the strategy, which will be adopted by the household, in the context of vulnerabilities.

This chapter concludes that "DFID Sustainable Livelihoods Framework" is made up of five key components. The first one amongst them vulnerability context, which signifies the insecurities on which the framework have very little or no control. The second component is the livelihood assets, which are the fundamental requirements for a positive livelihood. The third component is "transforming structures and processes", which describes the public and private sector, along with the environment in which they operate. The fourth component is the livelihood strategies, which describes the set of activities to achieve the livelihood outcomes. While the last component is livelihood outcomes, which

is the end product of the livelihood strategy and analyses whether livelihood is sustainable or not. All these components are interrelated to each other, and collectively define the DFID Sustainable Livelihoods Framework.

From the existing studies, it has been found that the component of livelihood framework is heavily influenced by the external environment, in which they operate. Apart from that, policies and process also determine the livelihood outcomes. It can be concluded that the relation between the asset and external environment is two ways relationship, and both of them influences one another. Even though DFID Sustainable Livelihoods Framework is an effective tool for analyzing the livelihood, it has been criticized by many scholars on the ground that it doesn't utilizes the local culture and traditions while deciding on the livelihood types. Whereas other scholars conclude that this framework doesn't make use of experiences gathered from the previous generations, which is true as well to a certain extent. While another author critiqued this framework on the basis that it only makes use of rural assets, which are agro-based.

Chapter 4: BACKGROUND OF THE STUDY AREA

4.1 Introduction

This chapter provides details of Libya, the case study country and specifically highlights the Qarabulli district which lies in the eastern part of Tripoli, the place where the study was conducted. The chapter presents the historical, social, economic and geographical details of Libya.

4.1.1 Country Profile

Libya is a country in the Maghreb Arab region of North Africa, lying between 20° to 34° north and 10° to 25° east (Al Mahdawi, 1998). It is the fourth largest country in the African continent and the 16th largest country in the world (Al Mahdawi, 1998). The country is bordered by the Mediterranean Sea to the north with a 1900-kilometre-long coast line, Egypt to the east with a border running 1150 kilometers, Sudan to the south-east with a 383-kilometre borderline, Chad and Niger to the south with borderlines measuring 1055 kilometers and 354 kilometers respectively. Algeria and Tunisia are Libya's neighbors to the west and their borderlines run 982 kilometers and 459 kilometers respectively. With such a vast number of countries surrounding Libya, the country is often referred to as a strategic site for both economic and political reasons within Africa's northern rim (Al Mahdawi, 1998).

The Libyan Planning Council (LPC), (2005) estimates that the total surface area of Libya is 1,750,000 square kilometres (Km^2) of which more than 85% is a desert. Al Mahdawi (1998) cites Tripolitania, Fezzan and Cyrenaica as the three traditional parts of Libya which also boast of possessing the great oil reserves. Tripoli, Libya's capital, has a population of just over one million (out of Libya's six million people) (Libyan Planning Council, 2005). Benghazi, in the eastern part of Libya, is the other large and highly populated city in Libya (Al Mahdawi, 1998 and Libyan Planning Council, 2005).

With over 85 percent of Libya's total area being a desert, only 3.6 percent of the natural land is cultivated. An estimated 400,000 hectares is under irrigation and that is mostly government owned or sponsored (Mahmoud et al., 2000). Benghazi and the Jeffara Plains are two of Libya's most fertile areas and are economically the most important regions in Libya. As would be expected the majority of the agricultural activities are concentrated in a narrow strip along the Mediterranean coastline where Tripoli and Benghazi are located.

This study was conducted in an area called Qarabulli, which is found in the eastern part of Libya's capital Tripoli. Tripoli City covers 24083 hectares and is located between longitudes 13˚ 17' to 13˚ 35' east and latitude 32˚ 77' to 32˚ 90' north (See Figure 13 below).

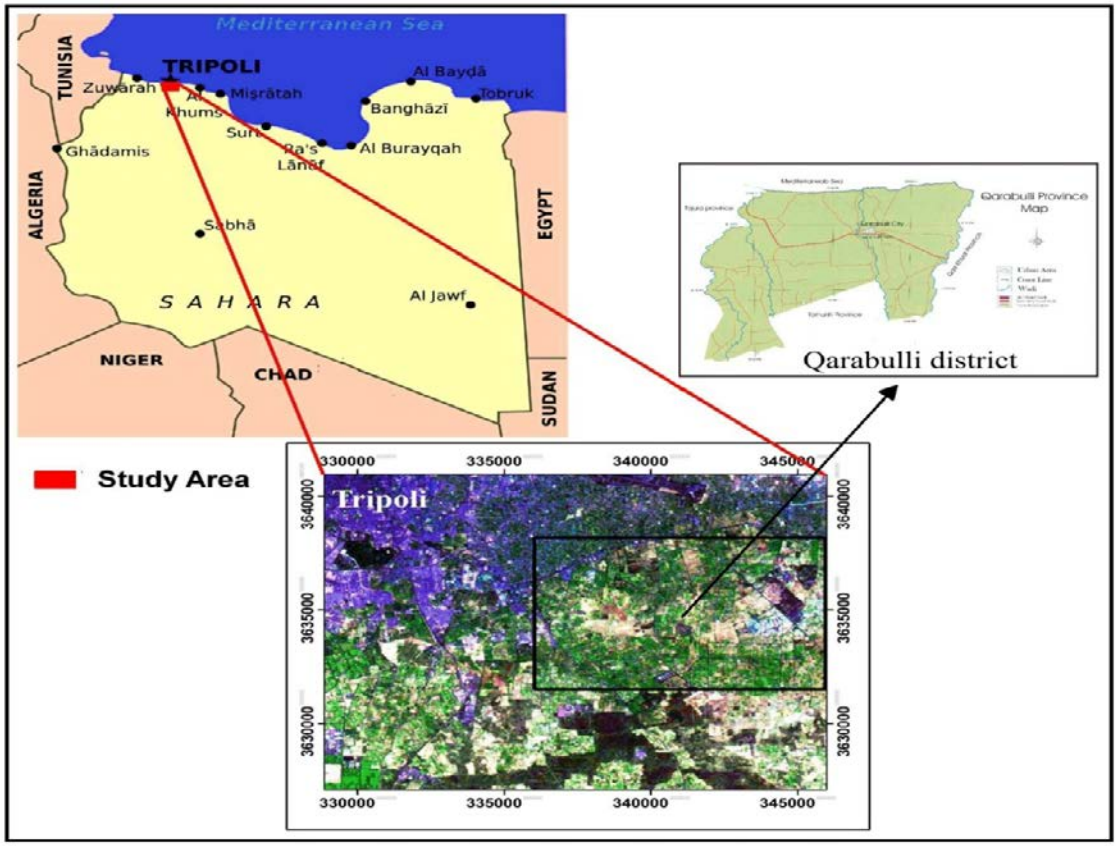

Figure 13: Location of the study area in the Libya Sahel.

4.1.2 History of Qarabulli

The district of Qarabulli is an extension of the Tripoli City. It has a very small population. In the year 2010, the population of Qarabulli accounted for 0.9 percent of the population of Libya. In this regard, it will be important to learn about the history of population growth in Qarabulli. To study the Qarabulli's population growth rate, the general population censuses conducted in the district were reviewed.

As per the census of 1954, the total population of Qarabulli District was around 9258. By the end of 1964, the figure stood at 10,366. The rate of population growth in this case was estimated at 3.73 percent per year. This growth was majorly attributed to the high standards of living which prevailed in the district, and also owing to migration which was the result of the distribution of Qarabulli farm development projects to residents outside the district. However, the biggest population growth took place between 1984 and 1995, when the population count rose to 38,857 with a growth rate of 4.55 percent per year. This was mostly due to migration which happened due to development of housing projects in the Qarabulli region, and also inter caste marriages of residents of Qarabulli region, with non- Qarabulli residents. However, post 1995 Qarabulli saw a massive decline in population growth, with the rate of growth at 0.7 percent in 2006. This was mainly due to the sanctions imposed on Libya by the international community, coupled with development of global recessions in 1980s' and drops in oil prices. Due to the prolonged sanctions, most of the development projects in Libya were stalled. During this period, a negative trend developed as well, whereas Libyans were involved in early marriages, and having children early (BSCL, 2010).

All the regions saw a sharp decline in population growth, except one region which was Al-Rawajih. Even though the population increase at a mild rate was witnessed, something which has to be analyzed is, did this population growth led to massive deforestation in that region.

Further, it was found that in the year of 1954, Qarabulli had only 1974 families, which drastically grew to 8706 by the end of 2010. The size of the household, and the number of the households kept on increasing, without any major dip in the numbers. In spite of a major raise in the standard of living of the Libyan people post discovery of oil, there was no notable decrease in the size of the households. This trend contradicted the trend that existed in the western countries, where economic development reduces the family size. Few key reasons behind this were, high birth rates, early marriages and tribal bonds (Bureau of Statistics and Censuses, 2012).

4.1.3 Libya's topography

Libya's topography consists generally of barren plains in the north of the country, plateaus and depressions in the south with the Mediterranean coastal lands and the desert being the most prominent natural features. Although Libya has a number of highlands, there are no true mountain ranges except those that lie in the southern desert near the border with Chad where the Tibesti Massif rises to a height of over 3,000 metres above sea level. There also exist barren waste lands comprising of some rocky plateaus and sand which allow only minimal and sometimes seasonal human habitation and agriculture can be conducted around some few and scattered oases (McMorris, 1979).

According to CIA, (2004) and El-Tantawi, (2005), the highest point in Libya is Bikku Bitti which lies at 2267 metres above sea-level and the lowest point is Sebkhat Ghuzayil which is 47 metres below sea level. Other notable geographical features in Libya include the northern coastal areas, the coastal areas of Tripoli that cover a total of around 300 kilometres where sandy regions and saline lagoons seem to be alternating.

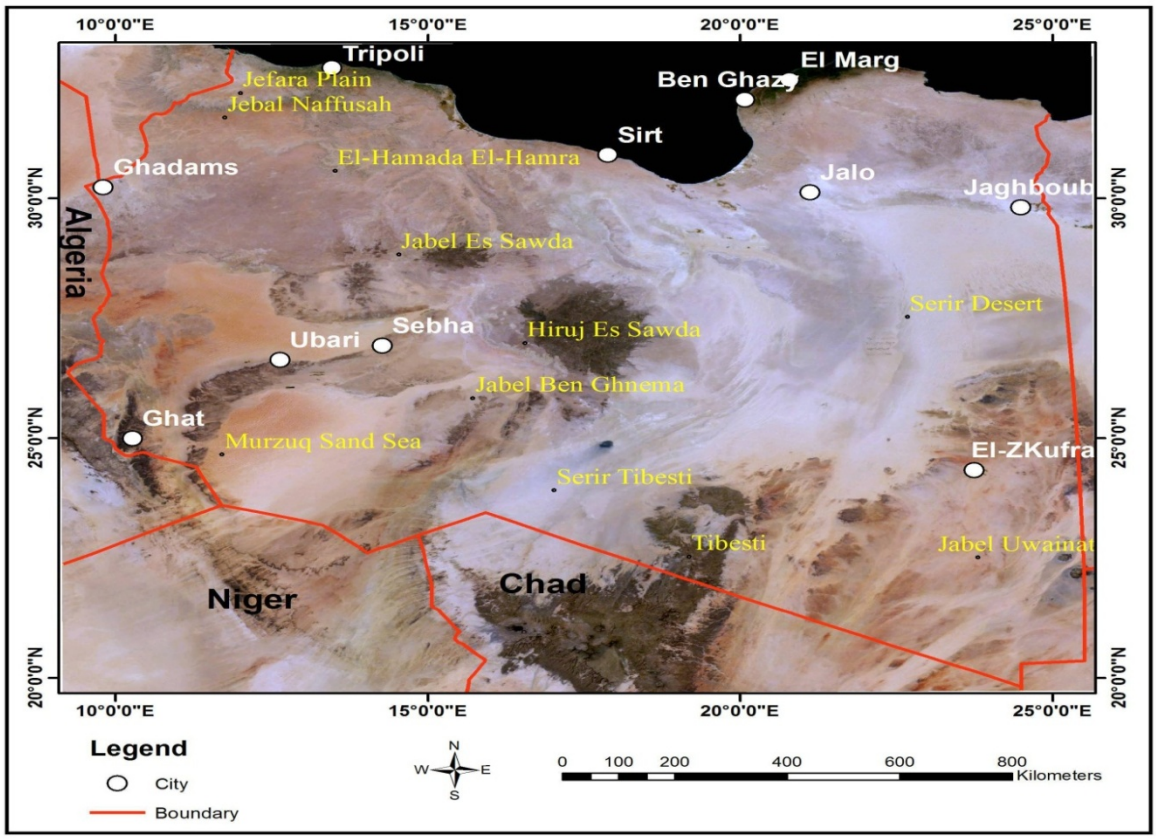

Figure 14: Topographic map of Libya.

Source: Biruni Centre for Remote Sensing and Space Sciences.

4.1.4 Climate

Due to the geographical positioning of Libya coupled with its size, at least, five different climatic zones are found in Libya, dominant among them being Mediterranean and Saharan climates. Abohedma and Alshebani, (2013) comment that Libya's climatic conditions can best be described as arid to semi-arid, with hot and dry summers and moderate winters with erratic rainfall. The coastal lowlands fall under the Mediterranean climate that is characterized by mild winters and warm summers. Changes in temperature are however experienced and are attributed to the 'Ghibli' winds which is a hot, dry, dust-laden desert type of wind, often lasting around four days, which helps to reduce

temperatures to ranges lying between 18°C to 23°C in both the summer and winter seasons.

Al-Hajjaji, (1989) suggests that because of the favorable Mediterranean climatic conditions, the coastal lowlands host 80 percent of the Libyan population. The desert interior experiences very hot summers and extreme diurnal temperatures and is not habitable places and hence has a very low population. Chapin, (2010) states that weather conditions are cooler in the highlands and frosts occur at maximum elevations.

While rainfall is the main feature of precipitation in Libya, the country does sometimes experience snowfall especially in areas that lie along the Mediterranean coastal region, where the largest recorded snow fall occurred in February 1949 where “the snow layer thickness measured one metre thick and persisted for three days at Jebal El-Akhdar” (Martyn, 1992: 222). Rainfall ranges from negligible to light rains and less than two percent of the country receives enough rainfall for agriculture. The mountain areas of the north receive on average, rainfall amounts ranging from 381 to 508 millimetres annually while the average for other parts of the country does not exceed 203 millimetres per year (Meteorological Centre Report, Tripoli, 2010). The Meteorological Centre Report, (2010) further highlights that Libya receives most of its rains during the winter season, mainly from November to March but the rains are not evenly distributed throughout the season. (Refer to Figure 15 below).

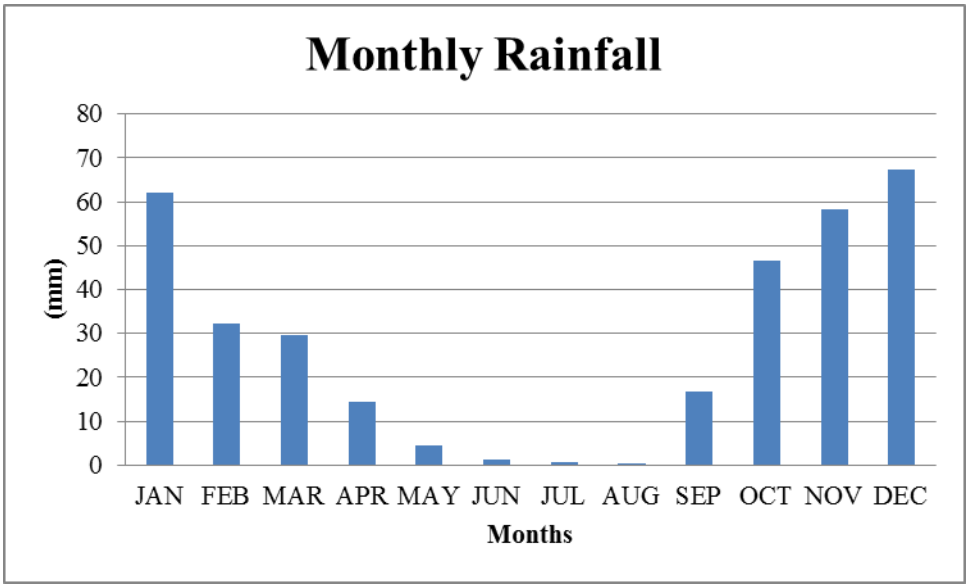

Figure 15: Rainfall pattern across the calendar months in Tripoli**.**

Source: Author's creation using datasets from the Meteorological Centre Report (2010)

The Meteorological Centre Report, (2010) indicates that temperatures in Libya vary from one region to another but also across months of the year. Mean annual temperatures increase gradually from the north to the south of the country during winter and summer seasons. Highest temperatures in the coastal zones are experienced in August while lowest temperatures occur between December and January.

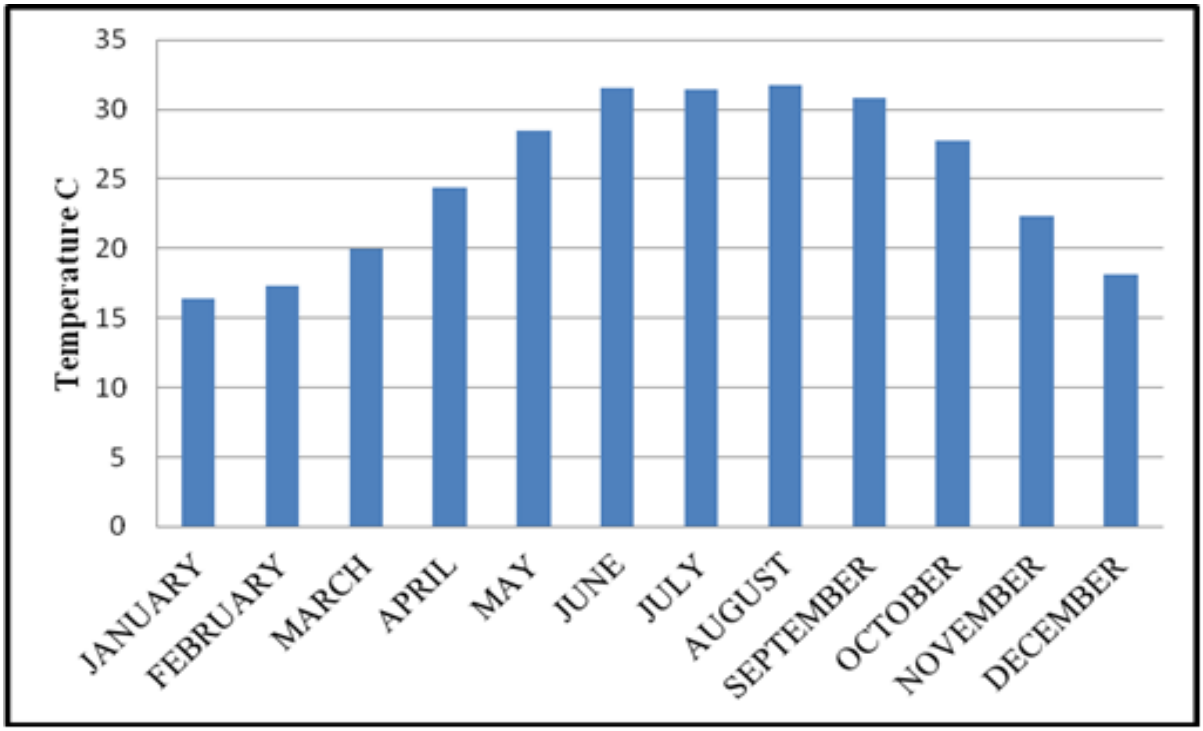

Figure 16: Annual average temperature reading for Libya.

Source: Author's creation using data from the Meteorological Centre Report (2010)

As Figure 16 above shows, Libya is hotter in the months of June to September with temperatures getting as high as 30 degrees during both day and night. Such high temperatures are not conducive for crop and animal production. Cooler months in Libya include November, December, January and February.

4.1.5 Libya-Economic profile

The World Bank (World Bank database, 2014) indicates that Libya depends primarily upon revenues from its oil sector, which contribute around 95 percent of the export earnings, accounting for just over a quarter of Libya's Gross Domestic Product (GDP). NEPAD and FAO, (2006) add that as is often the case with most oil producing countries, the Libyan economy follows a fluctuating pattern that depends on oil prices of the global

market. It is further stated that “Libya experienced negative growth rates of its GDP of 11.1 percent and 35.8 percent in the years 2000 and 2001, respectively, mainly due to the devaluation of local currency against all major world currencies and this had a negative impact on the main sectors of the economy” (NEPAD and FAO, 2006:8).

In addition to the oil sector, Libya also boasts vibrant non-oil manufacturing and construction sectors, which account for more than 20% of the GDP (World Bank, 2014). These two sectors have over the years expanded from processing mostly agricultural products and have ventured into the production of petrochemicals, iron, steel and aluminum (World Bank, 2013). Being a country that is 85 percent desert, Libya imports about 75% of its food requirements (WHO, 2010).

4.1.6 Population of Libya

The population of Libya has been growing over the years, from 3.7 million in 1986, 4.7 million in 1990, 5.237 million people in 2003 and 6.332 million in 2010 (Bureau of Statistics and Censuses, 1986, 1990, 2003, and 2010). The population in Libya is mainly concentrated in two areas, the northwest of Libya where about 65 percent of the total population in Libya lives and this is where Tripoli the capital of Libya is located. Tripoli alone has a population of more than one million. The north-eastern part of Libya called the Ben-Ghazi Plain is the second area with a high population concentration.

The main reason for the high population concentration in these plains is the availability of resources such as, water, vegetation, fertile soils and seasonable, moderate climatic conditions. In terms of the rural-urban population split, approximately 90 percent of the Libyan population live in the urban areas with the other 10 percent living in rural areas including the fringes of urban areas (see Figure 17 below).

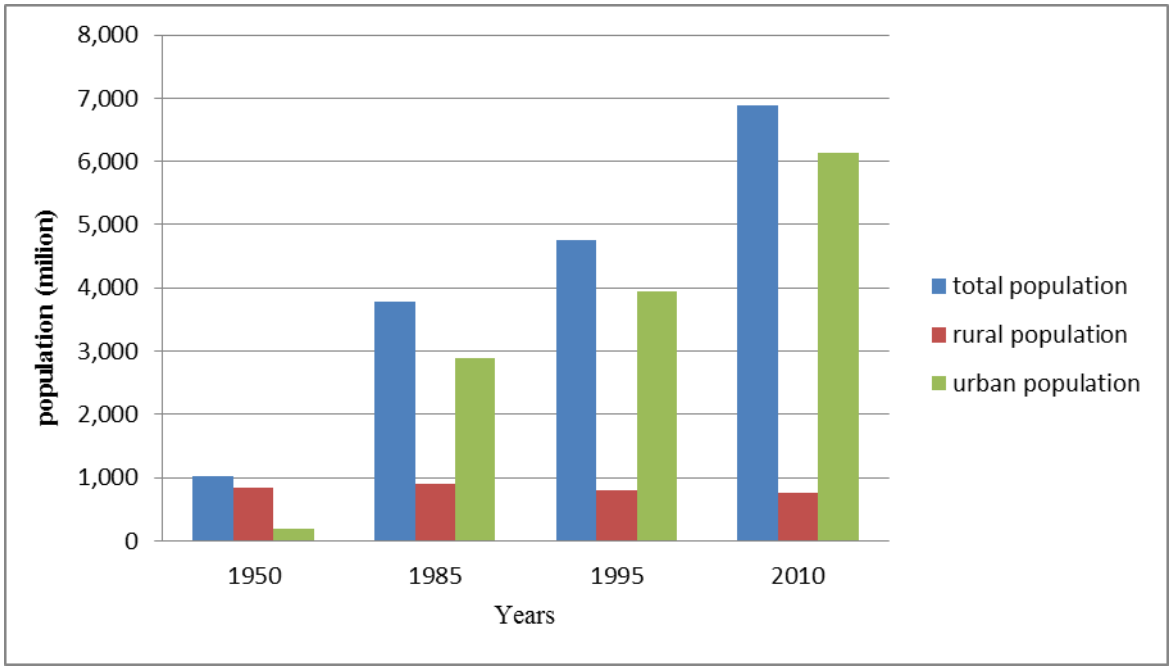

Figure 17: Libya - Population Distribution trend - Urban and Rural areas.

Source: Author's creation using Figures from National Information Authority in Tripoli of Libya from 1950 to 2010.

As Figure 17 above shows, Libya has undergone rapid urbanisation since the 1950s when the rural population was higher than that in urban areas. About 20 years later (around the 1970s) the rural population started dwindling while the urban population started increasing such that by 1985, the number of people living in urban areas in Libya had almost tripled. The trend continued and by 2010 almost 9 out of 10 Libyans were living in urban areas (Bureau of Statistics and Censuses, 1986, 1990, 2003, and 2010). Based on this trend, the Library of Congress, (1987) projected that at the rate Libya was urbanizing, by 2030 at least 93 percent of the Libyan population would be living in urban areas, a figure that is more than five times the number of people that were living in Libya's urban areas in the 1950s. Additionally, the development of infrastructure that has concentrated in urban areas such as universities, hospitals, good roads, housing and

public offices and services have all facilitated social development so people are able to link friends and relations to job opportunities, and this too has helped increase population in Tripoli (Brauch, 2003 and El-bendak, 2008).

Deliberate Libyan Government policies and strategies during the last three decades have also helped expand the cities in Libya (El-bendak, 2008). The concentration of development in urban areas, especially Tripoli, following the discovery and exploration of oil in Libya has in the past decades been pulling people from rural areas in Libya and from across the national borders and these have significantly led to population growth in Tripoli and other cities in Libya. Advancement in medical and health sectors have also helped in increasing the population of Tripoli as through the use of modern medical technologies many of the diseases that people would have died from are now being treated. People are now living better and healthier lives due to better incomes since people are gaining employment in the oil sector, and this too, has made a significant contribution to decreased mortality rates.

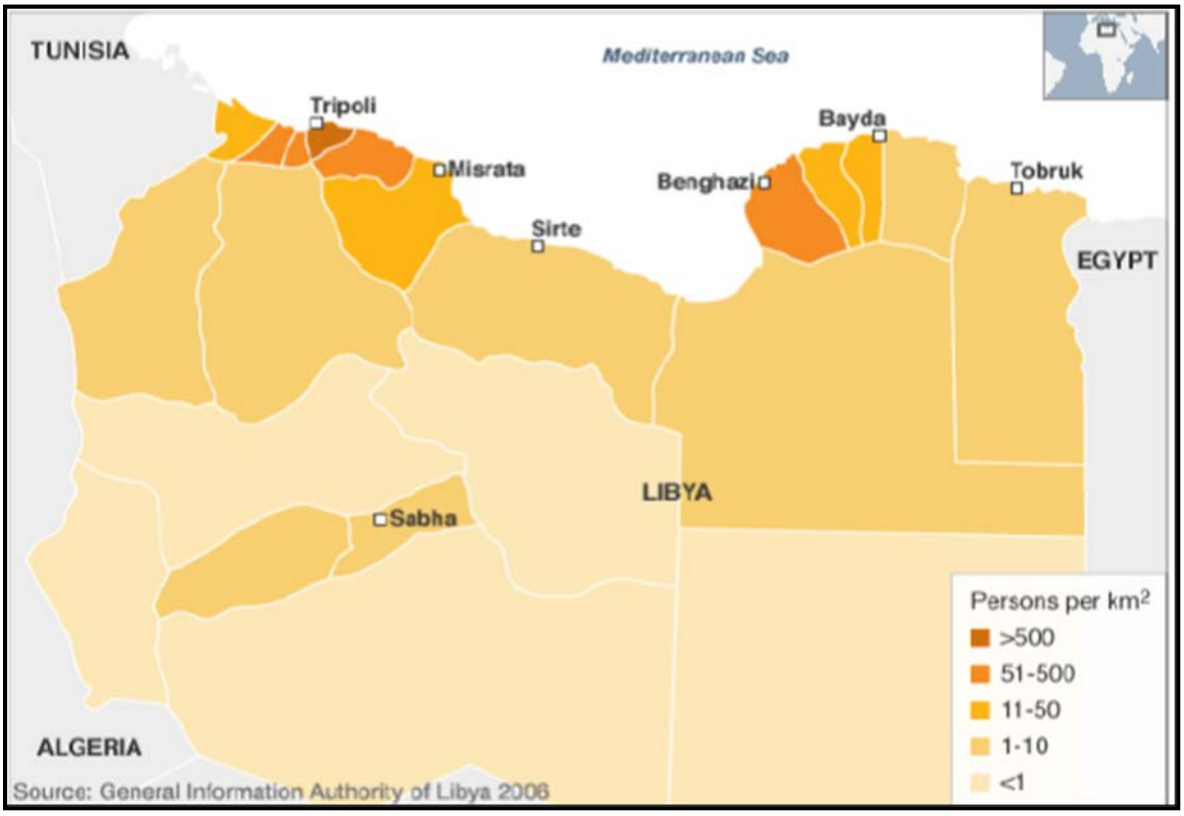

Figure 18: Population density map of Libya.

Source: General Information Authority of Libya, 2006.

Despite Libya being one of the largest countries in Africa, the country has a moderate population density last estimated by the World Bank in 2013 at 50 persons per square kilometre (World Bank, 2013). As the map in Figure 18 above depicts, the population is concentrated along the Mediterranean coastal areas with significantly higher population densities in Tripoli and Benghazi.

The urban population of Tripoli has increased largely because of the rapid economic development that Tripoli has witnessed since the early 1960s following the discovery and subsequent extraction of oil. The booming oil sector in Tripoli is indicated as the main factor that has been pulling people from rural areas to Tripoli. The oil sector plus the provision and availability of essential services like water, electricity, education and health

are also pull factors for rural populations that made them moving into the city searching for alternative forms of livelihoods.

As Figure 19 below shows, Tripoli's population has been steadily growing mainly because of the many opportunities that the city offers to its citizens. Tripoli is not just an economic hub for Libya but also plays an important economic and political role for other countries in the region. Figure 19 below shows that the population of Tripoli and its fringe areas has increased from 797 thousand people in the 1980s to over 2.3 million in 2010 and is still growing (National Information Authority and Documentation in Tripoli, 2010).

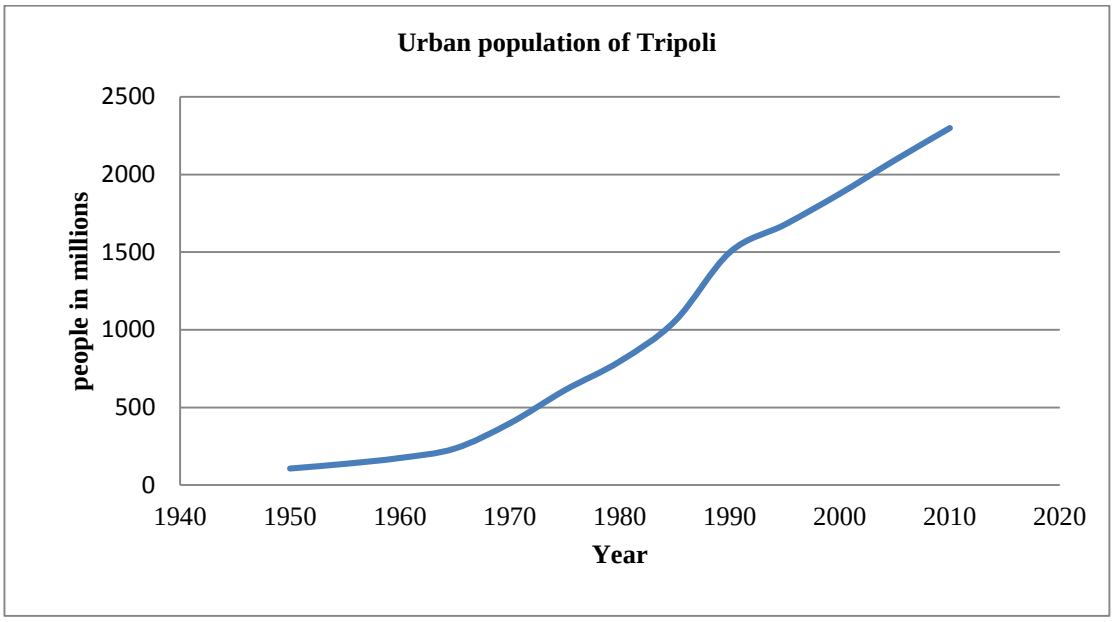

Figure 19: Population growth trend in Tripoli and its surrounding areas

Source: National Information Authority and Documentation in Tripoli, 2010.

Another major factor that has been pulling people from rural areas to urban (Figure 19) is the social transformation that has been happening. Since 1969, the Libyan government has been developing modern and high-tech infrastructure to support and generate

development. The significant investments have propelled the transformation of industries and services one associates with urban life.

4.1.7 Agricultural livelihoods and urbanisation in Libya

The agricultural sector in Libya is still ranked as the second most important production sector as on average, the sector contributes around 10 percent of the national GDP. The importance of the agricultural sector in Libya is also highlighted by FAO, (2011), a United Nations (UN) organization that has, since the early 1950s, been providing agriculture and food security related technical assistance to the Libyan Government through various activities and projects. Since 2000 efforts to modernize and improve agriculture, forestry and fisheries have been supported by massive investments in agriculture; the aim was to improve food security situation and to ensure policies' and programmes' implementation in this regard (UNCT, 2012).

Libya has earmarked approximately 2.2 million hectares of land to the agricultural sector with approximately 239,000 hectares earmarked for irrigation agriculture (Azzabi, 2010). Looking at the size of the land indicated for agriculture, Azzabi, (2010) argues that this is a strong indicator of commitment by the Libyan government to improve the sector. The Libyan government also recognises the importance of agriculture through the varied and multiple agricultural policies that have attempted to combat food insecurity, a top issue for the government in an effort to minimize the country's over-reliance on foreign sources for food supplies.

Ben-Hamed and Elhoush, (2014) concur that agriculture in Libya is still an important sector but the two are quick to point out that the contribution of the sector to national GDP has been declining over the years. Cereals especially wheat and barley, legumes, vegetables, fruits, meat and dairy products are cited by Azzabi, (2010) as being the major agricultural products in Libya. Apart from the economic contribution through the national GDP, the agricultural sector in Libya also offers various forms of employment to around

17 percent of the economically active population in Libya, the majority being members of poor households (FAO, 2006). Notwithstanding the many positive contributions, the agricultural sector has for many years been making to Libya's economy, the sector is currently faced with complex and multiple challenges that range from reduced workforce, availability of very limited renewable natural resources including fresh water, climate change and the loss of vital soils due to increased salinisation of lands on which agriculture can be practiced. Most of these challenges are stated in literature to be by-products of urbanization. Concurring with this observation, Azzabi, (2010:79) notes that the agricultural sector in Libya "encounters some difficulties and constraints, such as water shortage, unfavorable weather conditions, desertification, lack of technology transfer, a weak linkage between research and extension".

The majority of Libya's workforce is no longer employed in agriculture, but in the administration sector, a source of livelihood for more than 72 percent of the working age group in Libya (El-bendak 2008). Providing evidence on this high and rapid urbanization rate, UNDP, (2006) indicates that two of Libya's largest cities, the capital Tripoli and Benghazi currently are home to over 50 percent of the Libyan population. This rapid urbanization, one of the highest in Africa, is mainly attributed to the discovery and subsequent extraction and exportation of oil in Libya. Additionally, the high population growth Libya is currently witnessing is also attributed to the absence of family planning policies which in a way has negatively impacted the agricultural sector including the allocation of fewer funds when compared to off-the-farm services like health and education.

The World Health Organization (WHO, 2010:15) attests that Libya's scattered population plus the vast geographical area and the influx of immigrants have been having a negative impact on lives of peri-urban dwellers as there is immense pressure being put on social service provisions such as health and education. The urban fringe areas surrounding Tripoli have witnessed significant changes as a result of urbanization, including pressure

being exerted on land for agriculture and the surge in demand for agricultural products like fruits, milk and vegetables (Turner et al. 1997). Al-Hajjaji (1989) indicates that before the development of the oil sector in Libya, the majority of Libyans households were engaged in subsistence farming and herding but the numbers have been dwindling as people prefer working off the farm.

4.1.8 Urbanisation in Libya

Abiodun, (2007) writes that urbanisation in Libya is a product of natural population growth and rural to urban in-migration that includes migration of people from rural areas in neighboring countries who move to Libya in order to diversify their livelihoods. There are, however, significant challenges attributed to such high rates of urbanisation where the process is unplanned, uncontrolled and spontaneous (Abiodun, 2007).

One such challenge is the lack of proper housing and in Tripoli urbanisation has resulted in overcrowding, slums and the building of substandard housing, all of which negatively impact the health of household members. Abiodun, (2007) argues that the location, design, and layout of a dwelling unit can contribute to sustainable development.

Secondly, the rapid urbanisation process witnessed by Libya, coupled with the many opportunities the oil sector has been providing, has also led to a reduction of man-power in the agricultural sector in Libya. The reduction has affected production levels as the majority of agricultural workers have opted out in favour of formal employment in the oil sector. Foreign migrants are now being used as labourers in most Libyan farms. This urban in-migration affirms what Al-Buainain, (2000), Brauch, (2003) and El-Bendak, (2008) indicate, which is the fact that many people from rural areas are migrating to urban centres in the hope of achieving a better life through good education and employment.

Thirdly, urbanisation in Tripoli, has also led to the encroachment onto fertile farmland where around 23 percent of fertile farmland has been affected thus, reducing the already meagre amount of farmland in Libya (Bezemer and Headey, 2008). This, according to Bezemer and Headey (2008), is affecting the overall production within Libya's agricultural sector. FAO, (2011) identifies the reasons for the low performance of the agricultural sector in Libya as being caused by various natural, environmental, economic and institutional challenges and constraints. Furthermore, Bezemer and Headey, (2008) specifically note that urbanisation in Libya is responsible for the over-cultivation of available agricultural lands due to the increase in the demand for food by inhabitants of both urban and peri-urban zones. It is claimed that the growth in population in urban areas is responsible for producing an equivalent increase in demand for food and other agricultural products which forces farmers to over-cultivate the land so that they can meet the ever-increasing demand and become economically better off.

Fourthly, the intensified use of agricultural land accelerates the rate of soil erosion and has also led to the loss of agricultural land. Heavy grazing of livestock has contributed to the reduction in fertility and in some places, there has been a total elimination of vegetation due to the erosion of the fertile top soils. The loss of top soils not only affects livestock but has contributed to reduced crop activity. Furthermore, in efforts to meet demand, farmers have intensified their production methods using heavy machinery and artificial fertilizers and pesticides that contribute to the pollution of water and land resources (NASR, 1999). Additionally, machinery and fertilisers are not easily afforded by poor households.

The pressure exerted by urbanisation in Tripoli has also caused administrative challenges in that the concentration of the population and economic activities on a small region but with a pleasant climate is acting as an administrative burden on Libya's planning authorities who are responsible for managing and controlling settlements and land use development in the region. For instance, while the Consultative Office of Facilities

declared in 1988 that there was need to restrict the growth of Tripoli as a way of preserving agricultural lands, the Department responsible for Urban Land Development went ahead and took about 50 percent of the total fertile agricultural land in 2000 (Brebiush, 2006, p.221). This land was to be used in the expansion of Tripoli, thus going against the decree made by the Consultative Office of Facilities. As a result of this decision, the share of the agricultural lands per capita in Libya declined from 4.47 hectares in 1954 to around 0.34 hectares in 2000 (Al Jlala, 2005). Not only did this activity lead to loss of more fertile land, but the conversion of agricultural land into non-agricultural usage also affected households that could have used the same land as a source of livelihood. This is a clear illustration of an administrative tug of war between the two government institutions.

While acknowledging that urbanisation in Tripoli has come along with the advancement of agricultural technology, Azzabi, (2010) contests that most of the modern agricultural technology in Libya only serves selected state-managed large agricultural projects and well-to-do farmers. Only a very small population of local smallholder farmers benefit from this advanced technology. Azzabi, (2010:78) points out that some of these advances are "technologies related to seeding, fertilizing, irrigation, agricultural practices, hybrids and certified seeds, harvest and storage." Failure to adopt and use modern technology by local peasant farmers has also affected the agriculture-related livelihoods as the poor soils no longer produce enough crops and the farmers cannot afford the high costs of artificial fertilisers (Azzabi, 2010).

Tripoli has witnessed the massive and often unnecessary cutting down of trees in order to create space for the construction of infrastructure that urban life needs, like buildings and roads (Bezemer and Headey, 2008). This has accelerated the desertification processes. NEPAD and FAO, (2006) reveal that the number of small farms, (less than 20 hectares in size) has been decreasing in and around Tripoli as more and more land is taken up for urban development. The two institutions indicate further that although farming on small

farms has been characterised by limited labour and lack of enough farm resources, like fertilisers and hybrid seeds, the objective of farming has always been to sustain and provide livelihood for the families in peripheral areas who looked to agriculture as the only source for employment and source of living. Evidence highlights that the number of farms that are less than 5 hectares in size has decreased by around 14 percent between 1974 and 1995 as a result of expanded urbanisation (NEPAD and FAO, 2006:6). It needs to be noted that most households in Libya have land holding that are less than 5 hectares in size(NEPAD and FAO, 2006).

The picture in Figure 20 below illustrates how the vegetative cover has been affected as land is being cleared and transformed from agricultural use to give space to emerging new urban infrastructure. As can be seen there are marks of a heavy machine being used in pulling or pushing the trees and other vegetation, which loosens up the top soil making the soils even more prone to wind and water erosion. The loose and finer top soil particles are blown away in strong winds and rains carry away the topsoil and dump the particles into rivers and streams causing sedimentation that then causes flooding in some places and also affects the generation of hydroelectricity.

Figure 20: Vegetative cover damage- land transformation in study area settlement expansion around Tripoli (study area).

Source: Taken by the author on 17.09. 2012.

Figure 21: **Transformation of forest trees to wood fuel in study area.**

Source: Taken by the author on 17.09. 2012.

Apart from clearing land and vegetation cover for the construction of roads and building, urbanisation has also significantly affected vegetation as people cut down trees to produce charcoal that is considered an affordable source of energy for most urban and peri-urban areas. Figure 21 above shows some of the charcoal bags that the researcher observed during field visits in Libya.

Aqeil et al., (2012) states that water is one resource that affects all the facets of social structure and civilisation and hence is often regarded as a resource that supports the social and economic development of mankind. Fresh and usable water is an essential factor in the sustainability of economic development, ecosystems functioning and the availability

of a good environment (Aqeil et al., 2012). Aqeil et al., (2012) also state that Libya has in the past decade been experiencing an increased demand for water. Despite the presence of only a few surface and open fresh water sources, Libya boasts of a considerable amount of underground water which has, in the past years, been extracted more quickly than nature can replenish. Despite the over-extraction of underground water for domestic, industrial and agricultural purposes, available water volumes seem to be dropping and fail to meet the daily demands especially in urban areas where water is sometimes rationed. Urbanisation in this situation is viewed as a major contributing factor as the higher the population of cities like Tripoli get, the more underground water has to be extracted.

However, it needs to be noted that over-extraction of usable underground water in Tripoli and surrounding areas has led to the salinization of land (NEPAD and FAO, 2006). The reduction of soil moisture has allowed sea-water to get into the coastal aquifers and this has negatively impacted the quality of water and levels of soil fertility, making the soils almost unusable for agricultural production as they are too salty for crop production. Records indicate that within the proximity of Tripoli, sea water has penetrated previously well stocked fresh water. This occurs by up to about 20 kilometres in land. Much of the land that was previously used for irrigated agriculture is now saline and no longer usable for agriculture.

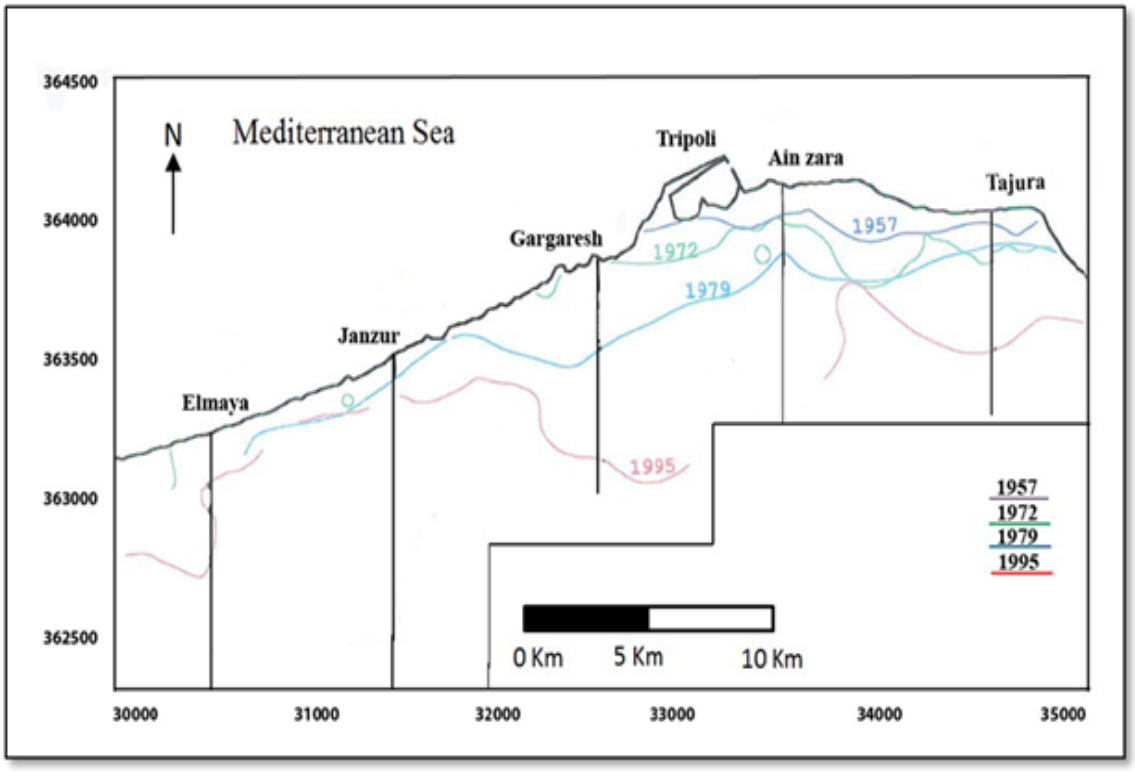

Figure 22: Sea water intrusion in and around Tripoli.

Source: General Water Authority in Tripoli, Libya. (2000)

Figure 22 above reveals that sea water, which is salty and cannot support growth of vegetative cover, has been occupying space that was previously occupied by underground fresh water in and around Tripoli. Floegel (1995) found that sea water migration inland led to the loss of 9km of agricultural land, which could be enough to support the food needs of many poor and vulnerable households in peri-urban areas of Tripoli.

FAO, (2011) argues that the rate at which urban developments have affected groundwater, which constitutes around 97 percent of Libya's usable water, is resulting in the depletion of water tables, seawater intrusion, and water and soil salination. It is the opinion of FAO, (2011) that because of the depletion of usable water, the agricultural

sector is negatively affected, hence there is a strong and urgent need to develop a comprehensive policy that can guide the sustainable and efficient management of water resources in agriculture. FAO, (2011) further reveal that urbanisation in Tripoli has also increased levels of chemical usage in the many industries that have flourished in the city which have produced multiple health hazards through water contamination, reducing food and animal production levels.

Azzabi, (2010) sums up the effects of urbanisation on agricultural products in Libya by attributing the persistent failure of the sector to meet agricultural demands over the past years as reflected in the Figure 23 below. As can be seen, meat production against demand in Libya has been decreasing. In 1980 Libya was able to meet 77 percent of its meat needs but 20 years later this figure has reduced to 68 percent. Azzabi, (2010) explains that the growth in urban population has increased demand for meat and meat products but the loss of agricultural land within the fringes of Tripoli and other cities in Libya has meant that land where animals could be raised is no longer available. Figure 23 shows that Libya has managed to meet its vegetable needs and Azzabi, (2010) comments that this has been because the government has specific vegetable producing projects.

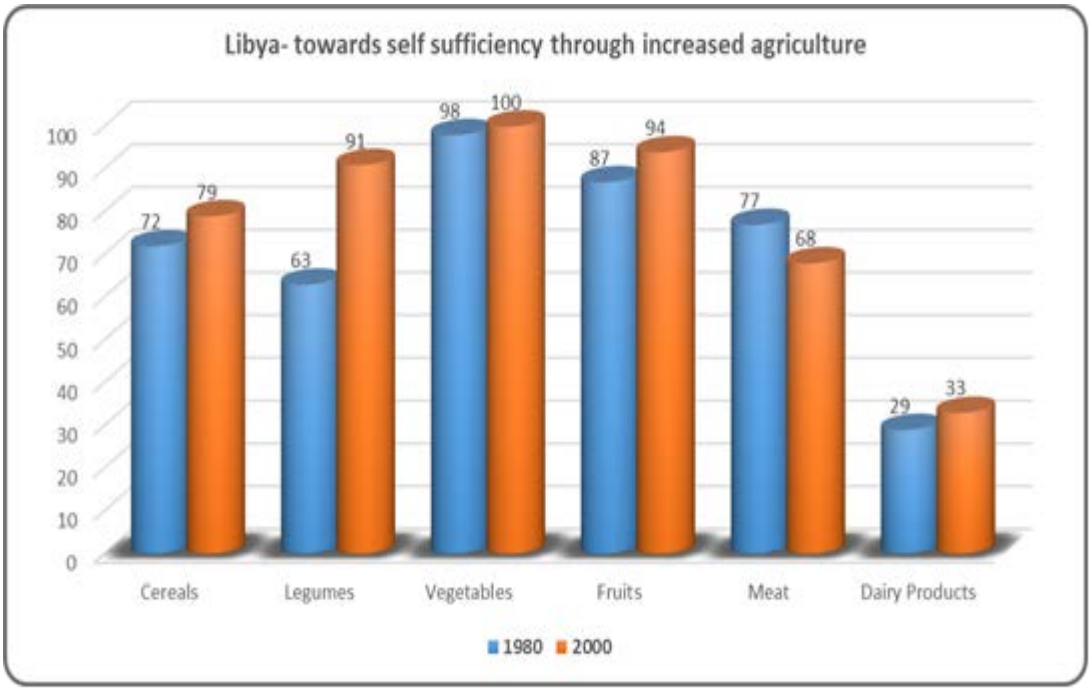

Figure 23: Agricultural Production-Libya towards self-sufficiency

Source: Author's creation using data from Azzabi (2010).

The Libyan government's desire to improve the agricultural sector through increased financial allocation has only yielded trivial results. For instance, Falkenmark, (2009) reveals that in the 1970s the Government of Libya invested around 30% of the national budget on agriculture but the investment only led to the production of 207,000 tonnes of cereal, which represented around 15% of the country's cereal demands. Although more funds have-in recent years- been made available for agricultural development, actual progress has not been matching with the investments made.

In a 2011 FAO report, the Libyan Government fully acknowledged the need and importance of developing the country's agro–industry and has over the years emphasized in all agricultural development plans the need to increase the value of agricultural products and agriculture's contribution to GDP. The investment goal in the agro-industry

sector for the Libyan Governments as indicated by FAO, (2011:8) was to "reduce production waste, stabilize supply through the extension of marketing agricultural products over a longer period of time and provide employment opportunities." The Ministry of Planning Budget Implementation Report (2007) and Ben-Hamed and Elhoush, (2014) noted that there has been a visible decline in the value of investments in the agricultural sector in some years. The agricultural investments in 2004 and 2006 was 262.7 million dinars and 175.3 million dinars respectively. However, these investments were almost doubled in the year 2007 and reached up to 330.14 million dinars.

While large investments as indicated above were made by the Libyan government which included resources for the establishment of food–processing factories, such as fruit and vegetable canning, beverages, baby food, milk factories and wheat mills (FAO, 2011), the sector continued to perform poorly. This was due to, among other things, over dependency on imported raw materials resulting in low utilization of existing capacities and higher unit costs (Ben-Hamed and Elhoush, 2014). Furthermore, Ben-Hamed and Elhoush, (2014:21) added that the sector's inability to compete with similar products was due "to low quality and higher costs, inefficient management and little contribution to marketing local production also hindered performance." The lack of progress in the agricultural sector has over the years forced Libyans to remain heavily reliant on agricultural imports, which are estimated at 75% of its annual demand (Falkenmark, 2009 and Ben-Hamed and Elhoush, 2014).

To counter challenges of poor performance, the Libyan government engaged in a man-made river construction project with a goal to ensure that water for human consumption and agricultural use is made available. Furthermore, as a way of improving the agricultural sector, especially smallholder farming, in July 2003, the Libyan Government signed the Maputo Declaration, thus pledging to support the implementation of the Comprehensive Africa Agriculture Development Programme (CAADP) under the New Partnership for Africa's Development (NEPAD) and committed to increasing its

investment in agriculture and rural development. Through this commitment, Libya pledged to provide more funds to the agricultural sector. Ben-Hamed and Elhoush, (2014) found that there was an increase in the volume of agricultural investment in the Libyan economy between 1990 and 2002. This was responsible for the gradual increase of contribution to the GDP that the sector was making. Additionally, FAO, (2011) indicates that in supporting its local peasant farmers, who are looking at agriculture as the only form of livelihood, the Libyan Government has in the past two decades been developing and implementing critical policies and interventions that are aimed at empowering farmers in peri-urban areas. Some of the most important initiatives that have been conducted are the "wide-scale subsidies, the establishment of resettlement schemes and large-scale strategic public projects especially for wheat production in the desert and of large scale dairy, sheep and poultry farms" (FAO, 2011:2).

4.1.9 Nature of Urbanization in Libya

Libya's urbanization can be described as more conventional in approach, compared to some other countries in Africa. In the year of 1967, Robert Harrison conducted a study on the migrants, and the growth in the city of Tripoli. He pointed out that most of the migrants were attracted towards the cities of North Africa during the 1950s and 1960s, because these cities were major manufacturing hubs. He further indicated that, during 1950s, industry in Libya was centered on two cities, Tripoli and Benghazi. While around 79% of the industrial labor was based in Tripoli (Harrison, 1967).

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However, it was found that industry was mostly based on the processing of the agricultural related products. The basic services were mainly available in the old city of Tripoli, which was the reason why population was concentrated around the old city. Harrison points out that, one of the auxiliary reason behind the migration was pursue of education. Most of the migrants moved in order to study in technical colleges located in Tripoli, or pursue higher studies located in the universities in Tripoli, with a motive of

getting a good job in the city. According to estimates during the Italian colonization (1915 – 1936), more than 100,000 migrants entered Tripoli (Harrison, 1967, p. 405).

Since, the year of 1930 Tripoli has been center stage of urbanization, receiving thousands of migrants every year. With this steady rise in the urbanization, Tripoli can be classified as over urbanized, and this has negatively impacted the basic accessibility services in the city. This is the similar trend in other African cities as well. One of the immediate impact of over urbanization was acute housing shortage in Tripoli. In order to measure the flow of migration, this research determines the migration role as a component of urbanization and a secondary factor, in addition to the natural growth, behind the rapid growth within the urban system of Libya during the last three decades. In spite of slower rate of urbanization, the urban population has grown in Libya. The rate of urbanization from 49.7% in 1970, had risen to 77.9% in 2010. Since the year 1960, Libyan development has been led by the revenues from the oil, and from 1980 onwards, government has started diverting the surplus revenue towards infrastructure projects (Almokhtar, 2015).

To summarize, it can be said that oil has been the principal source of income for Libya. The petro-dollar assets helped the urbanization in Libya, facilitated by real estate bank loans. Ministry of planning has facilitated easy availability of loans in order to cope with urbanization. They have also formed various youth organizations. However, there is no set process for the loan, and this casts a doubt on the role of planning supervision. Overall, the urbanization in Libya can be termed as an unplanned growth with inadequate infrastructure. On most of the occasions, urban planning and regulations have been heavily influenced by the politics, which has prevented the achievement of any form of positive outcomes. In order to analyze this, a brief analysis of urbanization laws in Libya will be made.

4.1.10 Urbanization planning history in Libya

Urbanization in Libya has gone through different phases and structures, right from the era when Libya was under roman rule. Libya was under colonial rule from 1835 to the beginning 1960s and its influence could be seen in the Libyan urban planning system. It was the year of 1835, when the Ottomans established the official urban planning municipal authorities in Tripoli. The “Wali” who holds the “Mayor” position in our present-day system managed those municipal authorities. Under the colonial rule, the urban planning was limited, in terms of expansion and infrastructure. Ottoman rule deeply concentrated on core services like, water and communication in the urban areas. It has to be noted, during those days Tripoli was a walled city, and the growth was exceptionally well managed outside the walled city, with proper streets. There were multiple core services developed during this era, which saw the development of central hospital, art school, and traditional crafts. Indeed, the Ottomans established the urban planning system, which included proper growth management by issuing licenses and enforcing the regulations of the municipal administrations. This is something which can be seen in today’s era as well.

Once Libya went under the colonial rule of Italy in 1911, base maps of Tripoli were created. This included surveying the city, along with mapping the streets of Tripoli, and marking the high-rise building within the city center of Tripoli. The core objective behind this was to implement the design of Rome in Tripoli (Misallati, 1981). The plan of Tripoli was clearly demarcated into distinct areas, which were government buildings, residential areas and commercial areas. Along with this, open spaces were marked as well. There were two squares within the city center, which were marked in the plan. This kind of planning falls under the concentric zone model, which helped to manage the growth of the city right from the central square to the walled city. In order to facilitate spatial expansion, at a later stage the wall was demolished to facilitate the spatial expansion of Tripoli. The plan also distinguished the buildings based on their heights.

The official certified plan of Tripoli city was released by Italian engineers in 1936, which was comprised of three different schemes for the urban area. In addition to this, “Urban Legislation Act” was enacted, which detailed the planning standards for buildings (heights, shape, design, and backyards) and permitted land uses within the city limits. Measures were taken to preserve the archaeological remains in the city, as they have deeper connection with the Italian culture. Post Italian rule, Libya was under the rule of British and France, however the urbanization which was developed during the Italian rule didn’t sustains, because of lack of educated citizens who were capable enough to work on urban planning.

4.2 Chapter Conclusion

The chapter highlighted how the urbanisation process in Libya has been taking place. In Tripoli, this has led to the encroachment of fertile farmland that has not only reduced the amount of farmland that is already affected by the fact that Libya is 85 percent desert but has also affected the number and types of crops and animals’ farmers can raise on their farmland.

It is therefore clear that urbanisation in Tripoli; Libya is having a negative impact on peri-urban areas, and in particular the agricultural sector. This is a clear threat to the farmers themselves, but also to the ability of Libya to provide sufficient food for the growing population. This is why this research is important as it seeks to understand the reality of these changes to individual farmers and can provide evidence of the true impact of these changes. Furthermore, the research intends to give insight onto the policies and practices that farmers believe will aid in the mitigation of the worst impacts of urbanization.

Chapter 5: RESEARCH METHODOLOGY

5.1 Introduction

This chapter outlines the methodology that was employed in this study. It also provides a justification for the selection of the research methods adopted. Additionally, the chapter also details software packages that have been used as part of the data collection and analysis processes.

Touted as one of the best people centered livelihood frameworks, the DFID Sustainable Livelihoods Framework has been selected to be the conceptual framework for this research. Using responses from carefully designed interviews and analysis of satellite imagery with reference to the DFID Sustainable Livelihoods Framework, a qualitative and quantitative assessment of any changes and associated effects on household livelihoods will be made.

Through the use of evidence gathered on the ground, this research aims to identify the vulnerability context under which farmers in peri urban areas are earning their livelihoods. The researcher also wants to examine how individual households manage the impacts of urbanization. Specifically, the researcher's ambition is to understand better how city expansion in Libya is impacting surrounding agricultural areas and households' livelihoods.

In trying to meet the above research objectives, the researcher developed a simplified version of the DFID SLF presented in Figure 10 above. The simplified model that the researcher developed is presented as Figure 24 below. As can be seen from the simplified model, the researcher's assumptions which this research has to either confirm or not include the assertion that there is a two-way relationship between the Vulnerability context in which peri-urban farmers are earning their livelihood and the Transforming Structures that dictate the legality of the processes that farmers have to adhere to when

conducting their livelihood. In this respect, this relationship (i.e. the two-way relationship) affects and impacts one another. While the vulnerability context could impact the nature of transforming process a community could have, the nature and the way the transforming processes is dictated might also impact the levels of vulnerability context of an area. In this respect, the researcher wants to understand this relationship by focusing on events around the peri urban areas of Tripoli. The simplified framework also indicates that apart from affecting and impacting each other, the vulnerability context and transforming structures jointly impact the nature and levels of livelihood assets people in area can possess or have access to. The nature and levels of livelihood assets that peri-urban farmers will have at a time, does to an extent affect the livelihood strategies they can employ at a particular time, which eventually impact the livelihood outcomes peri-urban farmers will attain. This research will attempt to contextualize the above interconnections that exist among and across the various sections of the simplified livelihood framework.

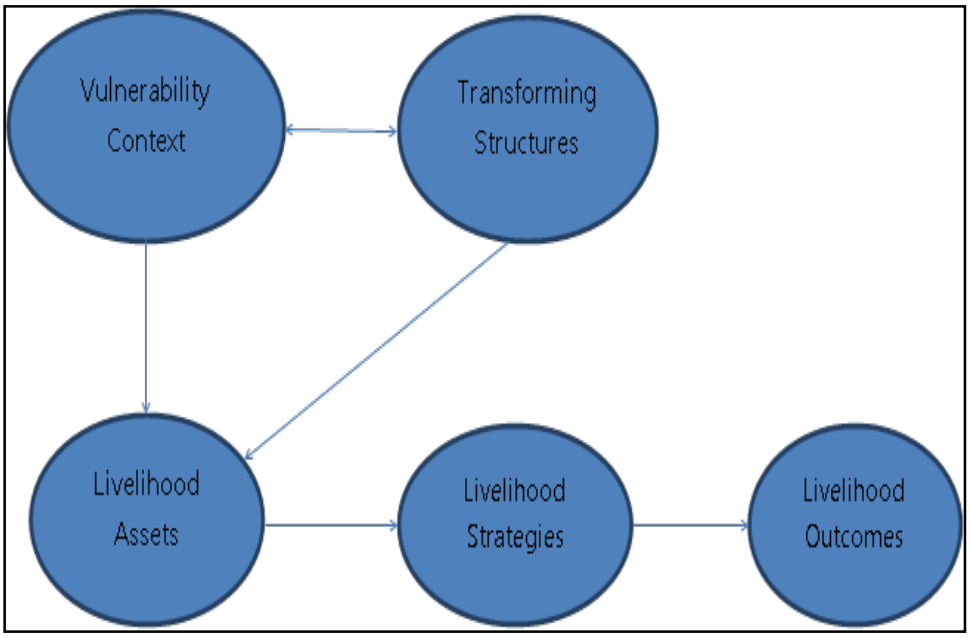


Figure 24: A simplified version of the Sustainable Livelihood Framework- The Conceptual Framework for this research. **Source:** Author's creation.

5.2 Research site

The research was undertaken in two stages. While stage 1 used satellite remote sensing and GIS to identify vulnerable areas i.e. areas that are experiencing rapid land use and land cover changes, Stage 2 employed qualitative research methods to understand the impact of changes on household's livelihoods. Stage 1's data collection process aimed at understanding and detecting land use and land cover changes on the urban fringes of Tripoli and helped to identify the Qarabulli district. The data collection process conducted in stage 2 aimed at qualitatively assessing by using participatory approaches, the opinions and understanding of the respondents regarding the effects of urbanization on the kind of livelihoods they are engaged in, including how the farmers are coping with any identified changes within the livelihood arena they are in.

Qarabulli district, the focal study area, which lies in the eastern part of Tripoli, (see map in Figure 25 below), is where qualitative data was collected in stage 2. The area was selected as a research site because of three reasons:

- During stage 1; Remote Sensing and Geographical Information Systems identified Qarabulli area as one of the most vulnerable areas around Tripoli since the expansion of Tripoli city seem to have more and continued influence in the way and rate at which land use and land cover changes are taking place in the area.
- Majority of people in Qarabulli take farming as the only source of livelihood as there are no oil reserves in the area. Because of this, this study aims at exploring the effects of expanding cities i.e. the expansion of Tripoli to its peripheral areas, on surrounding agricultural area and the implications the extensions have on farmers' livelihoods. Further to this, the location of Qarabulli, plus the nature of the dominant livelihoods offer the researcher a good opportunity to learn from inhabitants about the challenges and changes that have been experienced in the area and how that might be linked to urban expansion processes.

- Data collection in this research was conducted at a time when Libya was highly volatile following the violent ousting of the Libyan leader, President Muammar Gaddafi. Having carefully assessed the situation in Libya, amongst the many areas this researcher could have loved to go and research in, Qarabulli was the most secure and peaceful area and it was envisaged that the data collection process will not be affected by instability that rocked Libya at the time data was being conducted. It was priority number one for this researcher that no life, the life of the researcher or the respondents, had to be put at risk because of their engagement in this research.

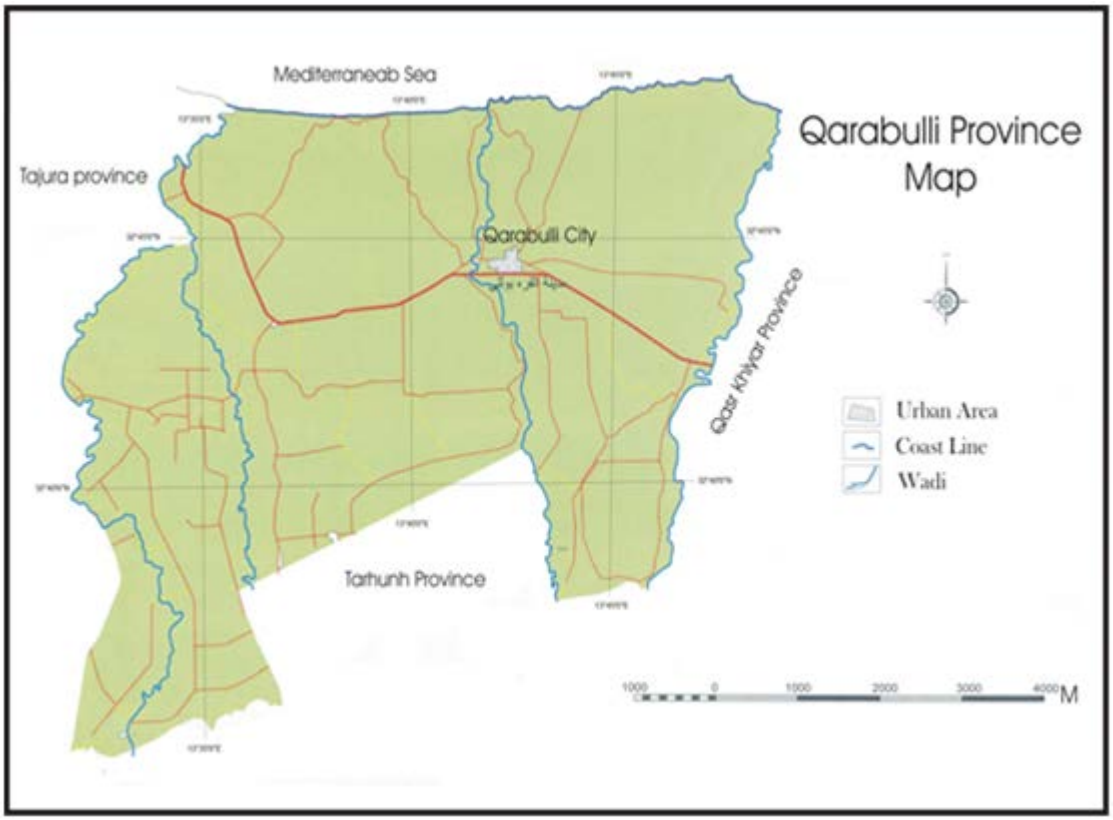


Figure 25: Qarabulli Province Map - the study area

5.3 Research methodology

Focusing on Qarabulli area in the east of Tripoli, the capital of Libya, the study aims at achieving six key research objectives as follows:

a. Identify land use/land cover changes emerging from recent urbanisation processes in the eastern part of Tripoli (Qarabulli area).

b. Identify the nature of lands that have experienced the most change due to urbanization.

c. Identify factors associated with urbanization processes that are driving land use changes.

d. Examine effects of urbanization on farmers' livelihoods, including the relationship between land conversion, degradation and desertification and how these are affected by urbanization.

e. Investigate and highlight challenges that farmers in peri-urban areas are facing when responding to land use changes caused by the urbanisation process.

f. Investigate how peri-urban farmers are solving challenges they face in peri urban areas and why they have chosen such options.

5.4 Choice of research methods

Teddlie and Tashakkori, (2009) indicate that when undertaking any research works, researchers need to examine the objectives of the study. According to Teddlie and Tashakkori, (2009), the process of examining research objectives is a critical stage within the research process as the examination goes a long way in helping researchers decided on the nature and kind of research methods they are going to employ during the research.

Further to this, Teddlie and Tashakkori, (2009) add that examination of the research objectives also provides guidance to researchers on who they have to look up to for research respondents, where these respondents could be and what specific areas or issues could an identified set of respondents be involved in.

After conducting a thorough examination of the above six objectives, the researcher has decided to use a combined approach where both quantitative and qualitative methods were to be employed in this research.

Talking of quantitative methods, Berg, (2007) indicates that research questions that are explored using quantitative methods examine any available relationships of research variables using numbers and percentages as units of correlations. The views of Berg, (2007) are in line with those expressed earlier by Mbabazi et al., (2003) who indicated that quantitative methods help researchers capture numerical data that can be presented through frequency distributions and ranges and are useful in describing the magnitude of the problem being investigated. On the other hand, qualitative methods according to Mbabazi et al., (2003) help researchers examine meanings to situations people face, identify processes taking place in particular areas and offer reasons and explanations on why certain events or trends are occurring in a particular manner or area.

Although quantitative and qualitative research methods can be used as independent research methodologies, Denscombe, (2014) and Bryman and Bell, (2015) argue that a research study that utilizes both quantitative and qualitative research methods benefits from the advantages that each method brings into research as there are more benefits in using the two methods to complement each other than opting for one. It is further opined by Denscombe, (2014) that the use of the two research approaches, a method called the Mixed Method Approach (MMA), ensures that the researcher gains maximum benefits. Mixed Methods Approach (MMA) as the name suggests is a research approach that combines the use of quantitative and qualitative research strategies and approaches in a

single research and both quantitative and qualitative data is collected, examined, analysed and reported upon.

Berg, (2007) and Denscombe, (2014) further indicate that the Mixed Research Approach, which is also referred to as the Multiple Research Methodology (MRM) or Multi-Methodology Research Approach (MMRA) by some authors, offers researchers the opportunity to examine research questions and existing correlations between research variables from multiple angles. The mixing of quantitative and qualitative research methods gives researchers the chance to select the best possible angle that brings the best research results as researchers have more chances to triangulate the collected data (Denscombe, 2014). Bryman and Bell, (2015) argue further that MMA enhances the comprehensiveness of research outputs especially in cases where meanings and conceptual relationships of variables are examined using human experience and behaviour, as is the case with this study that examines the impact the expansion of Libya's capital city is having on the livelihoods of farmers.

5.4.1 Nature of data collected

To ensure that the findings of this study- no matter how distinct they might be- still align or correlate with findings of other studies within the research area, the researcher conducted a thorough desk review on associated literature relate to urbanization and livelihoods and how the two concepts are correlated. In addition to collecting and reviewing literature as discussed in Chapter 3 above, the researcher also used quantitative and qualitative research techniques to collect primary data in the study area. The collection and use of primary as well as secondary data enhances the richness of the research (Denscombe, 2014). Denscombe (2014) notes that using both secondary and primary data helps ensure that secondary data, is supplemented by data collected directly from the research subjects, which greatly helps in deepening the levels of data analysis.

Finally, the interaction that the researcher has with literature on urbanisation and livelihoods, including the theories and frameworks related to urbanisation and agricultural livelihoods, helped in building a strong base on which the research data analysis was based. Details about the primary data collection process are discussed below.

5.4.2 Data collection and Research framework

Having evaluated the benefits of using the Mixed Methods Approach (MMA), in conducting this research the researcher purposefully collected and analysed both quantitative and qualitative data. For easy and thorough utilisation of each data collection method, it was decided by the researcher that the data collection and subsequent analysis be conducted in a two-stage but stand-alone data collection approach naming them stage 1 and stage 2.

Within stage 1, the researcher collected quantitative data using Remote Sensing (RS) and Geographical Information System techniques. Stage 1 of the data collection process aimed at understanding and detecting land use and land cover changes on the urban fringes of Tripoli and helped to identify the Qarabulli district (eastern part of Tripoli), as the research study area. Data analysis in this stage focused on changes captured on satellite images that depict the changes in land use and land cover that have been experienced in the study area.

Having used Remote Sensing and Geographical Information System to detect changes in land use and land cover in the study area in stage 1 of the data collection exercise, stage 2 involved using qualitative research methods to examine the effects the changes detected in stage 1 were having on livelihoods of farmers. Participatory Rural Appraisal (PRA), a qualitative data collection and analysis technique, was employed during stage 2 where a number of participatory qualitative research data collection techniques were used,

including; Mapping, Transect walk, Interviews, Time and Trend Lines, Tree Branch, Bean Counter and Solution Matrix.

In addition to the stated PRA tools, one-to-one structured interviews were employed that embodied open-ended questions and centered on issues that groups of farmers had already identified, these were:

a) What was the nature of the problems or challenges the respondent is facing or has faced as a farmer operating in the study area?
b) What were the effects of desertification on the farmers?
c) Were any farmers selling land, why and what was the land subsequently used for?
d) What specific changes have taken place in the area with regard to agricultural land and agricultural production?
e) What was the experience of the impact of Tripoli's expansion on the farmers?

Each interview started with some formal introduction and a reminder to the interviewee that the interview was a voluntary activity and that the discussions would be treated with strict confidentiality and the names of the respondents would not be made public. The duration of each interview did not exceed two hours with break, at least, after the first 45 minutes or one hour and the interview questions, sample of responses and a coded list of the 16 interviewees are found in Appendix B, B (1) and D respectively.

A framework guided the data collection exercise during the two stages of data collection (Figure 26 below).

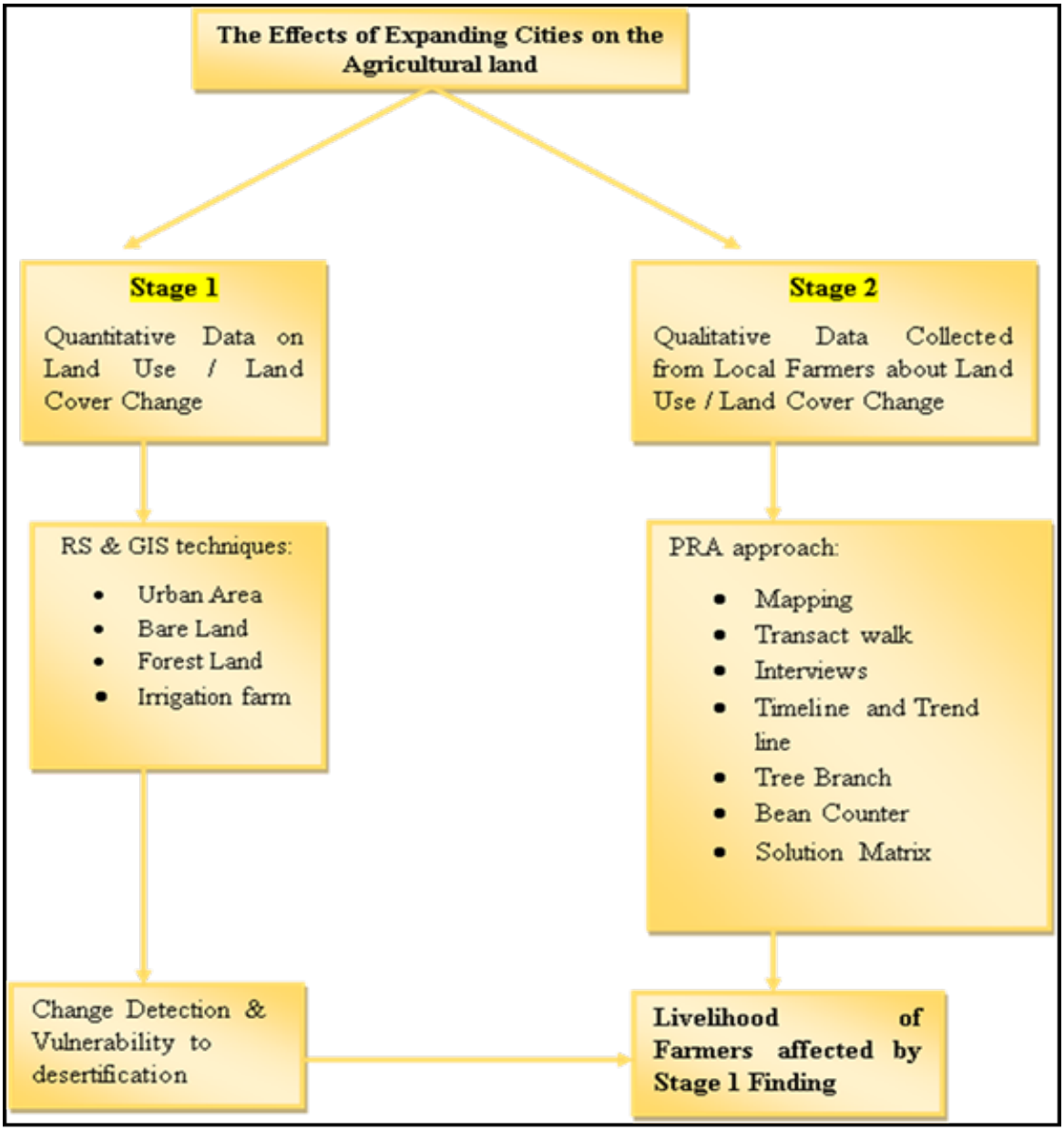


Figure 26: Data collection Framework.

Source: Author's creation.

5.5 Stage 1 Data collection process - First visit to Libya

The first visit to Libya was undertaken by the researcher from 21 July to 15 September 2012. This stage focused on the collection of data and satellite images using Remote Sensing and Geographical Information Management techniques. The collected data comprised of multi-sensor and multi-temporal data captured within the eastern part of Tripoli Libya.

Data in stage 1 was collected from a number of Libyan institutions most of them based in Tripoli and included:

- Libyan Centre for Remote Sensing
- Biruni Centre for Remote Sensing and Space Sciences,
- Tripoli Meteorological Station,
- Libyan Natural Resource Centre,
- Department of General Water Resources,
- National Information Authority and Population data,
- Centre of Research of Agricultural.

The need for understanding better how livelihoods have been changing over the years in the eastern part of Tripoli meant that Remote Sensing technologies had to be used to acquire information captured using airborne sensors or satellites. Rawat and Kumar, (2015) indicate that using digital technology when analysing satellite imagery helps in creating a better understanding of prevalent landscape dynamics as changes are easily noted through the comparison of the selected sets of satellite images over a selected period of time. Additionally, most remotely sensed data that is utilized in mapping and spatial assessments exercises have been obtained through the use of remote sensing

technologies in the form of electromagnetic radiation. The information is then converted into a digital image that can be embedded with other spatial data (Adrados et al., 2002).

Remote sensing technology has emerged as a potentially powerful tool for providing information on natural resources at various spatial and temporal resolutions and it is based on this that the researcher employed Remote Sensing and the Geographical Information Systems (GIS) approach in this study.

Remote Sensing and Geographical Information Systems (GIS) Approach

Remote Sensing (RS) and Geographical Information Systems (GIS) methods were selected by the researcher because these two techniques are the best available techniques that can be used to study and analyse the extent to which land use has changed in the study area over long periods of time, revealing details about the types of land that have experienced the most change. The use and importance of using RS and GIS analysis techniques when analysing and studying the impact of urbanization and pressures the process imposes on surrounding peri-urban livelihoods are better seen through studies that have been conducted using the technique. For instance, Tadesse et al. (2001) and Amente (2009) also used GIS and RS techniques to monitor spatial and temporal changes in a study that aimed at detecting land use and land cover changes in Addis Abeba city. RS and GIS analysis techniques were also employed in a study that Mundia and Aniya (2005) conducted in which they were examining the relationship between land use and land cover changes and urban expansion of Nairobi City in Kenya. In this study, through the use of satellite images for 1976, 1988 and 2000 plus with socio-economic data, it was revealed that built-up area of the Nairobi city had expanded by about 47 square kilometres against a similar amount that was lost by land previously covered by forests.

5.4.1 Remote sensing

Remote Sensing according to Adrados et al., (2002) is the "science and art of obtaining information about an object, area or phenomena, through the analysis of data acquired through the use of a device that is not in contact with the object, area or phenomena under investigation." Citing Gupta (1994), Malgorzata (2010) adds that through the use of remote sensing, researchers can measure changes that are or have been experienced on the earth's surface without necessarily being in contact with the earth as sensing and recording of the changes is refracted or emitted through electromagnetic radiation.

The use of remote sensing is said to have limitations, the first being that the process is expensive when used to capture data for small areas, especially where the research data will, as in the case of this research, only be used in a single analysis (Lillasand et al., 2007). Secondly, Lillasand et al., (2007) indicate that remote sensing technique demands that users acquire specialist training on how to use devices and how to conduct the actual interpretation and analysis of the captured images.

Despite these challenges, the researcher opted to use remote sensing as there are some benefits that the method brings into the research. Firstly, satellites that capture images used in remote sensing keep permanent records of the images captured which means that such images are always available for verification if need be, in addition to providing vital information on the different land changes that have taken place over a variety of wavelengths and periods of time, thus giving researchers the opportunity to select time durations and nature of changes to be analysed (Malgorzata, 2010).

Secondly, since the captured data often contains multiple information, captured at different scales, resolutions and periods, a single remotely sensed image can, in the opinion of Adrados et al., (2002) be analysed and interpreted for multiple purposes and applications thus giving more flexibility to researchers to bring out multiple results from a single satellite image. Thirdly, satellite images are captured multiple times and this

according to Lillasand et al., (2007) helps in the monitoring and analysis of changes that occur in dynamic mediums such as water and agriculture, which cannot be monitored easily without frequent capturing of the changes therein.

Further to the above reason, remote sensing was also selected because there is limited obstruction during the process of data capturing as the remote sensor works passively when recording the information through the use of electromagnetic energy. The use of remote sensing is also good because the method provides high resolution of data, especially in urban areas, by focusing on a small area thus making it a critical technique for use in assessing areas that have undergone the most change within a given period.

Lastly, Adrados et al., (2002) and Lillasand et al., (2007) concur that since the interpretation and analysis of the data collected using remote sensing is conducted in a laboratory-like situation, the technique does help to reduce bias that comes with the physical presence of the data collector and interpreter in addition to reducing the amount of field work that researchers have to conduct.

It needs to be stressed that the security situation in Libya at the time of data collection also helped in deciding on use of remote sensing as that meant that the researcher would spend much of the time in Tripoli which was more secure and this helped reduce security risks.

5.4.2 The Geographical Information Systems

Verd and Porcel (2012:2) describe Geographic Information Systems (GIS) as “a set of methods, software and technologies developed for the storage, analysis and mapping of geographic information.” Verd and Porcel (2012:2) further note that although for decades “the integration of social and territorial information through GIS was exclusively quantitative” recent advancement in the use of GIS has made it “become an important resource for mixed method and multi-method approaches.” GIS is also called “Computer

Mapping" (Jardine and Teodorescu, 2003). Jardine and Teodorescu, (2003) indicate that the use of GIS methods in research is "about creating maps on a computer for a variety of descriptive and analytical purposes. Gregory (2002:7) reveals that GIS can be used in three basic ways namely: "a spatially referenced database, as a visualisation tool and as an analytic tool."

Just like Remote Sensing technique, the GIS technique also offers researchers a lot of benefits over traditional maps or other forms of digital mapping. According to Jardine and Teodorescu (2003) one advantage is that the GIS technique can help researchers, planners and analysts visualize data which aids in creating a better understanding of patterns and concentrations of spatial phenomena that are related to a particular research area. A further advantage of GIS methods is that if used correctly, it has the ability to show layers of information which helps in uncovering spatial correlations from multiple sets of data (Miller, 2006).

A further advantage of GIS methods lies in the ability of the devices and techniques to identify a variety of perspectives on the object that is under examination but is located at an oblique angle. In addition to this, GIS methods are also able to obtain additional graphical information regarding the site where the object is located (DiBiase et al., 2010). This makes the technique more useful in obtaining information/data on land use and land cover changes taking places on the surface of the earth, including places that have uneven surfaces.

Additionally, Acker and Brown (2001) argue that unlike ordinary maps which have limitations on how they can be analysed, data captured using GIS methods can be easily integrated and connected to any computer operating system including Microsoft packages and telecommunication devices such as mobile phones and GPS, thus giving researchers a wider range of choices on what device they can conduct data analysis and interpretation. David et al., (2010) add that GIS data input like Vector and Raster, may

help in locating the actual site through the use of cell matrices and allows a quick analysis of quantitative data which offers researchers the opportunity to present data in its original form without losing the authenticity of the analysed data.

The advantages that have been highlighted are the factors that motivated this researcher to employ Remote Sensing and Geographical Information System (GIS). The data collection process schedule below indicates the nature of data collected and the dates when the researcher visited particular institutions in Libya to collect the relevant data.

Sources of data	Data type	Data Description	Date of collection	
			From	To
Libyan Centre for Remote Sensing	Land sat image	Different kinds of satellite imageries	22-07-2012	03-08-2012
Tripoli Meteorological Station	Climate data	1. Rainfall 2. Temperature	05-08-2012	12-08-2012
Libyan Natural Resource Centre	Soil data	1 .Soil types in the study area 2. Soil classification map of study area	13-08-2012	20-08-2012
General Water Resources (Libya)	Data on water resources	1. Water resources usage 2. Seawater intrusion	21-08-2012	30-08-2012
Desertification Department (Libya)	Deforestation	Deforestation by human activity	02-09-2012	09-09-2012
National Information Authority (Libya)	Population data	1.Urban population 2.Rural population 3. Population density	10-09-2012	18-09-2012

Table 5: Data collection schedule for stage 1-Quantitative Data

Source: Developed by the researcher.

5.4.3 Satellite images and image analysis process

During the geo-data collection process, three periods of satellite imageries and diverse ancillary data were collected as a way of adequately identifying historical land uses and associated land cover activities and changes that have taken place in the study area. The three Landsat ETM images that have been used in this study were captured on July 28, 1986, ETM+ September 29, 2003 and ETM August 26, 2009. For better analysis of the images collected in stage 1 an image contrast stretching approach, using linear and equalization was conducted, which in the opinion of Kerle et. al., (2004), Lillisand et al., (2004) and Youssef et al., (2011) help in improving visual interpretation in addition to improving the image's atmospheric and geometric correction.

Image NO	Satellites	Sensors	Date acquired	Resolution (m)	NO of Bands	Path	Row
1	Land sat 5	TM	28/07/1986	30m	7 Bands	188	37
2	Land sat 7	ETM+	29/09/2003	30m	8 Bands	188	37
3	Land sat 7	ETM+	26/08/2009	30m	8 Bands	188	37

Table 6: Details of satellite imageries used in this study

Source: Author's creation based on information from Libyan Centre for Remote Sensing.

The images described in Table 6 above were obtained from the Libyan Centre for Remote Sensing. Although the selections of the images seem random, these three images met a set selection criteria that indicated that selected images were to be:

- Long time series images - thus selected images have to be far apart in terms of times when they were captured and dating back into a period of more than 5 years for a better periodical analysis of any changes.

- Only images that have been captured within a particular season of the year but in years that are far apart. This would help in minimizing the influence of seasonal variations on the analysis result;
- Free of a lot of cloud cover thus selected images were to possess less than 10% of the cloud cover.

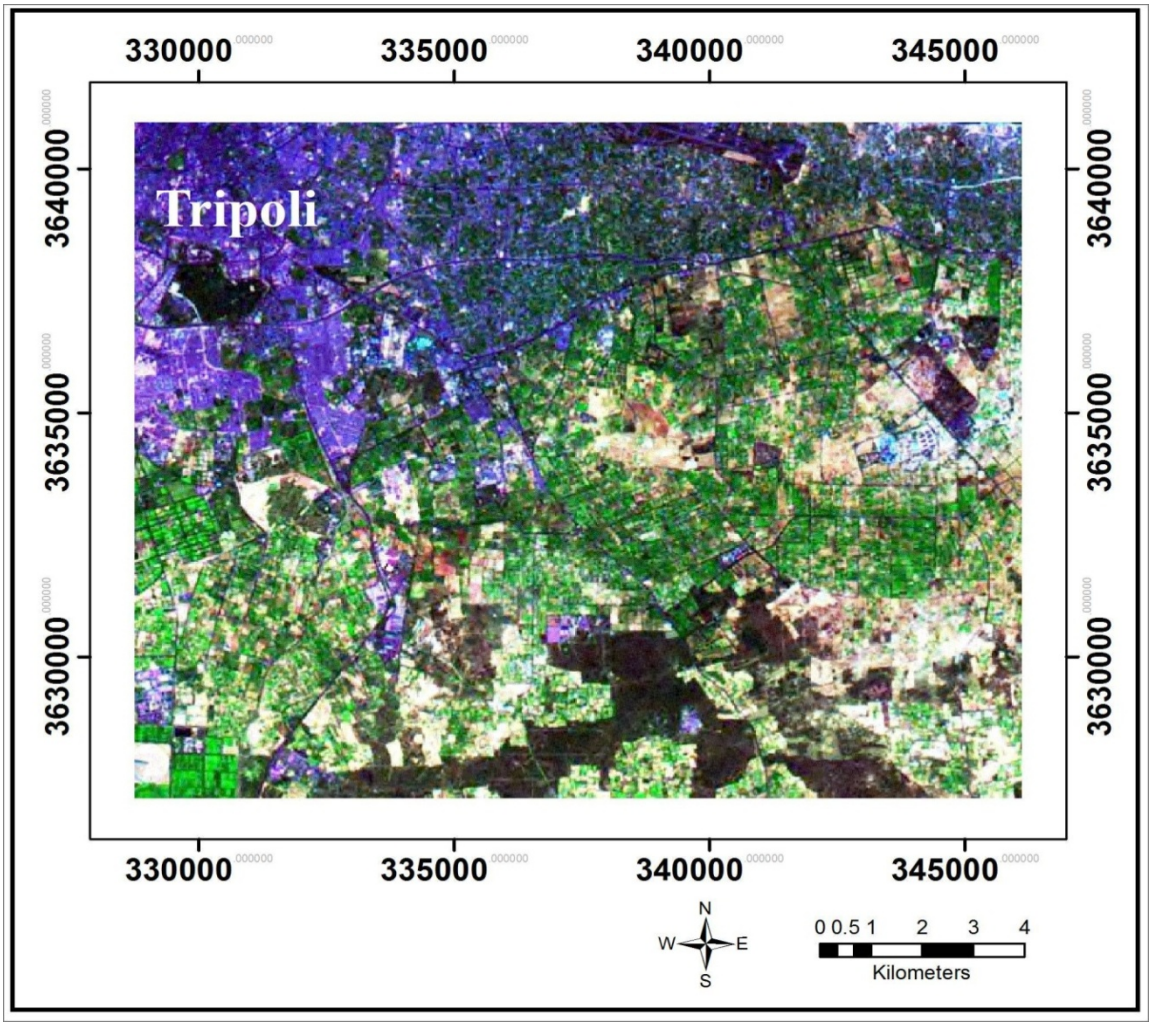


Figure 27: Satellite Raw image of the study area, 1986.

Source: Libyan Centre for Remote Sensing.

The image in Figure 27 above shows the study area as captured by the Landsat TM5 satellite where it is seen as a flat and relatively small area. The geometric correction was selected as the most appropriate model due to the fact that a first order polynomial is seen to be sufficient for medium spatial resolution images as far as flat areas are concerned. From both the image and map on which the image is referenced to, the Ground Control Points were selected in order to be spread over the area within the image. Having done this, the researcher later used the Lansat TM5 1986 image being the reference image and conducted an image registration. All other satellite images used in stage 1 of the data collection process will be referenced on the Landsat TM5 1986 image.

In this study twenty-five Ground Control Points (GCP) were selected from the topographic map for the correction of the Landsat TM imagery resampling which produced less than 1.0 pixel of Root Mean Square error (RMS) for each Landsat TM5, TM7 and TM8 images that were captured in1986, 2003 and 2009 by incorporating clear image features including the control points such as cross-sections. A first order polynomial model was applied as a way of ensuring correct referencing with the 1986 image as the reference point.

The process of geocoding was completed through Geometric Correction Package which includes a regression analysis between two variables, uncorrected image and master data. This study made use of two regression methods, the first, the image with input coordinate which considers input by user and the second entailed that image to image coordinates mapping is conducted as a way of making the two to become geocoded images.

Since Schott (1997) points out that in the majority of cases, the atmosphere produces some negative effects on pixel values of images hence such adverse effects must be eliminated before any analysis of the remotely sensed data is done. This is the reason why this researcher conducted a normalisation of the imagery based on radiometric parameters.

5.4.3.1 Satellite Image Classification

“Image classification is the process of creating a meaningful digital thematic map from an image data set” (Xiaojun Yang and Jonathan Li, 2012:70). The objective of image classification is to identify and portray unique features occurring in an image regarding the object or type of land use/ cover that the features actually represent on the ground (Lillisand and Kiefer, 1994). The process includes identification of data values that are known for distinct land cover types on the image; a computer algorithm is then used to divide the image into regions that correspond to each land cover type or class. The classified image is then converted to a land use map where the use of each area of land is known.

The term land use refers to the purpose that people use the land for in cities, national parks or roads while land cover refers to materials that an area is made from and might include concrete, soil or vegetation (Hassan and Amin, 2005). Anderson et al., (1976) and Jensen and Cowen (1996) further pointed out that image classification can also be thought of as the process of interpreting remote sensor data at various scales and resolutions which involve the use of algorithms.

Image classification algorithms are grouped into two thus; supervised and unsupervised classification. While supervised classification involves the analysis and identification of image pixels of known cover types and then a computer algorithm is used to group all the pixels, unsupervised classification, on the other hand, involves the use of computer algorithm to identify unique clusters of points in data space, which are then interpreted by the analyst.

Usually, there are three basic steps involved in supervised image classification procedures, the first being the identification of training regions through defining regions in the image that are considered to be areas of known feature types or covers classes. The second step involves calculating region statistics and this involves the calculation of

statistics for pixels in each training region. This is achieved by displaying the output classification image, assigning colours to classes and overlaying classes or using statistical means to assess accuracy. Samples of pixels are then selected based on available ground truth information to represent each cover type. Hence, the study area was classified into four categories: urban area, forest land, bare land, irrigation farm.

Further details on land uses and land cover from the study area are presented in table 7 below.

Classes of Land use/ land cover		Explanation
1	Bare land	These are areas with no or little vegetation and are characterized by sandy soil and dominated by non-natural vegetation.
2	Irrigated land	These are places where trees and crops are available and include such crops as almond, olive, citrus and fig, vegetables and these areas are cultivated through irrigation.
3	Urban land	These are residential sites and often characterised by the presence of intensive residential buildings
4	Forest land	These are forest vegetation type including evergreen, deciduous, and wetland forest vegetation type.

Table 7: Classes of land use/land cover from the study area

Source: Author's creation.

5.4.3.2 Image Accuracy assessment

Meaningless and inconclusive assessment on the image classification results sometimes precludes the application of automated land cover classification techniques even when their cost is more favorable with more traditional means of data collection. Lillasand and

Kiefer (2004) indicate that image classification is not complete until its accuracy is assessed. Image Accuracy assessment is a general term that describes the comparison that is made on the classification of an image with regard to geographical data that is assumed to be true and helps in determining the quality of the information which they are derived from and the accompanying land resource statistics.

One of the most common methods of expressing classification accuracy is the preparation of a classification error matrix, sometimes referred to as confusion matrix; which compares the relationship between known reference data and the corresponding results of the classification.

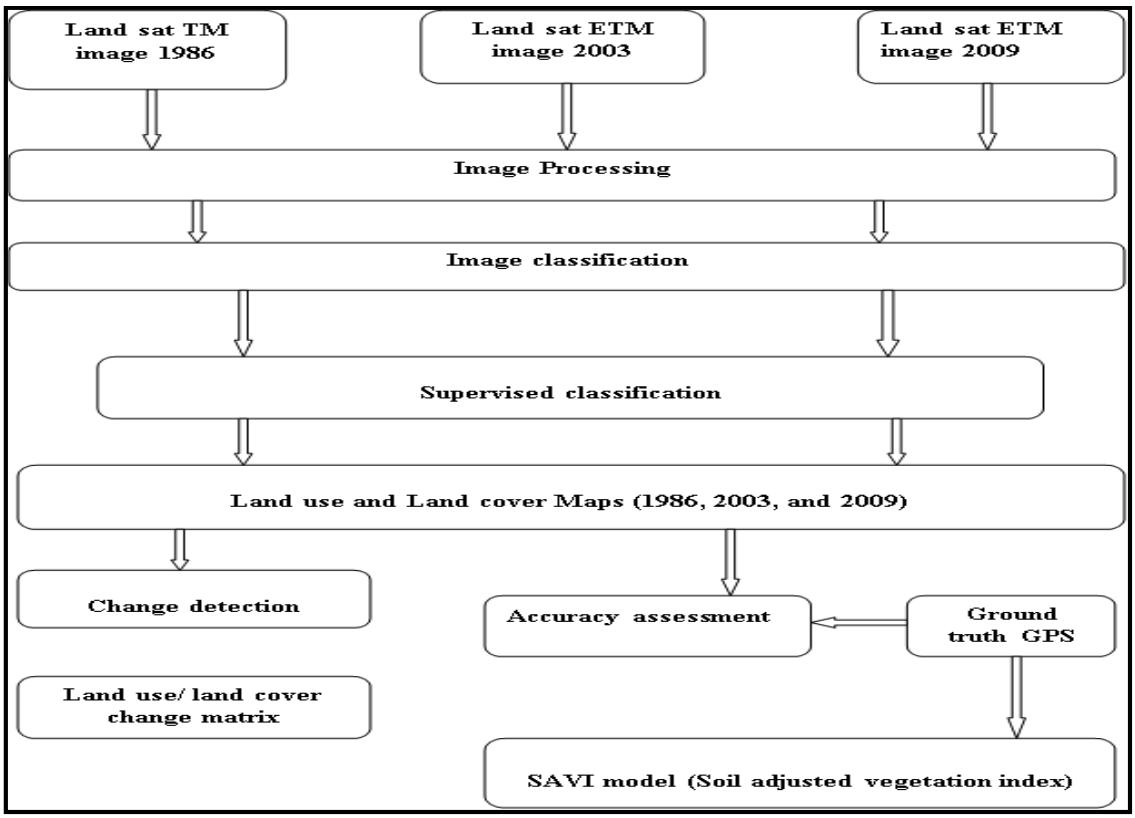


Figure 28: Image analysis and maps flow chart for land use/land cover a change in the study during 1986 to 2009

Source: Author's creation.

5.4.3.3 Soil Adjusted Vegetation Index (SAVI)

Huete (1988) developed the Soil Adjusted Vegetation Index (SAVI) which is used in minimizing soil noise in images and helps account for soil effects in areas of low vegetation cover. However, SAVI as well as other vegetation indices is just a measure of the relative abundance of vegetation and gives no indication of the vegetation species make up and composition.

To reduce the soil background effects, Huete (1988) proposed using a soil-adjustment factor L to account for first-order soil background variations and obtained a Soil-adjusted vegetation index (SAVI). In other words, Huete (1988) successfully normalized differences in soil substrate, consequently allowing a more accurate estimate of vegetation cover.

SAVI calculation used near-infrared band and red-reflectance band which according to Huete (1988) indicates that the L is a constant soil adjustment factor and the following equation is used in the calculations:

$$SAVI = \frac{(1+L)(\rho nir - \rho red)}{\rho nir + \rho red + L}$$

Where:

- ρ_{nir} is the near-infrared-reflected radiant flux,
- ρ_{red} is the red-reflected radiant flux,
- L is the optimal adjustment factor to vary with vegetation density and it accounts for differential red and near-infrared extinction thorough the canopy and its L is a correction factor and its value varies between 0 and 1 and its value is dependent on vegetation cover or soil moisture conditions (Source: Huete, 1988).

The reflectance between red and near infrared fluctuate proportionally, when the moisture content changes. Those two values are said to be correlated and have a linear relationship. This means that whenever one changes, the other changes according to the relationship that binds the two. The line that describes that relationship is known as the soil line, which is unique for each soil.

To indicate three vegetation cover indices for all parts of study area involved as follows

- Low vegetation density less than 0.2
- Moderate vegetation density between 0.2 and 0.4
- High vegetation density greater than 0.4

5.4.3.4 Land use/land cover change detection on images

Citing Dimyati et al., (1996), Rawat and Kumar (2015) reveal that land use and land cover are two separate terms but are often used as if they mean the same by many authors. Rawat and Kumar (2015:78) define Land cover as “the physical characteristics of earth’s surface, captured in the distribution of vegetation, water, soil and other physical features of the land, including those created solely by human activities, e.g., settlements.” Commenting on land-use, Rawat and Kumar (2015:78) state that land use is “the way in which land has been used by humans and their habitat, usually with the accent on the functional role of land for economic activities.” Further to providing these definitions, (Rawat and Kumar, 2015) indicates that land use affects the nature and characteristics of land cover available in a particular area and the changes in land cover affect the use of the land. The process of checking the changes in land cover and land use using satellite images is called change detection.

Change detection is a technique that is used to identify whether there are exist differences in the state of an object that has been captured at different times and an analysis of conducted on the two images (Singh, 2009). The objective of conducting change

detection is to discover any available or temporal differences of the object in the image over the two different times when the images were captured.

While it is argued by Rawat and Kumar (2015:78) quoting Riebsame et al., (1994) that although changes in land cover by land use do not always result in land degradation the authors add that “many shifting land use patterns driven by a variety of social causes, result in land cover changes that affects biodiversity, water and radiation budgets, trace gas emissions and other processes that come together to affect climate and biosphere” According to Ruiz-Luna and Berlanga- Robles, (2003) and Turner and Ruscher (2004) cited in Rawat and Kumar (2015) this is why it is critical that people acquire a greater understanding of existing landscape patterns become recognizing changes that have taken place in a particular landscape, often as a result of human activities and some natural occurrences is essential since it helps in land management and planning for development improvement (Rawat and Kumar, 2015).

There are several methods that one can use to determine changes that have occurred in an object over time but this study utilised two; Comparative Analysis of independently produced classifications and Simultaneous Analysis of multi-temporal data (Singh, 2009). In this study, the image change detection process was a three-staged process that paired the satellite images into three distinct sets as listed below:

- Land use and land cover changes between 1986 and 2003. In this phase, the researcher will use the satellite images that were captured in 1986 and 2003 and analyse the nature of changes that have occurred in between the years mentioned. The 1986 image will act as the baseline image, it being the oldest image. The changes that will be noted in 2003 are the ones that have occurred in the times indicated.
- Land use and land cover changes between 2003 and 2009. In conducting this change detection, the researcher will use the satellite

image captured in 2003 and 2009 with the 2003 image acting as the baseline image for it is older than 2009. Changes noted on the 2009 image will indicate the land use/land cover changes that have taken place in the years indicated.

- Land use and land cover changes between 1986 and 2009. As in the above stages, the 1986 image being the oldest of this set will act as a baseline and changes will be checked on the latest 2009 image.

After the change detection processes above are conducted a further analysis of the three results will be conducted by the researcher to affirm the nature of changes in land use and land cover in the study area that have taken place between 1986 and 2009 based on data captured on the three satellite images.

5.5 Stage 2 Data collection process

The second data collection exercise involved collection of data using Participatory Rural Appraisal (PRA) techniques. Previous studies have attempted to identify land use/land cover change and their implications on Libyan local farmers' livelihoods using a variety of methods including remote sensing and GIS. This study is the first to explore the implications of land use/land cover change on Libyan farmers' livelihood by using Participatory Rural Appraisal (PRA) methods.

This research was conducted from August, 12, 2013 to September 20, 2013. While stage one was conducted in Tripoli, stage 2 of the data collection exercise saw the researcher travel to the Qarabulli which lies in the eastern part of Tripoli in Libya. (Refer map in Figure 25 above). The main objective for the stage 2 data collection exercise was to collect data that would enable the researcher to know and understand how farmers in Qarabulli area are coping with the change in land use and land quality and how these changes have been affecting their livelihoods.

5.5.1 Participatory Rural Appraisal (PRA) techniques

The World Bank, (2014:183) looks at Participatory Rural Appraisal (PRA) as a "family of participatory approaches and methods that emphasize the utilization of local knowledge and enable local people to make their own appraisal, analysis and plans." The Bank further adds that PRA is founded on the principle of using group activities as a way of facilitating "information sharing, analysis, and action among stakeholders" (World Bank, 2014:183). The stakeholders that the World Bank (2014) list includes researchers, development practitioners, officials from Government and Non-Governmental Organisations (NGO) and members of the local community where a particular intervention is being implemented that warrant use of PRA methods.

The decision to use PRA tools in this research is a result of a careful analysis of the benefits that PRA research methods and tools bring in the process of data collection and analysis. The first benefit of using PRA tools according to the World Bank (2014) is that PRA tools enable local people who have enough knowledge about events and changes in their area to lead in the process of data collection and analysis while the researcher only acts as a facilitator of the process. The World Bank (2014) cites Theis and Grady, (1991) and Chambers (1992) who indicate that the participation of local community members during data collection and analysis is critical as it adds value to research results as diverse local community members in terms of their "socioeconomic, cultural, gender, and generational perspectives" (World Bank, 2014:191) act as validators of whatever results the research comes out with.

In addition to the above PRA as a research tool is a very flexible research tool that allows researchers and research respondents to use a number of methods that can be tailor made to suit the needs and demands of a particular set of research conditions (World Bank, 2014). Concurring with this, Mitlin and Thompson, (2005) indicate that proponents of Participatory Rural Appraisal research and development approaches claim that the

methodology is not only dynamic but also flexible in the way data is gathered by and with local people when exploring people's conditions and livelihoods.

Mitlin and Thompson, (2005) points out that one documented example that highlights application of Participatory Rural Appraisal (PRA) methods in urban development is from Sri Lanka. The Community Action Planners Sri Lanka's National Housing Development Authority used PRA in the Million Houses Program implemented between 1984 and1989. In the housing program, the Sri Lanka's National Housing Development Authority used the approach to motivate and mobilize people in urban low-income settlements to take the lead in planning and implementing an improvement programme which eventually empowered communities to further development initiatives in their own hands (The Million Houses Programme in Sri Lanka, 1994).

Other examples provided by Mitlin and Thompson, (2005) show PRA usage across the globe are in Table 8 below.

Place/Country	Use of PRA research methods
Fortaleza in Brazil	A number of NGOs used and worked with low-income community groups to gather their input in the redesign of houses and settlements that the Government was to engage in
Manila in the Philippines	PRA was used to source input from women through sharing life histories in addition to exploring critical events in the development of settlement in their areas. This helped in redesigning of resettlement programmes in the Philippines
Maharashtra in India	Following the devastation that was caused by an earthquake, PRA research methods were used by affected community members to identifying appropriate responses to the earthquake.
Lusaka in Zambia	PRA methodologies have been used to identify appropriate donor support and beneficiaries for income generation projects. This helped in reducing default rates in the project.

Table 8: Sample successful case studies on PRA usage

Source: Author's Creation using information from Mitlin and Thompson (2005)

Additionally, the researcher was motivated by the fact that "PRA methods emphasize the need for triangulation as a rule of thumb that at least three sources must be consulted or three techniques must be used to investigate the same topics" (World Bank, 2014:191). The use of triangulation in PRA helps in ensuring the credibility of the data collected but far much more it helps in ensuring that only vital information is collected and used to make the necessary research recommendations and decisions.

PRA method is based on participatory engagement and dialogue with farmers and that helps in getting the real-life implications of changes that rural communities like farmers face and how farmers respond to pressures that the changes in land use and land cover make on their livelihoods. Another advantage for using PRA approaches, is that rural communities like groups of farmers are given the opportunity, by using their local knowledge and experience, to analyze their own situation, plan actions, prioritise the order in which the actions are to be implemented, thus helping them to reduce the consequences that changes are having on their livelihoods.

16 respondents were engaged in the throughout the PRA methods, 10 of whom were full time farmers while 6 were doubling as Farmers and Agronomists who are working as officers with the Department of Agriculture within the Libyan Civil Service but they are all based in Qarabulli. The following PRA methods were used in the second stage of data collection of this study. A brief note on the justification for selecting the methods is in the paragraphs below, also it needs to be noted that the methods are indicated in the order they were applied during the data collection exercise.

5.5.2 Mapping

Cramb and Purcell, (2001) indicate that mapping as a PRA technique is a tool that uses map to help researchers learn more about a community or area under study by putting on a visual map of the area's resources that may include people and natural resources, plus any relevant issues people in the area might share. The maps used in mapping as a PRA tool can be flat two-dimensional drawings or physical models with three dimensions which can physically be representing land and other resources that are found in the area being studied. Mapping among other important uses helps in gathering general information about the resources that are available in a particular community which is being studied. Secondly, through mapping, researchers and communities that are involved in the mapping process are able to recognize the conditions that are available in

the area under investigation and how they impact the utilisation or failure to use the available resources that lie within the boundaries of the area under study. Lastly, mapping helps in ensuring that any existence of potentials that can be used in protecting or effectively using the resources for the benefit of the community are explored and any problems/challenges are worked out to ensure maximum benefits from the use of the resources in the area (Rambaldi, 2005).

5.5.3 Transect Walk

Transect walks are systematic walks within a study area normally done in the initial stages of fieldwork or data collection. It is useful if used as one of the early tools within the PRA process as it helps the research team in gaining a clear overview of the resources that are in the study area and to identify various land zones with specific constraints and opportunities. As a data collection tool within the PRA method, a transect walk can help in the identification of diverse resources that are available in an area plus the nature of land usage and the physical location of resources. Transect walks involve research teams and representatives of the local community who have knowledge of the area's boundaries and history and the involvement of community members physically walking in the research area, observing the areas' boundaries to identify or confirm the existence or lack of resources in the study area. As the transect walk is being conducted, the research team records the data and information being seen, such as the quality of soil, cropping patterns, vegetation, the size of farms, the nature and spread of vegetation in the fields. Additional data may also be collected on any relevant socio-economic and gender information that is visible in the research area (Robson, 2002 and Bryman, 2004).

5.5.4 Timelines and Trendlines

It is important to understand the historic developments and key events pertinent to the study area when undertaking any kind of research. To achieve this objective, the use of timelines and trend lines becomes very critical as the method accommodates people from

varied generations as well as all groups of the communities including men and women to narrate historical changes that the area under study has gone through. Chambers, (1983), Ann and Wolfgang, (1994) and Simon (2000) all agree that although the use or timelines or trend lines calls for the inclusion of all age groups and gender, it is vital for researchers to include and interact more with the older people who have stayed in the area longer than others.

Trendlines as a PRA tool help in gathering changes that have taken place in the study area over some periods of time that people can recall and is good for gathering data on changes that have occurred over time on areas like soil quality and use of fertilizers, changes in water quality and quantity, changes in rainfall patterns and quantities plus adoption of irrigation practices. Trend lines also help capture, the history of the nature of crops and livestock that people have been growing and keeping in the research area over time, changes in the amount of agricultural harvests and income trends over time for households in the area. While undergoing the Trendline analysis, Simon (2000), advises that community members must be encouraged to discuss further their comments on the changes being talked about. This helps the researcher to identify factors that must have facilitated the changes such as, asking farmers to state why they think there have been changes in the nature and quantities of soil, water, crop, harvest and income during the period under study.

5.5.5 Interviews

Interviews are one of the key and most used PRA methods in many research works (Robson, 2002). There are some interviews types based on the structure that a researcher can choose from, including Structured, Unstructured and Semi-structured interviews. Further to this, regardless of the nature of the structure of the interview, interviews can also be conducted either in a formal way or an informal way. Bell, (1999) and Robson, (2002) add that interviews can also be conducted as face-to-face with individuals or

groups of individuals who, as a unit of sample, will be responding to questions that the interviewer will be asking and that the group can be same sex or mixed group.

This research opted for a structured form of interview where individuals on a face-to-face basis responded to already prepared questions. One advantage for using structured interview is that the researcher has the opportunity to prepare in advance the questions that will be asked to community members and this helps in ensuring the interaction with respondents during the interview is well linked to the objectives of the research, hence time is not lost in discussing matters that have nothing to do with the research objectives. The other benefit of using face to face interview is that respondents are free to narrate changes that are being experienced even at the individual or household levels that many respondents might not be willing to share in a group setting as that might bring shame on their household or members of it. The researcher purposively selected elderly farmers to be among the respondents as a way of managing challenges of bias that often come with the use of individual interviews. Furthermore, questions in most interviews as a form of PRA tool are geared at questions that ask the: what, how, why, when and where. Further, community members are encouraged to say more on the changes that have been experienced but also what they think was responsible for the changes and how the effects were managed (Bryman, 2004).

Despite benefits associated with the advance preparation of questions during structured interviews, one disadvantage of structured interviews is that preparing interview questions takes much time and expertise to ensure that the questions are not misleading the respondent. In addition to this, in the case of one-on-one face to face structured interviews, challenges can be experienced when identifying respondents to respond to the questionnaires as some respondents might not have the capacity to provide the knowledge the researcher might be looking for. Hence Bryman, (2004) advises that as is the case with all other methods, interviews should be used alongside other PRA methods if better data is to be collected.

5.5.6 Bean Counting

The bean counting method is a PRA tool that is vital in situations where research respondents are expected to rank or prioritize things like challenges or solutions that have been identified. The method helps community members to put issues and solutions in order of importance starting from the least important to the most important ones (Kirsopp, 1994).

5.5.7 Tree and branches diagram method

The method, also called Problem Tree and analysis diagram, serves multiple purposes and is often used as part of the planning process that incorporates members of the community where the research will be conducted. The diagrams are used as visual tools for narrowing and prioritizing problems, setting objectives or making decisions. Information is organized into a tree-like diagram where the main issue is represented by the trunk and relevant factors, influences and outcomes are shown as roots and branches of the tree (World Bank, 2006). This method is useful when identifying underlying causes of problems which then are analyzed by people using tree diagrams as a community participation tool where each member or farmer is actively involved in the identification of one or many problems drawn from their personal experience (Nikolaus and Michael, 1999). Based on this tool, the farmers in any given area will be identified and the diagnosed problems should be addressed in the order in which the farmers think as important. Once this has been done, each problem will be looked at in turn, to determine the possible solutions to that problem.

5.5.8 Solution matrix

A solution or ranking matrix is a technique to help the participants define and reach a consensus on priorities and preferences. The participants make a list of the solutions they want to prioritize in order to come up with the best solution that is also compatible with

the local conditions when working on addressing problems that their community has been facing (Henk and Wilbers, 2004). This method encourages and supports the intellectual capacity of the community in order to identify their solutions thus giving them ownership of the solutions.

5.6 Equipment and Software used in data collection

A number of computer related digital devices and software packages were used in this study and these are indicated in the table below.

Device	Use in this research
Arc view GIS version 10.1	Used to complement the display and processing of the data plus location of GPS Sample points and imagery
ERDAS imagine version 9.2	to improve the image quality and to achieve better classification accuracy
Microsoft Excel	was used in producing the bar graphs and statistical analyses
Digital camera	Used in capturing meetings and interviews that the researcher conducted

Table 9: Equipment and Software used in data collection

Source: Author's creation.

5.7 Qualitative data analysis

This research made use of a host of qualitative methodologies, which facilitated the data collection, in conjunction with the quantitative methodologies. In order to achieve the empirical data at the beginning of the research, Remote Sensing and GIS methodologies were used. This definitely provided a lead to the next phase of data collection, which was established with qualitative methodologies. In this regard, PRA techniques were used, that helped in collecting maximum details on the research subject from the research participants. This helped in understanding the perception of the local community on the changes, which are happening around them. As part of the PRA methodology, at the initial phase, resource mapping was done; this enables the respondents to identify the existing resources in their area. Since this is the initial stage, it also acts as breaking ice session amongst the respondents. In the next stage transect walk was done, which was a field observation of the research premises. In this process, participants were randomly selected from their premises, with the motive of understanding the issues faced by them. The next phase was trend analysis, which involved the extraction of the historical information from the local community, and compares the same with the current situation. This helps to perform a comparative analysis of the changes that taken place in the research area. The next phase was the most important part of data collection, which was "Key Informant Interview" (KII). This was a face to face interviews conducted by the researcher with participants, with a structured questionnaire. This helped the participant to open up completely on the research issue, and provide maximum information on the same time.

From the interview, common themes were extracted for analysis. These were the emerging themes or patterns, derived from the interview excerpts of the participants. These themes were grouped together based on the underlying patterns. For example, farming type, land size and issues faced by the farmers. These themes were the key highlights of the interview excerpts of participants, which were enough to elaborate the

research problem. Post thematic analysis, tree box exercise was conducted, which helped in narrowing down the problems, and prioritize them accordingly. This helped in setting the objectives of the research, and actively aided in decision making. This is a group based activity, which helps in identifying the issues and suggests the solution for the same issues raised. Once the solutions of the problems have been identified, bean counter methodology has been used to rank the identified solutions. In order to rank the solution, a scale of 1 to 7 is used, and the ranking is done from the most important solution to the least important solution. The count of the beans, represents the ranking on the scale. At the final stage of analysis, a solution matrix is developed. A solution matrix is the solution concept for the problem, highlighting the priorities and preferences pertaining to the solution. This was again a group activity, where different groups of farmers determined the ranking matrix pertaining to the research problem.

5.8 Methodological limitations.

As PRA involves engaging, and analyzing the participants in their own environment, it definitely poses certain limitations. The PRA methodology definitely analyses the limitations of knowledge of the local community, while mapping these limitations to problem solution. One of the key limitations of PRA is that it allows for some generic data to be collected, then the researcher has to extract the exact information he/she is looking for from that generic data. Another limitation of PRA is setting the right kind of questionnaire, which will extract the exact information. For a PRA practitioner, it is very difficult to prepare the exact set of questionnaires, and he/she might prepare something which is based on his/her experience. Since PRA is a time bound activity, it is possible that the PRA practitioner might not be able to spend enough time amongst the community or village, to get an adequate amount of information. This is also a core limitation, since it might result in a biased research output. Another key limitation will be availability of participants, as most of the time they will be engaged in farm related activities. PRA in most of the cases is a team bound activity, one of the limitations in this case will be

finding right kind of team to accomplish the research objectives. Lack of communication skill, facilitation skills, and conflict negotiation skills, might become a huge challenge while communicating with the local community members. Some other limitations include, absence of institutional support as well as “open learning environment” within the organization. It is also possible that the participants might answer the questions in unrealistic way. On the other hand, actors of the research might not be neutral, and drive the research in a different direction.

Keeping the mentioned limitations in mind, it would be important to mention the limitations which were faced by the researcher as a PRA practitioner. One of the core limitation was operating in an area with inadequate security. This limitation partially limited the researcher’s freedom to move. As a result of this, the study was confined to one district. This resulted in very small samples which ultimately have narrowed the scope and objectivity of the study. Other form of limitations included the availability of local people and their willingness to take part in the process. Most of them were farmers, and were engaged in farm activities. As a result, most of the farmers found it difficult to make themselves available on the day, when PRA related activities were scheduled. As mentioned in the initial section, availability is a key factor for any successful PRA process as gathering people may pose a threat to the activity.

I have established this limitation from my experience as I had to cancel the first day of PRA simply because I could not gather the number I wanted, in order to initiate the PRA process because most of the participants were not available on the given day. Hence, I had to reschedule the process for a different day when I was able to gather a large number of local farmers. This availability factor can be overcome by providing incentives to local farmers. For example, giving them monetary incentives or materials that are relevant to their farming activities such as seeds and pesticides. In addition, it should also be recognized that PRA techniques are being used for the first time in Libya through this study and there is still more to be done in terms of using new approaches to get farmers to

participate in the process. One of the approaches to supplement PRA could be holding a seminar before the actual start of the process in which the farmers will be briefed in more details about the significance of the process.

5.9 Chapter conclusion

This chapter presented and discussed the nature of the methods that were employed in the process of understanding the effects of expanding cities on surrounding agricultural areas.

The research methods outlined in this chapter and the anticipated results are of significant importance for the study area, Tripoli, and for other parts of the world experiencing the same phenomena. The use of Remote Sensing (RS) and Geographical Information Management Systems (GIS) to identify the land use change and the impact of urbanization, will be the first time that this issue would have been evidenced in Libya. The government and the people can see land use change all around them, but it is only when there is statistical evidence then policies and practices can be formulated to address these challenges. Thus, as previously mentioned, the originality of this study lies in the empirical knowledge generated through this research such as combining Remote Sensing (RS) with social science investigations of people and their livelihoods, and using the Sustainable Livelihoods Framework (SLF) to conceptualize the consequences of urbanization on people's livelihoods. This aspect of the research will therefore represent a significant contribution to mapping and evaluating change.

The PRA data that this study seeks to generate will tell us more about the human, or livelihood impacts of these changes. The use of PRA in Libya has not been recorded prior to this study, and again, it represents a significant contribution to understanding how Libyan farmers are responding to change, in their own words.

Chapter 6: RESULTS OF STAGE ONE: CHANGES IN LAND COVER AND LAND USE

6.1 Introduction

This chapter outlines the main empirical findings that will be used in this study to examine the reasons and processes responsible for the changes observed in the study area. While this thesis has two chapters detailing research results, this chapter will focus on land use and land cover changes that have been captured through the use of Remote Sensing and Geographical Information Systems (GIS).

6.2 Changes in land cover and land usage

Land-use change in any area involves a shift to a different use whereas land-cover changes fall into two categories, conversion and modification. The former entails change from one class to another as in the change from grassland to cropland while the latter deals with changes within a category of land-cover like changes that are experienced in the composition of forest lands. From the three collected images, the researcher notes that there have been changes in the nature and size of the urban land area in the eastern part of Tripoli during the period 1986 to 2009. Urban land has been increasing in size over the years, which subsequently has been affecting the sizes of other classes of land, particularly vegetated and barren land cover which have been declining.

6.2.1 Land-use/Land-cover distribution

Three satellite images covering the eastern part of Tripoli including the Qarabulli area were generated, using data from 1986, 2003 and 2009. Land use classification has four land use classes, urban areas, bare land, forest land and irrigation/farmland. Table 10 illustrates the various percentages of land cover for these four classifications for each of the three years.

Land use / Land cover Classes	1986		2003		CHANGE (%) 1986-2003	2009		CHANGE (%) 1986-2003	OVERALL CHANGE (%) 1986-2009
	Area (ha)	Area (%)	Area (ha)	Area (%)		Area (ha)	Area (%)		
Urban area	4997	21	6383	28	+28%	9653	40	+51	+93%
Bare land	1602	7	4238	18	+165%	2775	12	-35%	+73%
Forest land	11183	46	10077	42	-10%	9391	39	-7%	-16%
Irrigation land	6241	26	3324	14	-47%	2204	9	-34%	-65%

Table 10: Land-use/Land-cover distribution

Source: Author's creation using data collected during Stage 1 of the data collection process.

Results of satellite images analysis of land use and land cover change in Qarabulli district (Table 10 above), reveal that the urban area increased to more than 20 percent between 1986 and 2003. Over the duration of the assessment (1986 to 2009), urban land increased by more than 93 percent having increased by more than 28 percent between 1986 and 2003. Forests land decreased by more than 7 percent while Irrigation/Farm land decreased in proportion by over 15 percent. Findings on land conversion over the past few decades showed increased alteration of farms' and forests' land into urban areas. Analysis of the land cover and land use changes presented in Table 10 above indicate a strange pattern on how the size of land classified as bare land has been changing over time. As can be seen in the table, bare land increased to 4238 ha in 2003 from 1602 ha in 1986, thus a 165% increase in size. Image analysis might not reveal the actual reasons behind this fluctuation. However, reading this change and correlating it with changes occurring in the other types of land within the same period, would made it reasonable to assume that land such as irrigation land was first converted into bare land before being converted into urban land, hence this explains the increase in the size of bare land. This could probably be so because the rate of urbanisation might have been slow as such at the

time of image development and that the process of turning irrigation land, for instance, into urban land was still work in progress.

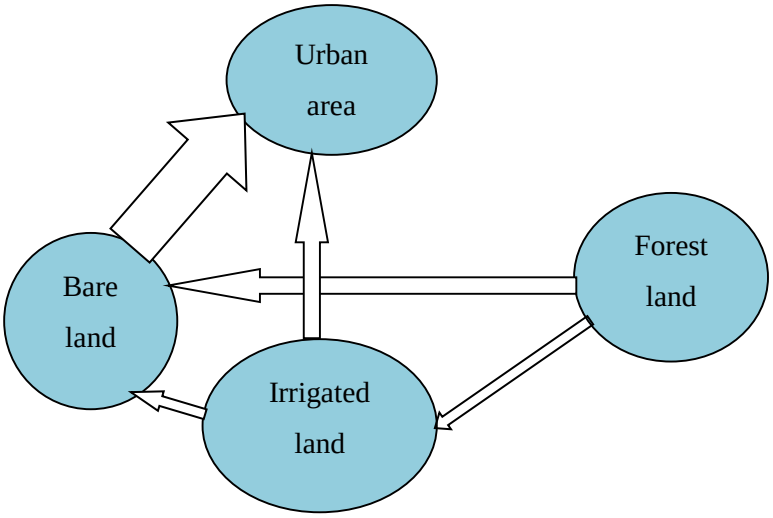


Figure 29: Shows the process of land use changes as observed by the researcher

Source: Author's creation

Figure 29 above illustrates the circle of the land transformation process. This copes very well with the literature as discussed earlier in Chapter 2 (See table 2 in Chapter2). Authors such as, Shahab (2000), Tran Thi Van (2006), Pauchard et al., (2006), United Nations Environment Programmers (2007), FAO (2010) and Siciliano (2012) have all reflected on this by given examples from all over the world; Vietnam, Indonesia, China, Egypt and Sudan to show how millions of hectares have been transformed into bare and non-agricultural land and consequently ended up as urban centres.

However, having cleared the land i.e. increased the size of bare land, the expansion of Tripoli continued with the conversion of the now bare land into urban areas through the construction of infrastructure like roads and buildings leading to the reduction in size of bare land by around 5 percent. It also needs to be noted that although there is a reduction in size of bare land between 2003 and 2009, over the 1986 to 2009 period, the size of land classified as bare land increased by 73 percent. The changes discussed above are summarized in the Figure 30 below.

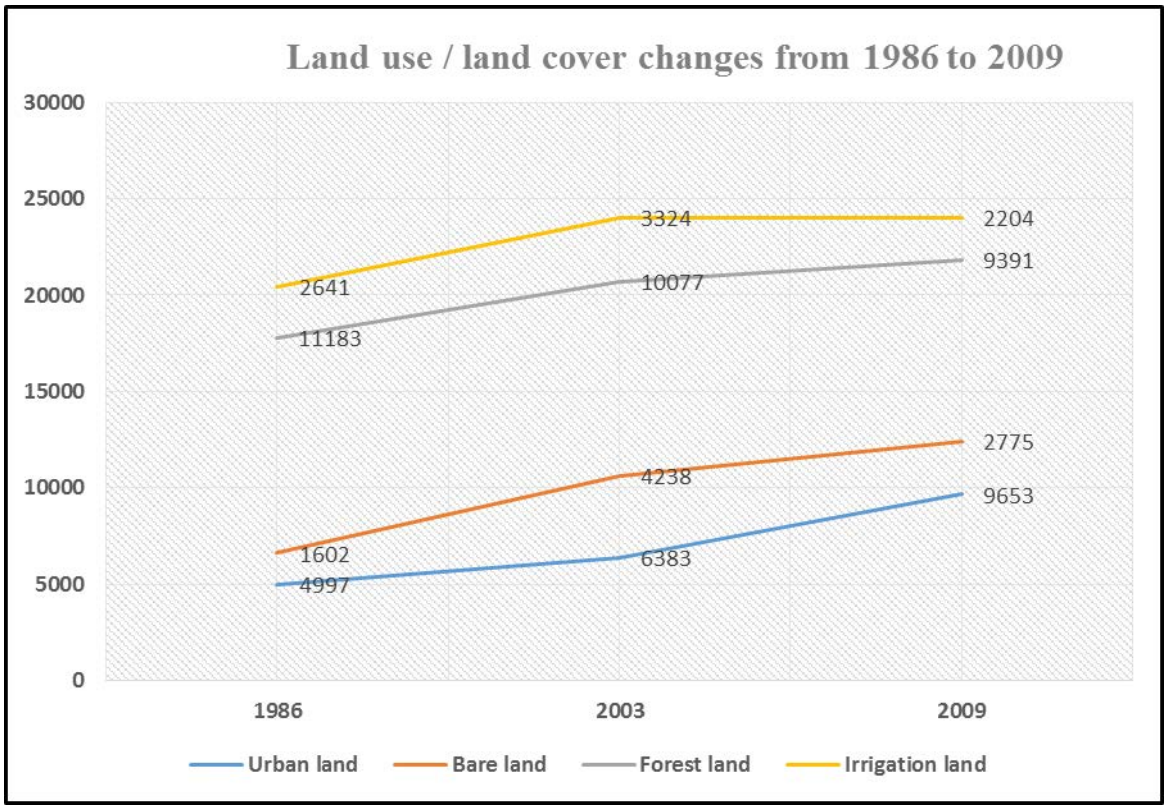


Figure 30: Land use/cover changes for each land classification type (1986-2009).
Source: Author's Creation

This rapid change in the various land uses and land cover into urban areas means Qarabulli is experiencing accelerated urbanization. Accessed literature does indicate that

the emergence of new land cover types in an area means that there is increased speed and intensity of surface run off which often times translates into increased rate of soil erosion.

The three maps below (see Figures 31, 32 and 33 below) illustrate the spatial distribution of the land use/cover classes indicated in Table 10 above. Changes in the images in these Figures below reflect the amount of land use change over the periods the images have been captured by the satellite.

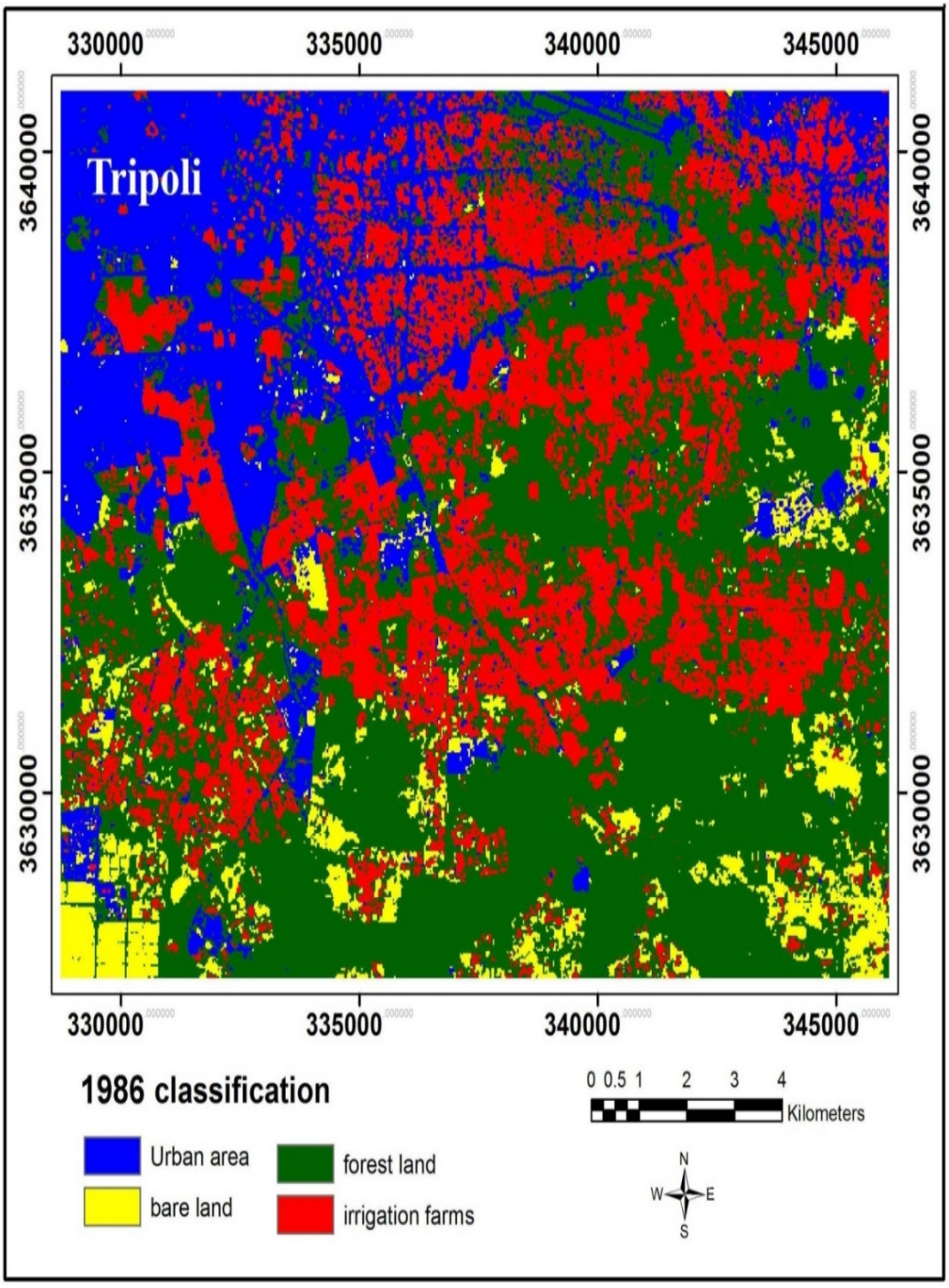


Figure 31: Land use/cover Spatial Distribution (Satellite map), 1986.

Source: Accessed Satellite Image.

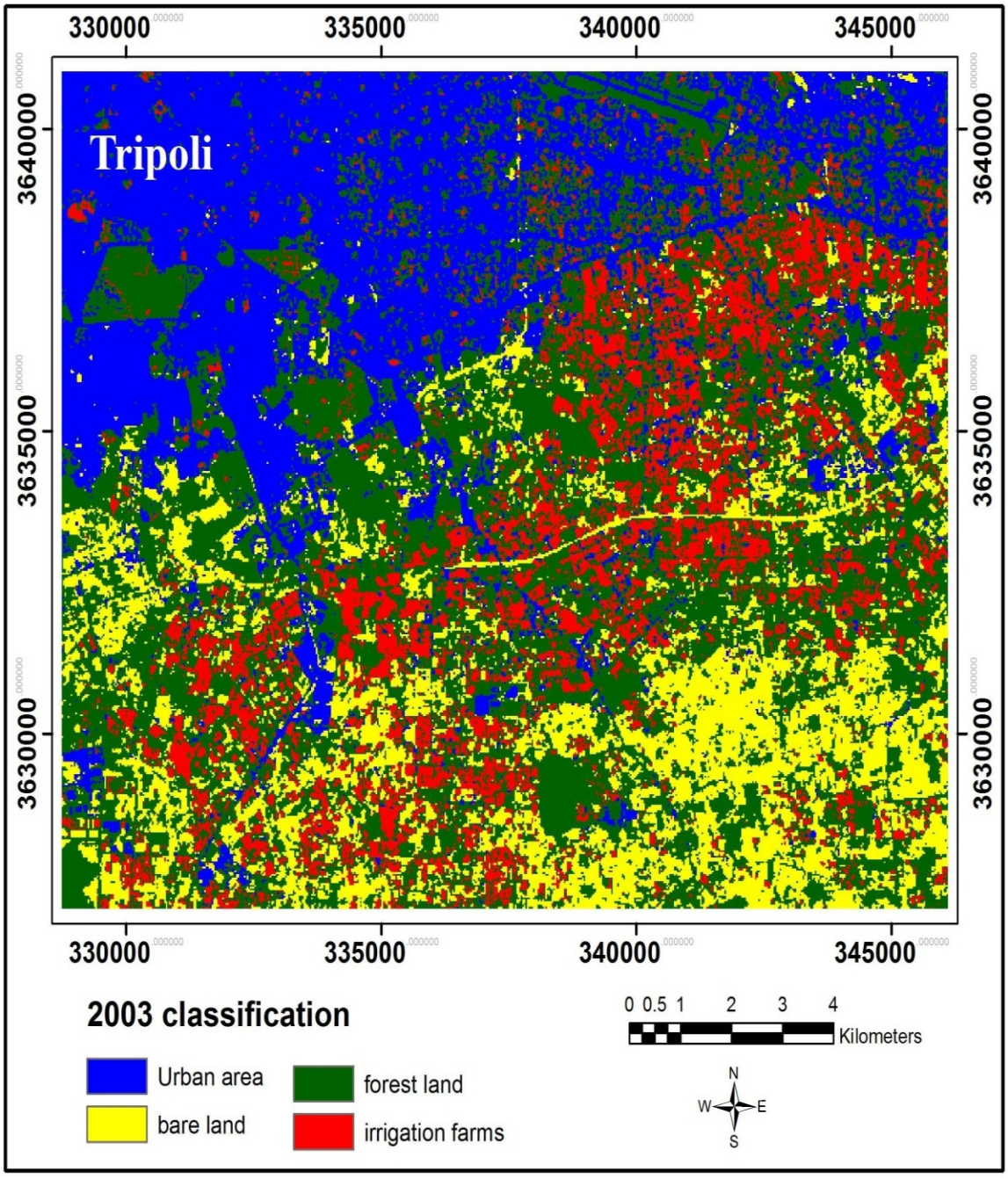


Figure 32: 2003 Land use/cover Spatial Distribution (Satellite map).

Source: Accessed Satellite Image.

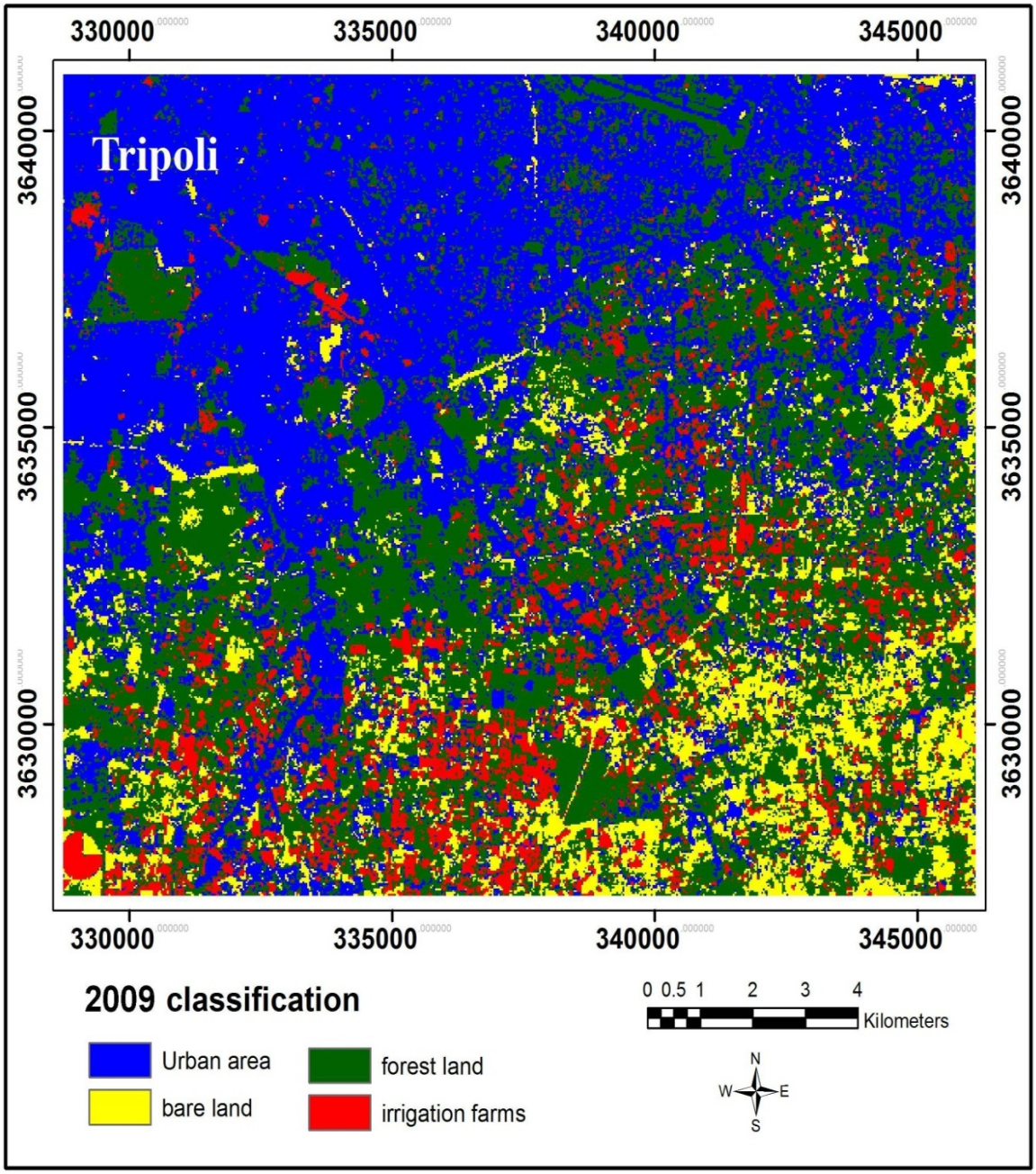


Figure 33: Land use/cover Spatial Distribution (Satellite map), 2009

Source: **Accessed Satellite Image.**

The blue colour indicates urban areas. Looking into the three images, the amount of blue colour on the 1986 (Figure 31) is slightly smaller compared to the amount of blue colour in 2003 (Figure 32). The 2009 image (Figure 33) has more of the blue colour than is in the 2003 image. As indicated in table 10 above this shows that urban areas have been expanding at the expense of forests (see reduced green colour as we move from 1986 to 2009 image) but also at the expense of land on which irrigation was being conducted. While Forest (green colour) and Irrigation (red colour) were dominant colours in the 1986 image, land classified as urban (blue colour) is the most dominant colour in both the 2003 and 2009 images signaling continued expansion of the urban area. The forest land (green colour) seems to be disappearing slowly as we move from the 1986 image through the 2006 image to the 2009. This signals that forests and other vegetation are being cleared as the urban area expands confirming what literature indicated that urban expansion is a process that brings about land use and land cover changes in an area. These findings indicate that this research is able to achieve its objective, particularly to identify land use/land cover changes emerging from recent urbanization processes in the eastern part of Tripoli, to detect the nature of the process and lands that have experienced the most change due to urbanization and the factors associated with urbanization processes that are driving land use changes.

6.2.2 Image Accuracy Assessment

The existence of more advanced digital satellite remote sensing techniques has further highlighted the need for image accuracy assessment[2] on any data collected using such

[2] The measure of Image Accuracy indicates the probability of a reference pixel being correctly classified. (Smith et al., 2010). The accuracy of the classification can be affected by such factors as: data availability and quality, data validity, the difference in time between the validation date and classified images, and similarities that may sometimes exist between land use/ land cover classes which might be tough to isolate (Zhu, et al., 2010).

techniques. Based on this, an accuracy assessment exercise was conducted on the three images used in this study and the results are as indicated in Table 11 below.

Land use/ Land cover classes	Over all accuracy	Kappa coefficient
1986	75.62 %	0.70
2003	83.57 %	0.76
2009	90.81 %	0.86

Table 11: Accuracy assessment results of the land use map produced from Landsat data

Source: Author's calculation

From Table 11 above and using the results of accuracy assessment on the 1986 image, it has been revealed that the land-use/land-cover classification for all the images in this study were correctly classified as the image accuracy rate stands at over 70 percent for all the images with the 2009 being classified with an accuracy of over 83 percent.

6.2.3 Image change detection for the study area

Image change detection is a technique that allows for the identification of differences in the objects over two or more-time periods (Singh, 2009 and Macleod et al., 1998).

The researcher developed and used change matrices as shown in tables 12 and 13 below, which helped in ensuring that the two satellite images were acting interdependently as calculations of the class to class changes in land-use/land-cover between the periods covered in the matrix. Additionally, the change matrix provides information on what exactly is taking place over the years between the times the two images were captured revealing among others processes such as deforestation, forest fragmentation and degradation.

Land use/ Land cover classes	**Period and area coverage**		**Change over the years**	**Percent Change**
	Original size in 1986	**Final size in 2009**		
Urban area	4996.8	9652.5	4655.7	93%
Bare land	1602	2775.2	1173.2	73%
Forest land	11,183.3	9390.7	-1792.6	-15%
Irrigation land	6240.6	2204.3	-4036.3	-65%

Table 12: Land use and land cover changes and change matrix (1986 – 2009).
Source: Author's creation

As can be seen in Table 12 above, land classified as urban area measured around 4997 hectares in 1986 and increased to 9653 hectares in 2009 representing an increase in size of 4655 hectares, thus more than 90 percent change. This change clearly illustrates that there has over the years been a great deal of change which is a result of new and highly concentrated urban areas.

Table 12 above also shows that the size of land classified as forest land areas had been reducing drastically from 1986 through 2003 to 2009. From data included in the table 12, out of the 11183 hectares of land that was available in the eastern part of Tripoli in 1986, a total of 5956 hectares of land originally marked as forestland was lost from 1986 to 2009 representing more than 50 percent reduction on the original 1986 forest land size.

Although it might be possible that some areas that were still covered with forests might have been miss-captured by the satellites, the high reduction is attributed to a number of factors including migration of rural people to urban areas. As people migrate, apart from creating demand for new areas to be cleared for human settlement, migration also leads to abandonment of forestland as the number of people that work at ensuring the survival of forest species is reduced which leads to the death of some species. Analysis of the satellite imagery indicate that the most affected forestland area lies in the south-eastern part of the city.

Further to the above, looking at Table 12 one notices that land that lay bare in 1986 which measured around 1602 hectares increased in size to 2775 hectares thus a net increase of 1173 hectares, a five percent increase from the original 1986 size. The majority of land that became bare land was previously land in the forest land class.

Lastly, one also notes that in Table 12 above, that a total of 4036 hectares of land classified as irrigation farmland where irrigation agriculture was being conducted was lost between 1986 and 2009, representing a net loss of around 65 percent.

Gained size from 1986	2009 Size changed to					Total 1986
	LU/LC classes	**Urban area**	**Bare land**	**Forest land**	**Irrigation farm**	**Original size in Hectare**
	Urban area	4182	727	47.5	40.4	**4996.9**
	Bare land	290.3	421.6	650.6	239.4	**1601.9**
	Forest land	2799	1303	5827	1254.3	**11183.3**
	Irrigation farm	2381.4	323.4	2866	670.2	**6241**
Total 2009		**9652.7**	**2774.6**	**9391.1**	**2204.3**	**24022.7**

Table 13: Land use and land cover changes and change matrix (1986 – 2009).
Source: Author's creation

A further analysis of the collected data was conducted using a Land use and Land cover Changes Matrix with the aim of identifying the actual losses and gains in terms of the size of each classification between the years 1986 and 2009. Table 13 above shows the results of the analysis.

As can be seen in Table 13 above, land that was classified as urban area changed from around 4997 hectares in 1986 to 9653 hectares in 2009, thus as indicated above a change in size of around 4656 hectares. The change matrix table above reveals that of this amount, 290 hectares were gained from land classified as bare land, about 2799 hectares from forest land. An additional 2381 hectares were gained from land that was in 1986 classified or used for irrigation farmland.

The change matrix also reveals that 727 hectares of urban land became bare land between 1986 and 2009. The greatest change is in land that was classified as Irrigation land, which changed from 6241 hectares to 2204 hectares having lost 2381 hectares to urban areas, 323 hectares became bare land while 2866 hectares were planted with trees and other forest species. Irrigation land that never changed use was 670 hectares. However, it also needs to be noted that there were some minor gains on the size of irrigation farm land as 239 hectares of bare land and 1204 ha of forest land were turned into irrigation farm land. Nonetheless, despite these positive gains the loss of land classified as irrigation farm land was greater. Although irrigation farmland lost the biggest area over the years, it gained a total of 2204 ha from the other three sets of areas with the majority of this gained land being from forest land that had 1254 hectares changed into irrigation farm land over the period 1986 to 2009.

6.2.4 Identifying vulnerability of land using SAVI model

The Soil Adjusted Vegetation Index (SAVI) model is used in mapping areas that are vulnerable to land degradation and desertification through the use of satellite digital multispectral data and the development of a simple model that allows an image to be generated. This helps emphasizing areas with low vegetation density and high reflectance soils. SAVI vegetation values are marked into three classes as below:

- Low vegetation density has a SAVI index of less than 0.2 and is represented by the Red colour and means that the distribution of vegetation cover is highly affected by degradation.

- Moderate vegetation density between 0.2 and 0.4 and represented by the slightly greenish colour and means that the distribution of vegetation cover is moderately affected by degradation.

- High vegetation density with a SAVI index of greater than 0.4 represented by the dark Green colour and means that the distribution of vegetation cover is not affected by degradation.

SAVI value calculations on the 1986, 2003 and 2009 satellite images, reveals that for the 1986 image its value was calculated as 0.6 while for the 2003 image it was 0.3 and the value for the 2009 image was 0.1. Further to this, some noticeable visual differences in the land use/ land cover were noted as shown in Figures 34, 35and 36.

It can then be concluded that the change from a SAVI index of 0.6 for 1986 to 0.1 in the 2009 means that there has been a great deal of degradation of vegetative cover in the eastern part of Tripoli. Images in these Figures show an overall decrease in SAVI vegetation reflectance values revealing that there has been some degradation over the time the images have been captured. These indices are a clear indication that there is a proportion distribution of vegetation cover areas using SAVI created images during the period in the study area; hence, the most important factor causing degradation of vegetation cover is the decline of land productivity.

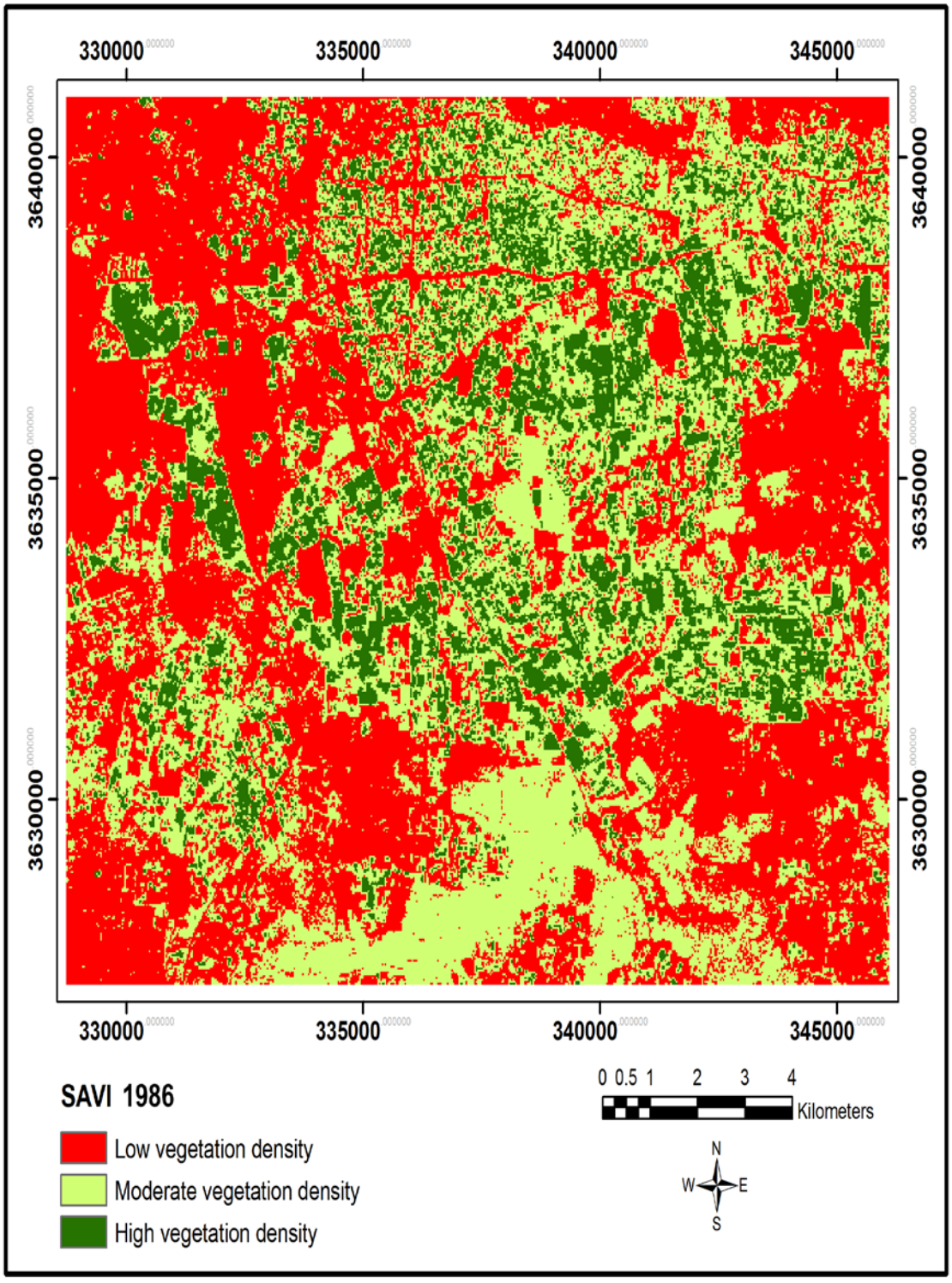


Figure 34: Vegetation density map for 1986 image.

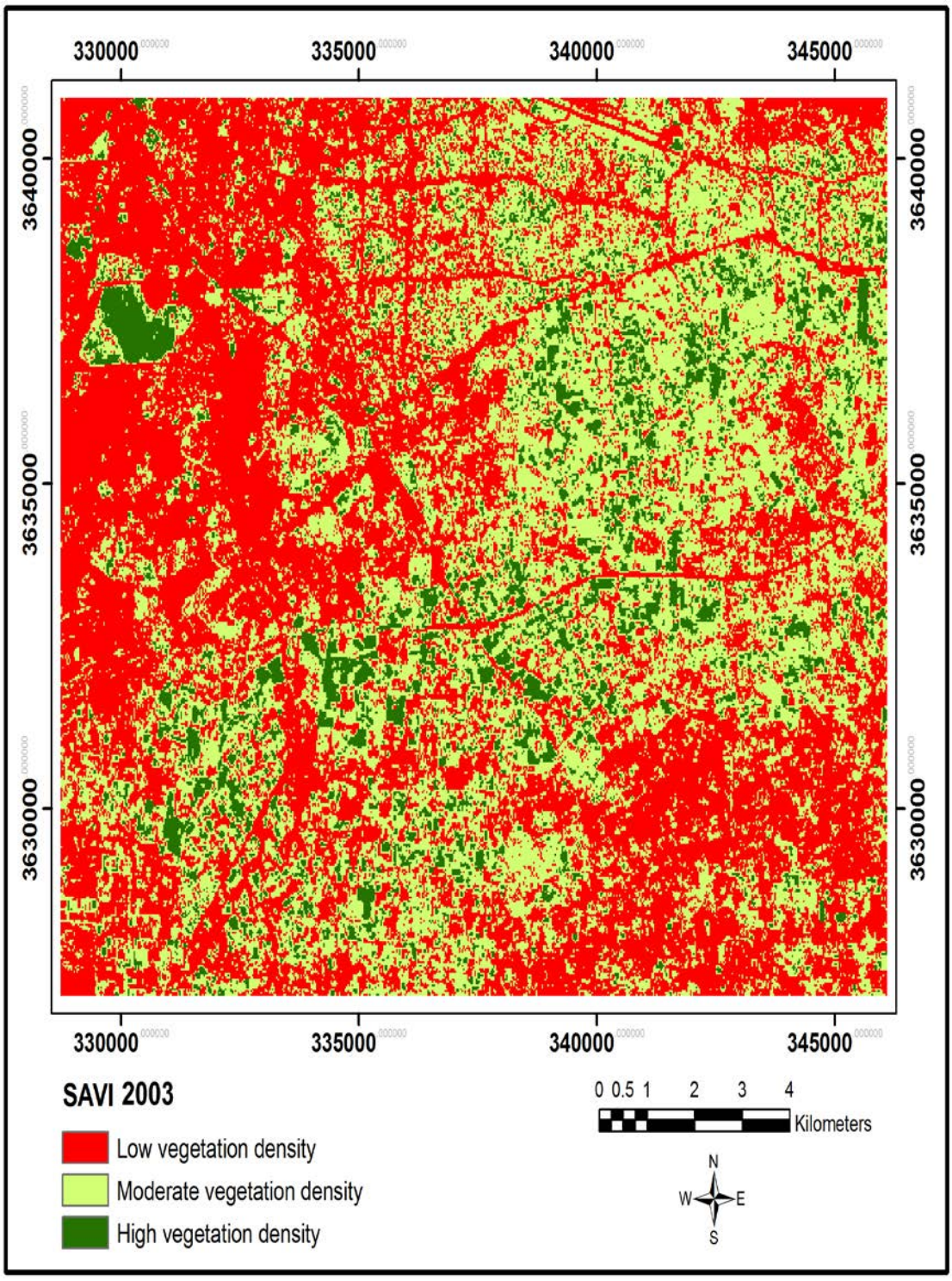


Figure 35: Vegetation density map for 2003 image

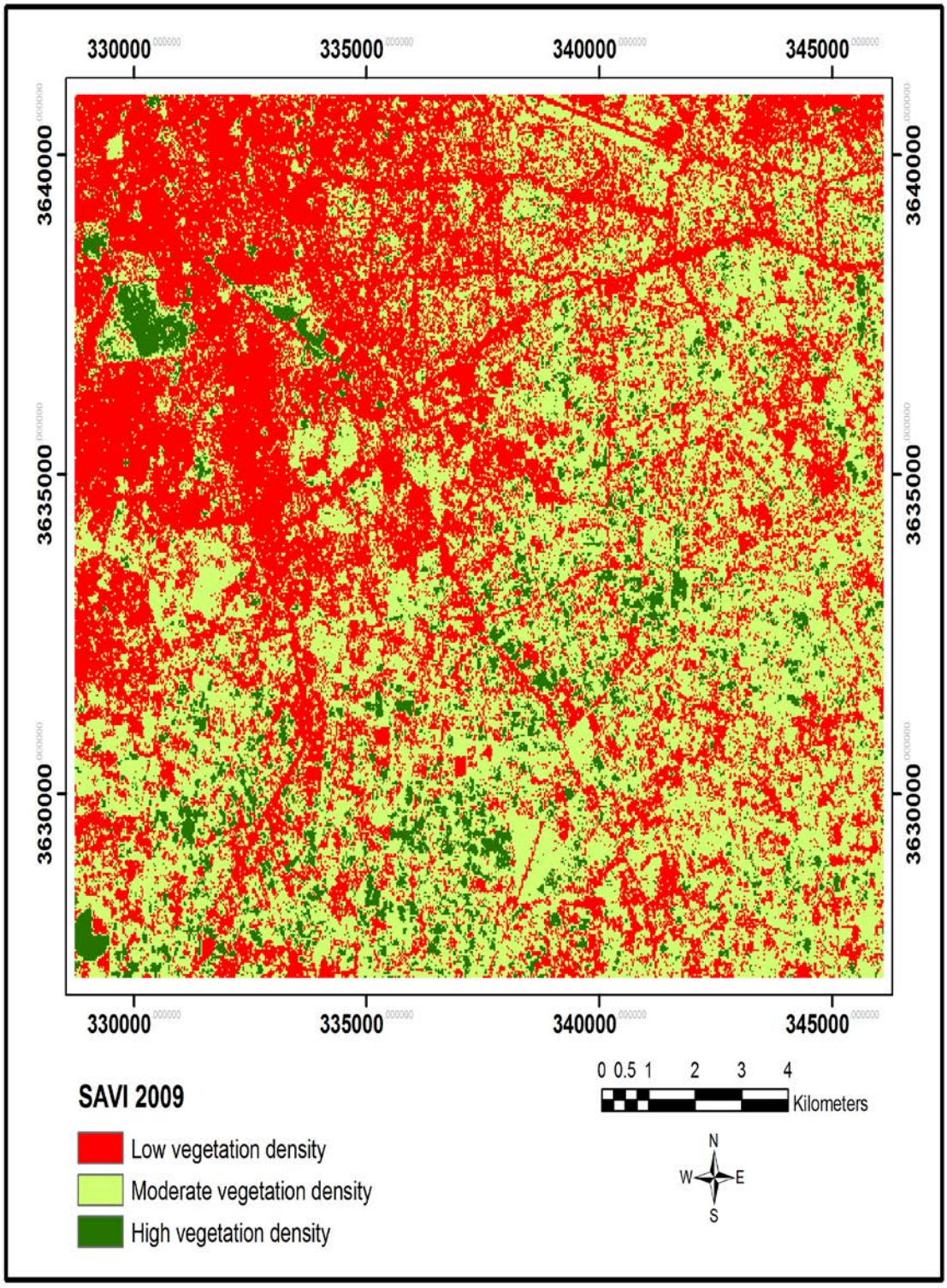


Figure 36: Vegetation density map for 2009 image.

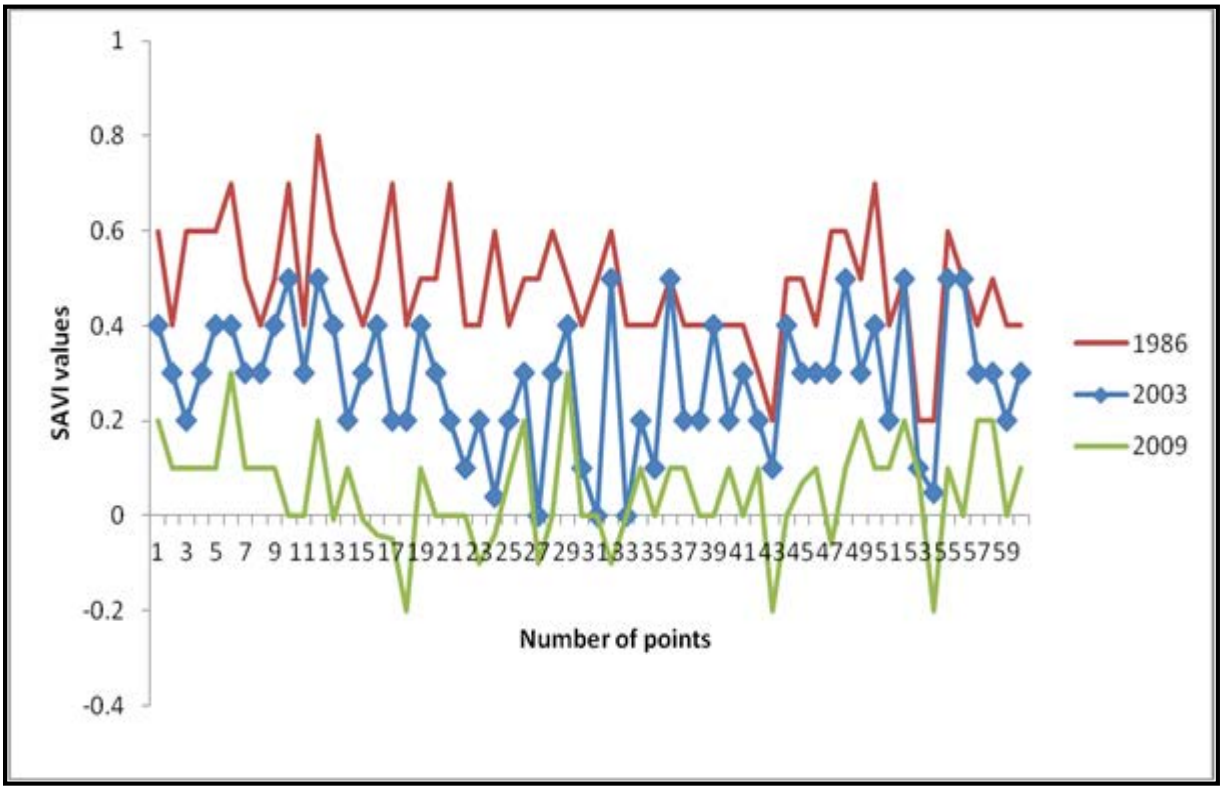


Figure 37: Graph showing SAVI indices for images of the study area (1986, 2003 and 2009).
Source: Author's creation.

Having conducted a SAVI analysis of the 60 collected samples from each of the three images of 1986, 2003 and 2009 (refer to appendix A), Figure 37 above presents a graph that illustrates the results of the analysis.

With reference to Figure 37 above, starting with the 1986 image, SAVI analysis revealed that there was no single sample with a SAVI index of less than 0.2 which means that in that year the entire land captured by the image had a slightly higher vegetation density. Figure 37 also shows that around 43 percent of the samples taken from 1986 image had a SAVI vegetation density that was classed as moderate vegetation density as the SAVI index was more than 0.2 but below 0.4. The remaining samples, 57 percent, had a SAVI index of more than 0.4 indicating that these were areas that had a high vegetation density.

Analysing samples from the 2003 image, it was realised that by this year 17 percent of the area had lost vegetation and their vegetation density had been lowered to less than 0.2. The number of samples with moderate vegetation density had increased from the 43 percent in the 1986 image, by almost 30 percent, to 73 percent on the 2003 image. High vegetation density in the 2003 image was only present in 10 percent of the samples.

Further changes are noticed in the samples from the 2009 images where the biggest percentage, around 85 percent has a very low vegetation density with a SAVI index of less than 0.2 while there is no single sample from this image that has a SAVI index of more than 0.4 as the remaining 15 percent are samples with moderate vegetation density as the SAVI index was more than 0.2 but below 0.4.

From the above findings, one can then conclude that vegetation density has been changing in the study area. It needs to be mentioned that the rate of vulnerability is so clear in the finding of the image of 2009 where no sample out of the 60 picked from the image has a SAVI index of more than 0.4 which on the SAVI scale indicates high vegetation density.

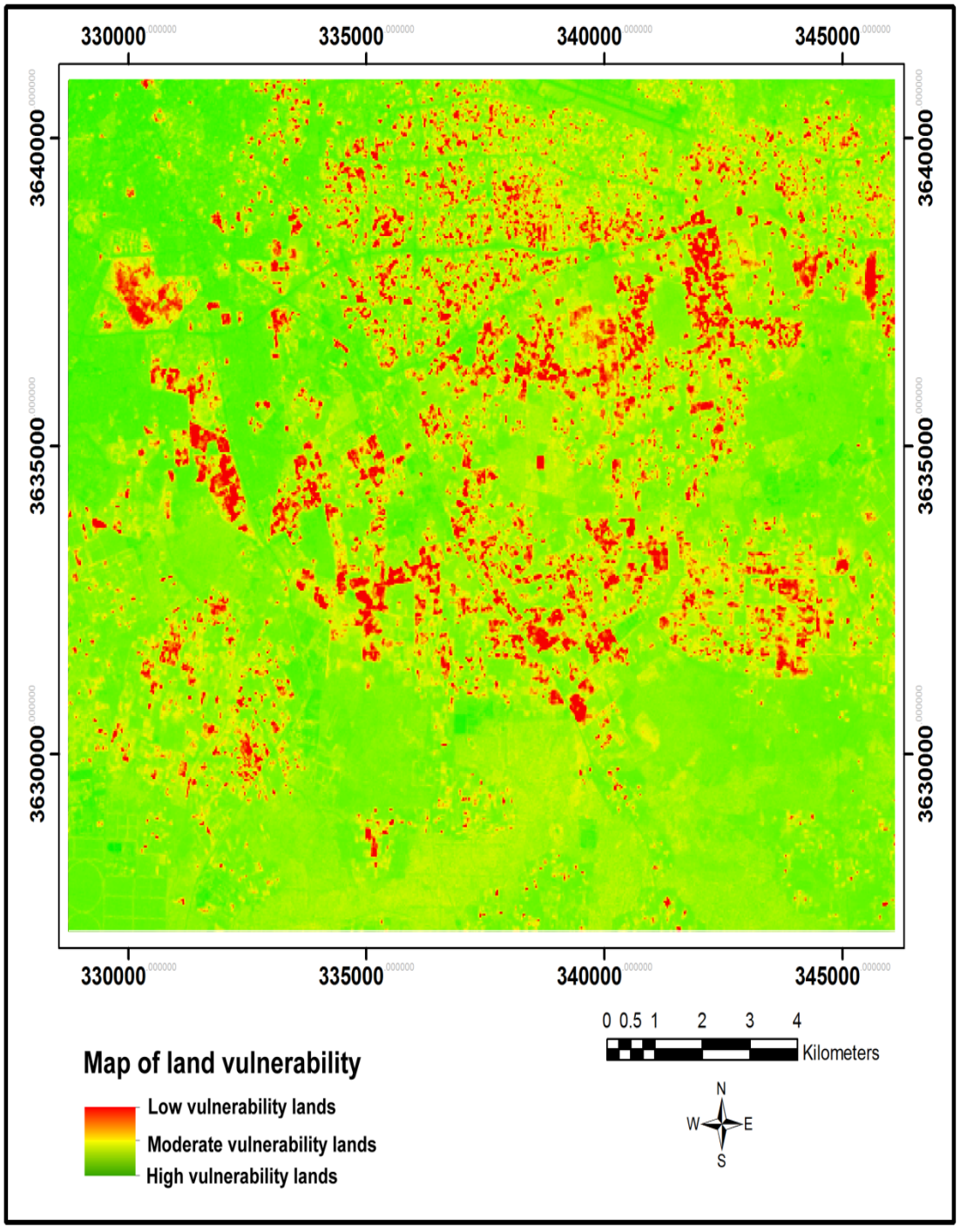


Figure 38: Vulnerability map 1986 to 2009.

Source: Libyan Centre for Remote Sensing

Assessment of vulnerable areas is important as it allows for the identification of areas or resources that are at risk of disappearing. Additionally, the assessment helps in highlighting threats posed by the reduction of such resources which could potentially lead to a disaster. As can be seen in Figure 38 above a greater proportion of area in the image, represented by the colour green, is of high vulnerability to vegetation degradation.

6.3 Summary of Satellite Image Analysis results

The analysis of land use and land cover change clearly shows that the peri-urban fringe of Tripoli has been undergoing significant change in the last few decades. Without question, urbanization is occurring. This is evident in the changes observed in the satellite images where more and more land is being converted from forests and agriculture into more urban uses. As the literature has suggested, the implications of such changes are immense, particularly for those pursuing agricultural livelihoods in these areas of change. The next stage of the research sought to understand, directly from these people, just how significant and potentially problematic these land use changes are for the sustainability of their livelihoods.

Chapter 7: RESULTS FOR STAGE TWO: PRA AND AGRICULTURAL LIVELIHOODS

7.1 Introduction

The Remote Sensing and Geographical Information Systems (GIS) methodologies identified specific areas where land use and land cover changes were occurring most significantly. One such area is Qarabulli district, an area that lies 35 Km south east of Tripoli. The district measures 150 square kilometers in size. According to BSCL (2010), 42000 people live in Qarabulli, 50 percent of these being male.

The majority of people in the district are either engaged in agriculture as their form of livelihood or work in the oil industry. This area became the focus for stage two of the data collection process that was conducted in the district from 12 August to 20 September 2013. In this phase, Participatory Rural Appraisal (PRA) techniques were used to gather detailed data on exactly what was happening in the area regarding land use changes, what people thought were the causes of the changes being witnessed, and how the inhabitants are experiencing and responding to such changes.

7.2 Initial briefing of research respondents

As an entry procedure, on August 12, 2013 the researcher requested and was granted a meeting with elders of Qarabulli district where the researcher briefed the elders on the purpose of the research. The researcher further explained why selected farmers in the area were to be requested to respond to prepared research questions and be involved in other data collection methodologies. Research ethics demand that respondents need to provide consent in order to be involved in any research work and this meeting was also used to seek advance consent of the farmers. It emerged during the meeting that the culture and tradition of the area empowered the local leadership to make decisions on behalf of their subordinates. The farmers' elders further shared with the researcher that

due to the then tense and volatile situation in Libya, it would be difficult for the researcher to randomly select possible respondents as many people would turn down the request thinking it was a political recruitment exercise.

Following this revelation, the researcher was advised that the elders would support the researcher by selecting an all-male team of research respondents. It was made known to the researcher that being a predominately Muslim society and in conformity with Islamic tradition as well as customs of the area, it will not be possible to engage women in the data collection exercise. The elders then mandated one of the officials from the Agricultural Extension Department in Qarabulli district who was present during the briefing to help with the identification of the required farmers. Figure 39 below shows the researcher (standing) briefing elders in Qarabulli district on the purpose and requirements of the research study.

Figure 39: Introductory meeting with in Qarabulli district.

Source: Photo taken by researcher during Fieldwork 12/Aug-20/Sept 2013.

7.3 Findings from use of PRA techniques

A number of PRA techniques were employed by the researcher and the sections below presents findings that emerged from the use of the various PRA methods.

7.3.1 Resource mapping by research respondents

The resource map drawing exercise was an initial data generation exercise that reminds respondents about the nature of resources available or that have ceased to exist in their area. Furthermore, since the exercise was one of the first activities the researcher conducted with the research respondents, the process was also used as an “ice breaker” that helped to put both the researcher and the respondents in a research participatory mode. The researcher guided the participants indicating that during the mapping exercise the members were to draw a map of their area indicating various key resources present in the area.

After a number of sketches were produced by the farmers, focusing on the mapping of their community, the farmers were finally able to produce a joint sketch map of Qarabulli which can be seen in Figure 40 below. This shows some of the resources in the area including forests, farmland, settlement areas, river and roads.

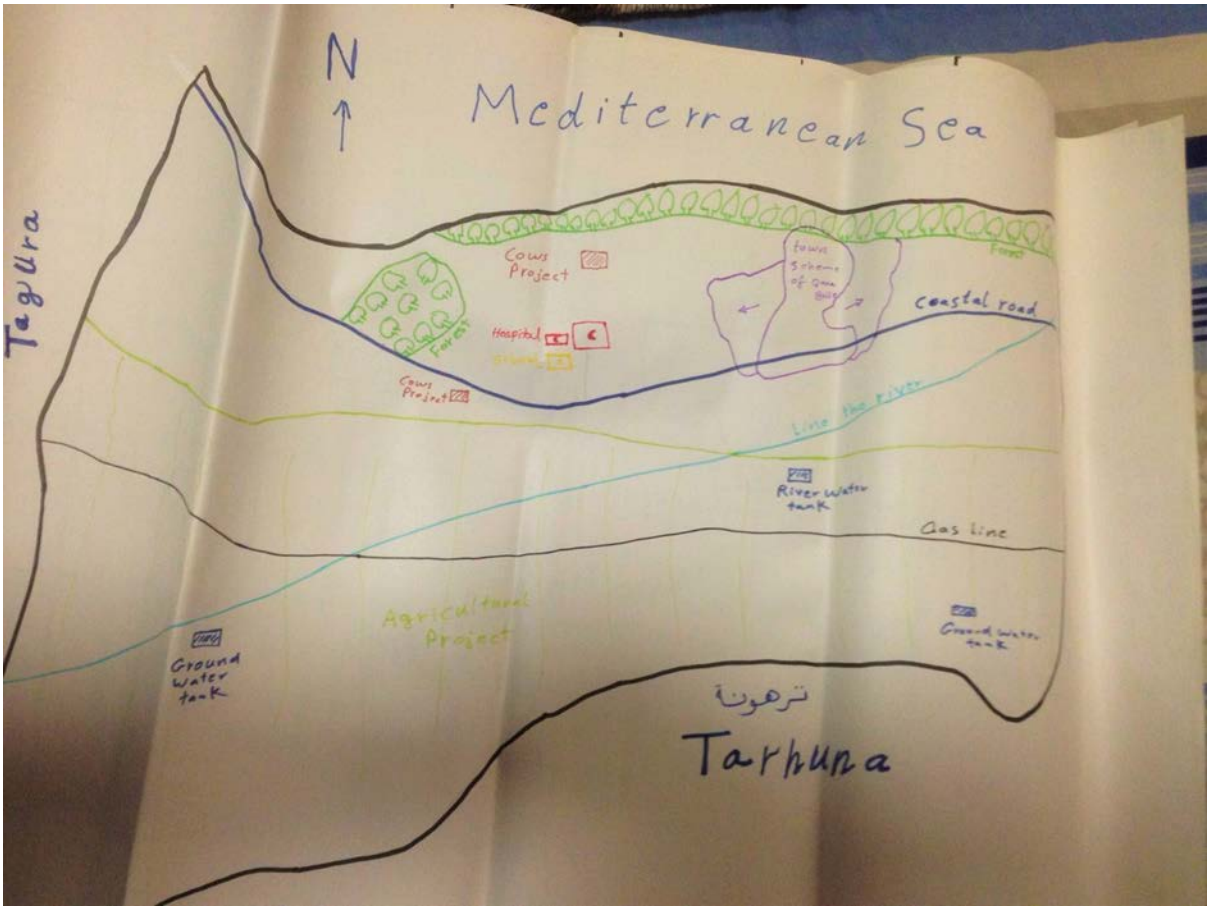


Figure 40: Map of Qarabulli district drawn by local respondents.

Source : Photo taken by researcher during Fieldwork Aug-Sept 2013.

Listening to the discussion the respondents were having while drawing the map, the researcher managed to note the following key points:

- Agriculture is a dominant livelihood in the area with the majority of households depending on it as their sole livelihood. Further to this, the respondents also indicated that there are around 1050 farms in the area but these farms are of varied sizes ranging from 2 hectares to 26 hectares, but only a few households possess farms that are 26 hectares in size.

- Since Agriculture is the dominant livelihood in the area, respondents agreed in their conversation that although the area boasts a road network comprising of both big and small roads, only those roads that directly lead to the market in Qarabulli or Tripoli were to be included on the map.
- The respondents also spoke of major land marks in the community that included the Water tank, Schools, river (this is a man-made River constructed by the Libyan government to supply water from reservoir in the south towards the North for agricultural and household use where most of Libya's population has settled) , ground-based water from the reservoirs, water tanks and wells (water sources), a gas line, community Mosque, houses including those belonging to workers from the Agricultural Department, the market, Banks and shops; including those selling agricultural equipment and food stuffs.
- There was a heated debate among the respondents on whether the Agricultural and the National Commercial Banks that were operating in the area were to be included on the map. Some respondents criticized the Agricultural bank on the basis that it only served the “working class” and not the majority of the people in Qarabulli who are farmers. By ‘working class’, here they mean the civil servant employees, especially those of top leading jobs others argued that the bank, on several occasions, has served farmers. During the discussion, the majority of respondents revealed that the Agricultural Bank, which came into the area to support farmers with loans, has been used to help improve their farming. However, it changed policies in 2001 and started offering loans, often to people with collateral, to be used in construction of dwelling units, thus leaving out poor households who had no collateral and therefore couldn’t benefit. The respondents were not sure if farmers could access agricultural related loans from the National Commercial Bank.

The respondents, especially full-time farmers, also spoke of the Qarabulli Agriculture Project established by the Libyan Government in 1950 that was

further developed by the Libyan authorities in 1970, praising it as one of the interventions that has continued to bring new economic dimensions in the Qarabulli district. Through this project the local farmers have been able to make a positive contribution to the national economy through the sale of cattle, sheep breeding and other agricultural products such as barley, wheat, vegetables, chili, aubergine, and potato and fruit trees.

The respondents mentioned that the original plan of the government sponsored agricultural project (farming scheme) was to enable farmers in the area to practice irrigation fed agriculture. However, the construction of three big ground water tanks and the lack of non-salty water in the area have been compelling most farmers to still practice rain dependent agriculture. This has over the years affected the amount of yields farmers produced. There are still some pockets of farmers who are engaging in irrigated agricultural activities, but some indicated challenges being faced by farmers including salty water which blocks irrigation pipes (which are expensive to replace), thus making irrigated agriculture an expensive venture. The role played by agronomists, from the Agricultural Department, in the scheme was also highlighted. The role of the agronomists was to improve farmers' capacity and knowledge of new farming techniques, including the use of chemical fertilisers and irrigation with direct contact and direct involvement with farmers, etc.

While commending the officials from the Department of Agriculture for the technical support they provide to the farmers, it was mentioned that lack of financial support from the Libyan Government to the department has over the years been the main constraint towards efforts to improve farmers' capacity and knowledge of new farming techniques, including the use of chemical fertilizers.

- Linked to the Qarabulli Agriculture project is the Cows Project. The researcher noted from comments respondents were making about the cows project that: *"The cows' project is a viable project but the there is a lack of enough land on which the cows could be grazing"*(F13).
- According to the respondents, notable changes within the Qarabulli district landscape are related to the expansion of the Qarabulli Settlement scheme (as indicated in the Town Scheme of Qarabulli in the map in Figure 39). Respondents hinted that the residential area has over the years been expanding as more and more infrastructure, including shops and houses were being constructed. While the scheme used to be situated on one side of the coastal road that leads to Tripoli, residential areas now cover both sides of the road having eaten out a considerable amount of vegetation that stood on the other side of the road. Further to this, the extension (see direction of growth of dwelling area on map in Figure 40), has also contributed to the erosion of the forest reserve that lies close to the urban area.

  According to the respondents, expansion of the settlement scheme has contributed to the clearing of the forests in the area, creating fears of desertification. It was noted that apart from clearing land where new buildings and roads would be constructed, more land has been cleared and changed from farms to cater for the growing population.

The mapping of these resources and the information collected by the researcher, as discussed in detail by the respondents and as per the resources included in the map (see Figure 40), have helped the researcher to identify core physical livelihood assets of the Sustainable Livelihood Framework (SLF).

7.3.2 Transect walk

The researcher facilitated a transect walk with the farmers in order to gather information through direct observation of the study area. In order to have an in-depth understanding

of farming in the area, one farm was randomly selected for the transect walk, figure 41 shows the map of route of transect walk and location visited.

Figure 41: Transect Walk Map

Source: Author's creation

Before the start of the walk, the researcher (seen in Figure 42 below) conducted a briefing session to respondents that were to be involved in the transect walk highlighting why the walk was being undertaken and what key issues/items might be observed. The observations were then presented on paper while photographs of key issues or objects were also collected.

Figure 42: One farmer stressing a point to the Researcher (left hand side).

Source: Photo taken by researcher during Fieldwork Aug-Sept 2013.

A number of issues were noted during the transect walk and a discussion during the walk further revealed finer details of the issues noted. Topping the conversation was the change farmers have been noticing in the quality of the water now available in the area. The respondents claimed that there is more Iron and Sulphur in the water they draw from wells for irrigation and household use. During the transect walk in the area, farmers pointed at some irrigation pipes that had been heavily corroded by these chemicals when the pipes were being used to irrigate crops in the field. It was noted that so far the solution to such corroded pipes is complete replacement of the affected pipes thus making irrigation agriculture more expensive as farmers have to regularly incur extra cost in replacing the pipes.

In addition to the damage caused to the pipes, the rather acidic water also affects growth of plants, especially the salty nature of the water is not conducive for crop production,

especially vegetable production, which is the most common agricultural activity. The respondents indicated that the salty nature of the water then limits the nature of crops one household can cultivate in their field.

Figure 43: Corroded Irrigation pipes**. Source:** Photo taken by researcher during Fieldwork Aug-Sept 2013.

Apart from replacing corroded irrigation pipes as shown in figure 43, it was also highlighted during the walk that some farmers are now engaged in a kind of drip irrigation in their fields. In this situation water is brought through thin pipes distributed along the field area to water the farm drop by drop. The idea is to irrigate the land by using minimal quantity of water so as not to waste much water. This involves plastic pipes joined together and distributed all over the field to cover the whole area that needs to be irrigated. Actually, this is a modified type of sprinkler- locally known as ‘distillation process’, which is commonly used in Libya to reduce quantity of water used in irrigation. However, the majority of respondents and farmers in the area have no clear understanding of how to go about the distillation process even though there was great.

When the researcher explored further why there was that deep interest to adopt the process one farmer indicated that from what people have been witnessing from farmers that are watering their crops using distilled water, it would appear that there are a number of advantages associated with the process, one being that there is minimized wastage of the water as water is provided direct to the crops. It was explained that since the farmers are using drip type of irrigation, unlike the flooding irrigation method where a farmer has to flood the entire field even places that have no crops, the dripping method only allows water to be put in places where crops are. The respondents said with water getting scarce each passing year, maximizing the usage of water for irrigation is what most farmers would want to be doing but they are limited hence there is need to have them empowered with skills to ably distil the water to be used but also how to manage the drip irrigation method.

Motivation for farmers to engage in the use of distilled water for irrigation also stems from the fact that farmers who have adopted the distillation technique are now having good quality crops in their fields.

Figures 44, 45 and 46 show flourishing Chilli, Aubergine, and Potatoes which are products of irrigation that is using distilled water.

Figure 44: Chilli

Figure 45: Aubergine

Figure 46: Potatoes

Source: All photos taken by researcher during Fieldwork Aug-Sept 2013.

It was also observed during the walk that most farms were affected by pests, with lettuce crops being the most heavily affected. As can be seen (in Figures 47 and 48 below), most

of the lettuces on the farm were attacked by pests. Farmers participating in the walk indicated that the presence of pests in the region was another great challenge farmers are facing in the area. Unfortunately, the farmers indicated that they have not been trained on how to treat or prevent the presence of this pest. The most common pests that were seen in the sampled field were green worms.

When the researcher checked with the respondents on finer details about the pest situation, it was indicated that the situation seems to be worsening each passing year. One respondent, who is an Agronomist, indicated that the problem could be attributed to climate change. The Agronomist revealed that although there are chemicals that farmers have used to treat the green worms, costs associated with such chemicals deter poor households from accessing the chemicals. A second agronomist who also practices farming in the area in addition to working with the Department of Agriculture indicated that there are new lettuce varieties available on the market that are more pest resistant but people have got used to the most current type, hence adoption rate of the new types of lettuce is still too low.

Figure 47: Lettuce attacked by pests

Figure 48: Lettuce attacked by pests

Source: Photo taken by researcher during Fieldwork Aug-Sept 2013.

Soil quality was another key issue that the farmers spoke about while participating in the Transect Walk. The soils are poor having been cultivated non-stop (they did not follow the agricultural cycle, which allows the resting of some land on a cyclical basis.) for about 5 years or more consecutively. The farmers all agreed that there was a need for artificial fertilizers. However, the farmers also acknowledged that they lacked knowledge on the nature of fertilisers that they might apply in their fields and any suitable combinations that would help the farmers to have more and better yields from their labour. It was noted by the farmers that had used artificial fertilisers in their vegetable gardens that chemical 'burning' occurred, resulting in reduced yields, However, one agronomist clarified to the group that applying too much of the artificial fertilizer can indeed burn vegetables hence the fertilizer must only be applied in the right quantities.

The next issue observed during the transect walk was that some of the farmers seem not to have cultivated their land for a number of years as the fields look covered with natural grass and associated weeds. While agreeing with this observation, the farmers indicated that the lack of enough man power to be used in the field was the main factor in this respect. When asked to elaborate further, the respondents indicated that the presence of the highway towards the sea coast, which directly leads to Tripoli has been acting as a motivation factor; encouraging people -especially the youth- to move to the capital. In fact, the researcher was shown a plot that had belonged to a young couple who have migrated to Tripoli, in the hope of finding a better life.

The lack of enough labour at household level has led to growth of grass which acts as weed and affects the growth of crops, since there is intense competition over the same soil nutrients between cultivated plants and grass. Figure 49 below shows how tall grass can grow in some of the farms in the district. Failure to fully weed the grass due to lack of labour means that crop production will be further decreased.

Figure 49: Grass growth which affects crop production.

Source: Photo taken by researcher during Fieldwork Aug-Sept 2013.

It was also observed during the walk that only a very small number of houses in the area had household granaries or any other form of crop storage facility. When the researcher checked with the respondents, he was informed that most households do not need storage facilities as the yield from the fields are always lower and often consumed immediately following harvest. Hence, there is no need for construction of such facilities.

When the researcher asked the respondents what they thought might be possible solutions to the many problems shared and observed in the area, the respondents were quick to blame the government for not being supportive enough to farmers' efforts within the agricultural sector in the district. The respondents indicated that the government has over the years failed to provide material and technical support that could help the farmers deal with the challenges of salty water and the pests which attack their crops.

Additionally, the farmers indicated that they rarely get technical support from the government as there are no local agricultural advisors (extension workers) in the area

who can train farmers in new and better methods of farming. The lack of proper training, among others, leads farmers to use too much of the chemical fertilizers rather than organic fertilizers. Farmers in the Qarabulli area also make use of traditional methods of fertilization which allows natural reconstruction of soil nutrients as indicated in Figure 50 below.

Figure 50: Dissolving fertilizer

Source: Photo taken by researcher during Fieldwork Aug-Sept 2013.

7.3.3 Timeline and Trend line

Trend analysis involves the gathering of historical and current information through people's recollection of how events have been and are at the moment, focusing on changes that have or are taking place and what caused the changes and associated trends. When the researcher was briefing the respondents on what would be done in this PRA

method, it was agreed with the respondents that recollection of events, changes and trends would be for the period 1980 to 2012 thus a timeline of 32 years. It needs to be noted that only two respondents were aged below 40 meaning all the respondents were old enough to participate in the trend analysis process for the indicated timeline.

The farmers were asked to consider how things had changed over these 32 years, focusing on the issues that had been discussed including soil quality and fertilizer (represented by S in the transcript), water quality and quantity – rainfall and irrigation (represented by W in the transcript), crop production (represented by C in the transcript), size of the harvest (represented by H in the transcript), and Income trends over time (represented by I in the transcript). These same issues were also raised during the timeline analysis. Based on the timeline, the farmers were encouraged to discuss further pertinent changes and trends experienced over these issues. As can be seen in Figure 51 below, the farmers made use of percentages to express their knowledge and perceptions of changes that they seem to be noticing in various areas over time.

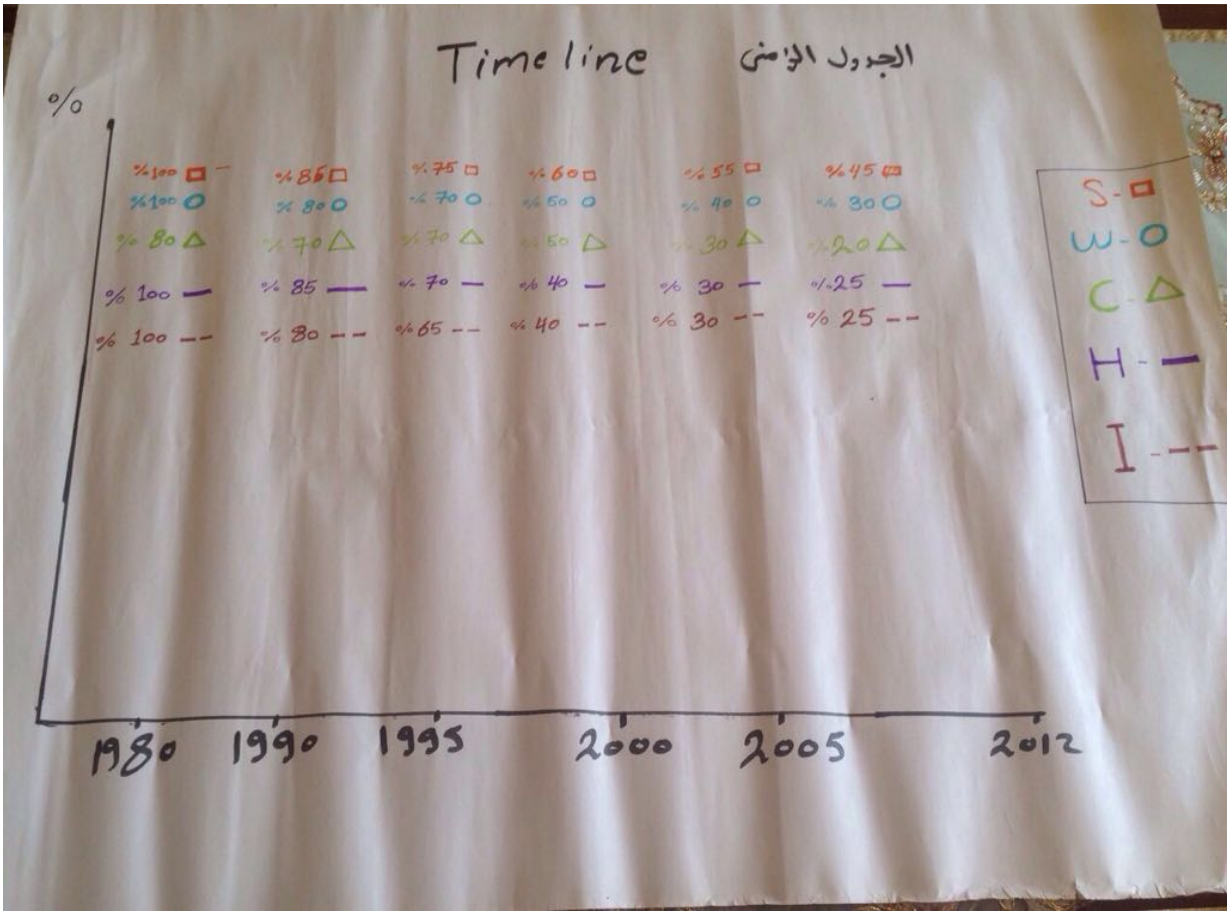


Figure 51: Timeline in Qarabulli area to get participants' perceptions

Source: Photo taken by researcher during Fieldwork Aug-Sept 2013.

According to farmers, the soil quality around 1980s was very good such that the farmers equated it to 100 percent. The farmers also agreed that water quality and quantity around 1980s was also very good and would be scored the same as soil quality. However, in the 1980s crop production was rated by the farmers as 80 percent good.

Although the respondents indicated that the 80 percent score for crop production in 1980 signaled that crop production was very good, the researcher realised through further questions that were asked that crop production could not be scored at 100 percent because the respondents felt that despite having excellent soil and water quality (scored 100

percent), crop production was a product of not just water and soil quality. Some respondents indicated that other factors like land ownership and size of the farm also impacted crop production. Being a traditional community, only males are expected to own land and as such male descendants only inherit land from their fathers. It was stated that tradition also demanded that when a father dies his land has to be divided equally among his sons and this reduces land holding size. This means those who have inherited the land would only be able to cultivate on much smaller plots and that affects crop production.

Secondly, the respondents indicated that literacy levels of the farmers in the area were low and this too affected production adversely; since the rate of adoption of new farming technology was low due to lack of educational skills. Additionally, it was mentioned that because of the high levels of illiteracy among farmers in the area, some farmers used seeds of poor quality. In addition, they also utilized inefficient traditional farming methods that depended on old traditional tools, thus also negatively impacting crop production.

As seen in the trend graph in Figure 52 below, from the narration and scores the farmers were giving over the indicated years, the scores on soil quality decreased by 15 percent from 100 percent in 1980 to 85 percent in 1990. The farmers indicated further that in 1995, soil quality reduced further to 60 percent and then to 55 percent in 2005 and 45 percent in 2012. Overall, the soil quality reduced in quality by 55 percent over the 32 years used in this trend line.

The creation of a Trendline for water quality and quantity revealed a similar pattern. The scoring of the farmers indicated that water quality moved from100 percent 1980 to around 30 percent in 2012, a loss of 70 percent over 32 years. The farmers indicated that the reduction in soil and water qualities resulted in a reduction in the amount of crops being produced. The amount of crops that farmers were able to harvest from their fields

reduced from the 80 percent indicated for 1980 to 20 percent in 2012 thus a 60 percent reduction.. Since harvested crops are sold as a means of raising household income, the farmers indicated that income levels that are dependent on agriculture reduced from 100 percent in 1980 to 25 percent in 2012 representing a 75 percent loss of income for most households.

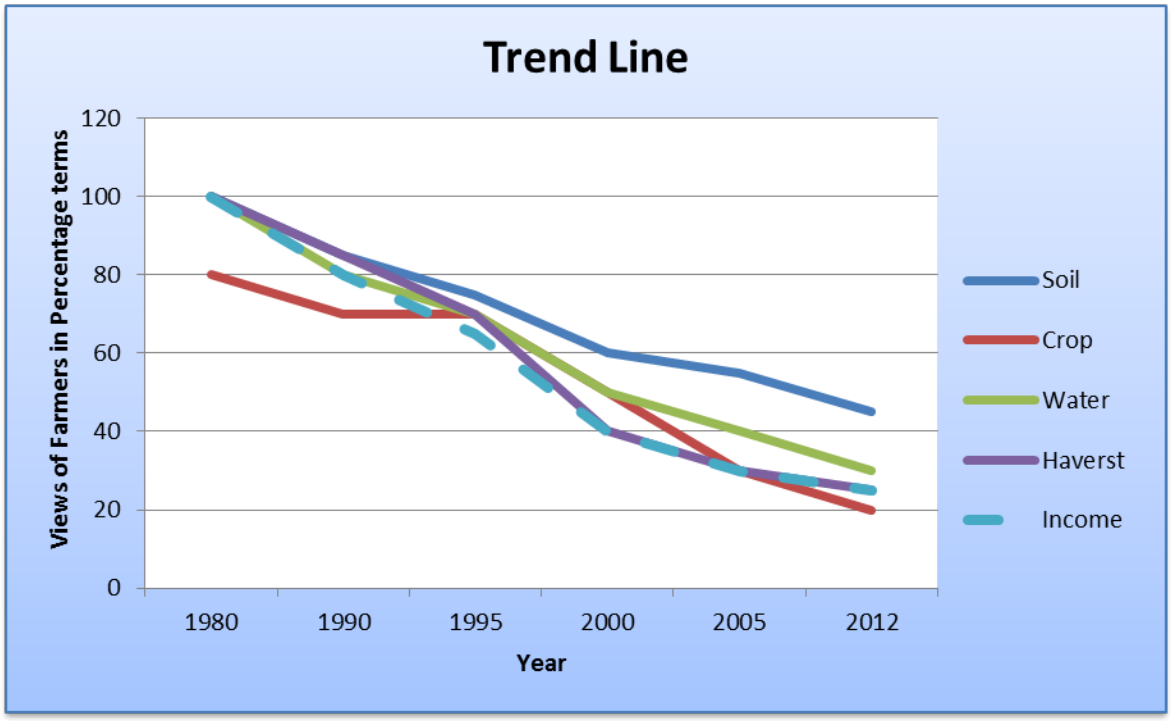


Figure 52: Trend line and scores by farmers in Qarabulli.

Source: Authors creation

The farmers identified a number of reasons for decreased production but key were the deterioration of water supply and soil quality and the lack of agricultural inputs and supplies.

7.3.4 Key Informant Interviews (KIIs)

As a way of gaining a deeper understanding of the experiences of the farmers in Qarabulli, the researcher conducted face to face structured interviews.

Demographic details of respondents

Demographic		**Number of respondents**
Gender	Male	16
	Female	0
Age (yrs.)	Below 30	1
	31-40	1
	41-50	7
	51-60	1
	61-70	3
	Above 70	3
Occupation	Farmer	10
	Farmer + Agronomist	6

Table 14: Demographic details of interviewees

Source: Authors creation.

As table 14 indicates, there were no females among the respondents in this study. It needs to be noted that being a rural area inhabited by conservative community, it has not been possible to have women respondents as they are rarely allowed to be interviewed by a man who they hardly know. Based on respect for the culture and tradition the Qarabulli society stands for, the researcher decided to work with the available respondents who

were all men. The researcher was lucky that among the 16 farmers who participated in the one-to-one interviews, six of them were employees within the Department of Agricultural where they were working as Agronomists. An Agronomist is seen as an agricultural expert who has specialised knowledge and expertise in the science of plants, food, crop rotation, irrigation, use of fertilizers and drainage management. Despite this, the respondents indicated that these available Agronomists cannot officially train farmers in Qarabulli district as they have not been tasked to do so by their department.

Since the study was digging out the history of how land use and land cover have been changing, it is important to note that the majority of the respondents (14 out of the 16) were aged 40 and above, which mean they have been living in the area long enough to have experienced the changes that the study has revealed. Only 2 respondents were aged below 40, this confirms what the literature reflect in this respect that young people are shunning away from the agricultural sector and opting to go into urban areas; they perceive they will get a better job and have more prospects in an urban environment. Several respondents also hinted that some of their own relatives and nephews have moved to Tripoli expecting to get a better life off the farm.

7.3.5 Emerging themes from the one-on-one interviews

The one-on-one Key Informant Interviews helped unearth or confirm themes that emerged during the other data collection sessions with selected groups of farmers. Having collected the bio-data of the responding farmers, the farmers were asked a number of questions and a variety of themes can be picked from their responses. The sections below highlight some of the themes the researcher has picked from the conversations.

7.3.6 Type of farming and land size

All the 16 farmers are engaged in agriculture as a personal business and their farms are not connected to any government project. The farmers further indicated that they are self-sponsoring their farming. Two thirds of the farmers were involved in agriculture for commercial purposes while a third were doing subsistence agriculture for household consumption only. Farmland sizes varied and ranged from 2 hectares to 26 hectares where both irrigation and rain fed agriculture are being used by the farmers. The farmers indicated that the number of farmers' holdings that are less than 5 hectares keeps growing each passing year as more sons are inheriting smaller fields that were owned by their father.

7.3.7 Nature of problems faced by farmers in the area

The farmers identified five groups of challenges:

a. Quality and quantity of water farmers are using on their farms.
b. Quality of the soil on which agriculture is conducted.
c. Issues related to finances and funding of agriculture.
d. Lack of government control and support from Agricultural Bank and government.
e. Economic environment.

All the respondents indicated that water quality and quantity issues were key for farming in Qarabulli district and added that the area is now experiencing reduced levels of rainfall that is leading to water shortages in most parts of the area all year round. Because of this, the farmers indicated that farmers are now left with no choice but to use water from wells for watering the fields. However, the farmers have realised that with the passage of time, the water they are using from wells contains Sulphur, iron and other kinds of salts that are spoiling the water quality and having a negative impact on overall agricultural

production. Evidence of the presence of Sulphur and other salts in the water is in the pipes that farmers are using when irrigating their crops. They have to be changed more often as they get blocked or develop holes through which water is seen lost unnecessarily making the process of irrigation difficult. One of the agronomists indicated that irrigating crops with water that contains many salts damages the nutritional values of the soils on which the plants are being grown, hence production levels are also affected.

During the interviews, the farmers revealed that the lack of rainfall in the area is responsible for reducing the quality of soil in the farms and the farmers indicate that the only way to improve soil quality was through the use of chemical fertilisers and pesticides. However, apart from the fact that the pesticides and chemical fertilisers are expensive for most of the local farmers, the agronomists amongst the respondents indicated that any excessive use of chemical fertilizers and pesticides will worsen the already poor quality of the soil.

Finance and agricultural funding is another major challenge raised by most farmers and they complained about the lack of government support for the agricultural sector. The respondents said that one of the reasons why agricultural production is so low is because the government does not support farmers in the area. The farmers said that there was a need for some subsidies from the government as a way of empowering the farmers to compete effectively with foreign agricultural products that Libyans are currently dependent on. It is the belief of the farmers that the subsidies will act as incentives to the farmers to produce more and help them buy better pesticides and fertilisers that are required in their fields leading to high production.

The respondents all claimed that as well as an absence of funding, they felt that there was little support of any kind from the Libyan government or the Agricultural Bank. This was a government initiative, set up in 1957 whose main aim was to establish a financial institution specialized on providing loans, insurance and facilitation related to agriculture

and livestock. This came in accordance with the general policy framework of the government in regard to agricultural support. The main target was to provide direct support to farmers through the provision of loans and other support and financial facilitations.

The farmers indicated that they would be happy if the government were involved more in supporting them by taking full control of the agricultural sector. Asked to elaborate further on this, the farmers indicated that they would like the government to regulate some practices in the agricultural sector including the provision of guidance and agricultural extension services on how to use chemicals on the farm and guidance on the best crops to grow on particular soil types. The farmers stated that despite the presence of agronomists in the area, the functions of the extension services were affected by the lack of funding. The agronomists were very limited in what they could achieve because of the lack of funding and investment and were only able to conduct very limited training and monitoring sessions for the farmers in the area.

The farmers also spoke about the role that the Agricultural Bank could play in the agricultural sector. They indicated that the bank could have been a good initiative if it were not politicized as is the situation now where it is not providing loans to farmers for agricultural production. The farmers pointed out that the Agricultural Bank in the area does not work for the benefit of farmers but rather was only benefitting certain individuals within the government. It was cited as an example by the farmers that there have been cases where Agricultural Bank officials have given loans to people in government to build houses yet farmers like those from Qarabulli cannot access the loans that would have greatly improved the farmers' chances to access agricultural inputs including equipment, seeds and fertilizers. This indicates there was bias and corruption. People were favored on political and kinship basis to receive loans. Those who did not have political influence or family and friendship relations were deprived from receiving such services and financial facilities.

The farmers identified high costs of fertilizers, seeds and pesticides as some of the major issues. The implication of this is that the farmers have to pass on the high costs of these farm inputs over to the consumers, making prices of locally produced agricultural products expensive when compared with imported agricultural products. Consequently, since the farmers fail to acquire the necessary finances, many farmers reduce their agricultural production and some are forced to abandon farming completely and use the land to build houses on. Second, there is constant fluctuation in the prices of local agricultural products which also leads to financial losses for the farmers as investments are often higher compared to the income they realize from the sales of their crops. Thirdly, the farmers complained about the distributional channels that exist in Libya. Agricultural products are often bulky hence transporting them to markets located in big cities poses a challenge as farmers incur high transportation costs. Additionally, selling the transported products demands that the owners spend more than a day in the city thus incurring additional cost for meals and accommodation for as long as the products remain unsold.

7.3.8 Effects of desertification in the study area

Although all the 16 farmers mentioned that there are a number of effects of deforestation on vegetation cover, farmers 2 and 3 went further to mention that increases in soil erosion is the most common manifestation of deforestation in the area. Although, farmers 4 to 10, agreed with the other farmers on the effects and causes of deforestation, they added that the increase in population density, putting pressure to clear new virgin lands is also a significant factor contributing to high levels of deforestation in the area. The six agronomists who participated in the study added that deforestation has been negatively affecting land cover and land use in the area. The agronomists added that the main cause of desertification in the area in addition to loss of land previously used for agriculture is the lack of knowledge about the environmental benefits of forests among many farmers, who out of ignorance are engaged in deforestation activities.

"You need to know that because we are not getting a lot of money from the farming we have been doing all these years to buy the things that our families need, many people are now using natural forests as a source of income. They cut down trees carelessly and forget about the benefits that forests provide to people" (F1).

7.3.9 Reasons for selling farmlands

Farmers were asked for their opinions on why farmers are selling agricultural land. All 16 farmers agreed that there many challenges that farming is now associated with chief amongst them are poor quality of water and soils hence most farmers are opting for selling land which they have been cultivating for many years. These are summarized in the figure below.

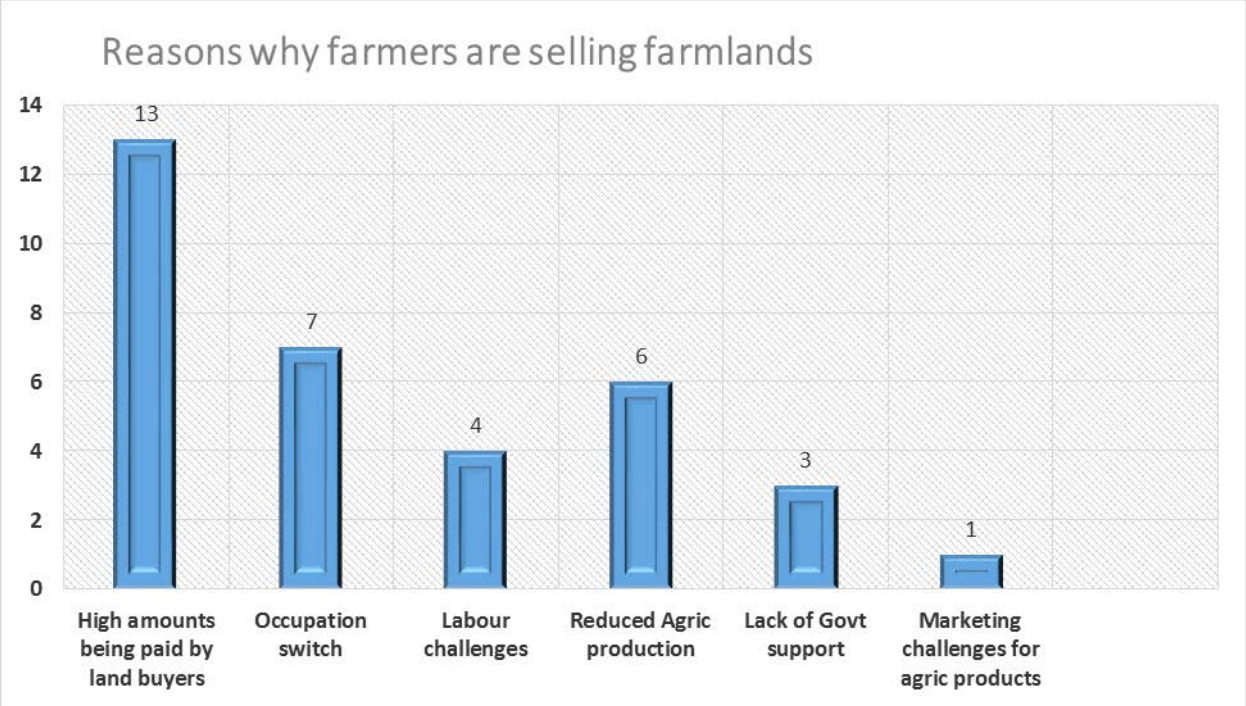


Figure 53: Reasons why farmers are selling land in Qarabulli district

Source: Author's creation using gathered data.

As Figure 53 indicates, 14 of the 16 respondents indicated that the main motivation for selling farmland is the high prices that land buyers are prepared to pay. The PRA exercise also revealed that people from urban areas buy land from local farmers who sell up because they are frustrated with the many challenges they face in the agricultural sector.

One respondent (F1) went further to talk about the boom in the housing market that is coming in as a result of the expansion of Tripoli. According to farmer 1, people are looking for land on which to build residential infrastructure that has led to an increase in the cost of land in the area. The high amounts being paid when buying land motivates others to sell their land. Respondent1 (F1) and Respondent5 (F5) concurred that most farmers are willing to sell their land as that fetches higher prices compared to the profits farmers are currently getting through agriculture. At least four out of the sixteen respondents indicated that shortage of labour for agricultural production was another key factor that moved farmers to sell their land.

The farmers indicated that the increase in urbanisation in Tripoli has led to a high demand for labour that has been motivating people from rural areas in Qarabulli to move to Tripoli in search of employment thus creating labour challenges in the area. Seven farmers revealed that because of the challenges in agriculture they would, if, offered a chance, opt for a switch in occupation and would leave their farms and go to work in the urban areas where they believe they are more likely to earn more.

The six farmers, also working as agronomists highlighted that farmers in the area do not have enough opportunities to improve their farming productivity. According to the six, there is the lack of awareness among farmers on how important the agriculture sector is and that the government is not supportive of farmers. As a result, farmers have no choice but to sell their farms and engage in other non-farm activities.

Figure 54: Vegetable market in Qarabulli area.

Farmer 14 (F14) raised the issue of marketing. According to him, lack of marketing of agricultural products leads farmers to sell their farms. In other words, the Libyan agricultural products are not properly marketed in the Libyan markets as they face competition from other foreign products from neighboring countries. Farmers are therefore blaming the government for not being supportive of their engagement in agriculture and their products as it appears the government prefers foreign products over those produced locally. Figure 54 above shows the researcher in the market where most products are imported, confirming what the farmer said. The farmers argued that land deterioration has a negative impact on farmers as it acts as a disincentive to them to continue growing crops.

7.3.10 Expansion of Tripoli and how farmers are affected

Asked to mention the impact that the expansion of Tripoli was having on the lives and livelihoods of farmers in the areas, it was realized that the respondents felt that there were both positive and negative impacts that people in the area were getting from the expansion of Tripoli.

The farmers indicated that urban expansion is improving the living standards of people by providing people with opportunities to find jobs as well as getting access to services. However, the farmers also mentioned the negative impact of urban expansion and blamed it for the continued decline of agricultural production since land for agriculture is being changed into residential area and labour is being transferred from Qarabulli to Tripoli.

7.3.11 Tree branches

The tree branch exercise is a visual tool that can help in narrowing and prioritizing problems, setting objectives and aiding decision making. The farmers in Qarabulli were supported by the researcher to identify and diagnose farm related problems using the Tree diagram. One key advantage of using a tree branches as a PRA tool is that in this scenario, the method allows the respondents to work as a group, discussing their problems and how they can work around in identifying and suggesting solutions to the challenges faced. This, as stated in the methodology section, helps in ensuring that the farmers are committed to working on the agreed solutions.

As can be seen in Figure 55 below, the discussions through the tree branches methods produced a number of challenges and the first problem raised by the farmers was that there was a lot of deterioration of water quantity and quality which result from lack of rainfall. In addition, the farmers also mentioned the increasing amounts of sulphur in water wells as an additional problem that has contributed in the deterioration of water quality on their farms, refer to Appendix E.

Figure 55: Tree branches for problems and solutions.

Source: Developed by the farmers during Fieldwork August and September 2013.

In discussing ways of working around this challenge, all the farmers agree that the best way forward on this matter is through the establishment of desalination plants on the coast. Secondly, working on long term solutions the farmers indicated that there is great need to increase the amount of vegetative cover as a way of ensuring that the area in future gets more water than it is doing right now. The latter solution is in support of what some farmers have suggested in the transect walk that irrigation distilling is a way to improve water quantity and quality and should be used.

The farmers also talked about the soil degradation due to farmers not following the agricultural cycle which makes agriculture unsustainable. The lack of natural elements in the soil due to over cultivation was highlighted as the core reason for the poor quality of the soils in the area. The suggested solutions by the farmers were twofold. Firstly, the soil should be analyzed before any crops are grown on it to find out what crops are good for specific soil types. Secondly, the agricultural cycle which is the annual cycle of activities that relate to the growth and the harvest of crop which include loosening the soil, seeding, special watering, and moving plants when they become bigger, and harvesting, should be followed properly while allowing the soil to be fertile.

The third problem the group raised was to do with finances, a challenge attributed to lack of support from the government. The farmers suggested that the existing Agricultural Bank should play a more supportive role and encourage famers by providing them with agricultural equipment and seeds at affordable prices. More importantly, the group suggested the support and development of an agricultural association which would act on behalf of the farmers.

Problems related to energy were also raised by the research respondents. For example, regular power cuts and lack of electric generators impact on farms and destroy crops. Farmers make use of treadle pumps to water crops which is a challenge as farmers need to manually draw water from a well or a nearby stream to the field. Both diesel and

electric pumps are not only expensive but they are difficult to use with the worry of power cuts and expensive fuels. The farmers suggested that the government should help in establishing solar power plants, especially in areas where agriculture is the main form of livelihood.

The final problem the group identified was related to desertification which they said is caused by deforestation, overgrazing and lack of rainfall and high winds. The farmers suggested that the reforestation activities should take place in areas where the deforestation has occurred.

7.3.12 Bean Counting

The Bean Counter method is used to help communities' rank solutions that they have formulated, and the researcher used the method in Qarabulli district with the respondents ranking the solutions in order of importance starting from the least important to the most important. The results of the ranking by the farmers in Figure 56 below that uses the scale of 1 to 7 with 1 being the least important solution while 7 indicates the most important and viable solution, refer to Appendix F.

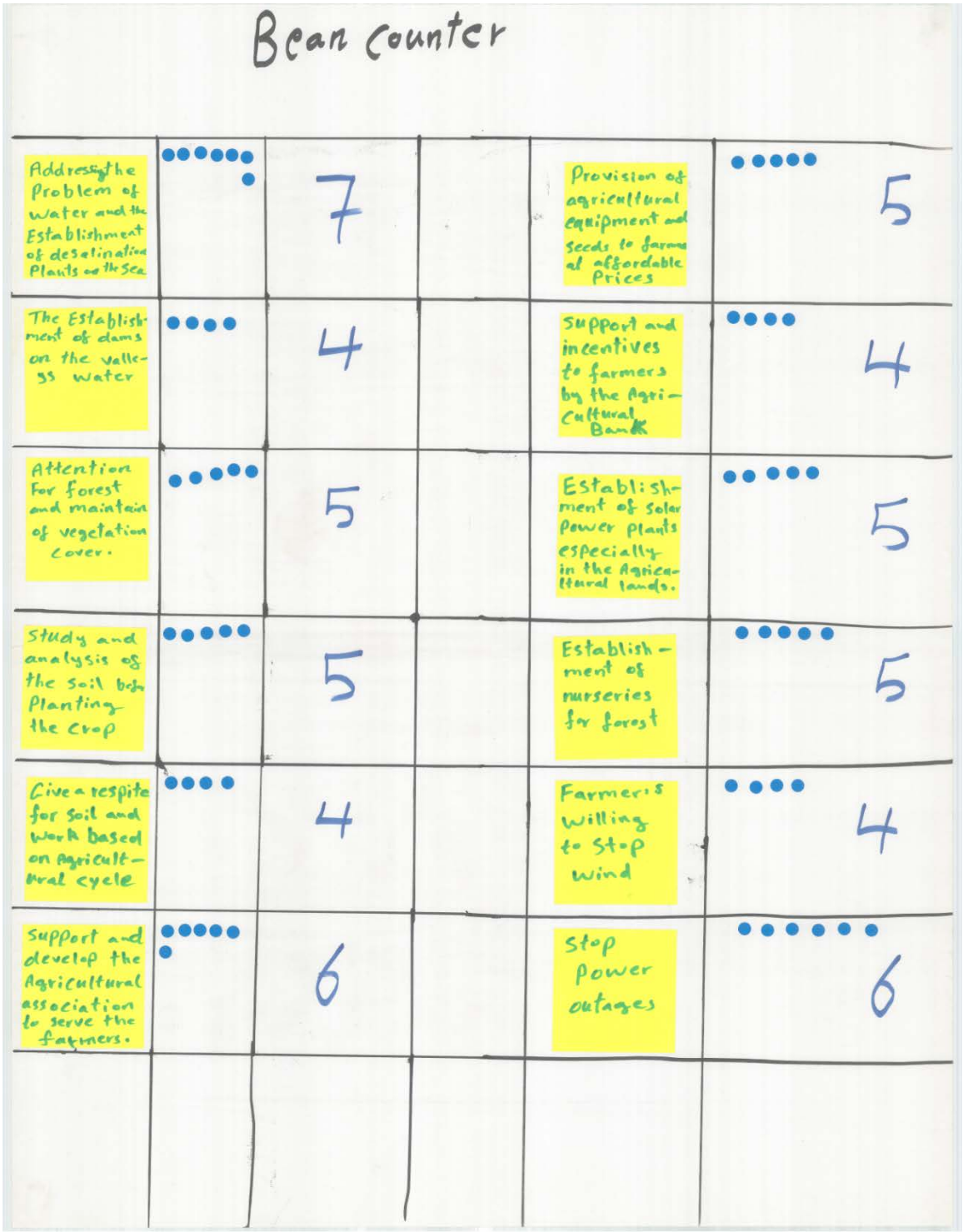


Figure 56: Solution ranking by respondents using Bean Counter method.

Source: Developed by the farmers during Fieldwork August and September 2013.

As can be seen in Figure 56 and the farmers who participated in the Bean Counter exercise indicated that the most important solution is one that addresses the issue of water quality and quantity. This is “why” in figure above and water quality and quantity is ranked as number one. This outcome is not surprising that the farmers scored highly the solution related to water quality and quantity, and the establishment of desalination plants on the sea. The researcher noted during the interaction he had with the farmers that their number one concern was water related since the people in Qarabulli look up to water as the prime asset and great for agricultural development and livelihood in general. The second ranked solution is the support and development of the agricultural association, plus the establishment of solar power plants in the agricultural areas which would help in solving the problem of power cuts. Conversely, the solutions to the problems that have attracted least importance with the lowest score include the establishment of dams in the valleys and soil analysis before planting the crops.

7.3.13 Solution matrix

In using the Solution matrix, respondents agreed that they are going to vote when deciding on priorities and preferences. The ranking matrix in Figure 57 below has been split into four groups with each group having three voting farmers. The groups are identified as A, B, C and D. Each group was allowed to give a score ranging from 1 to 5 for each of the identified solutions where 1 was the lowest score and 5 the highest score. In the end, the scores given to each solution by the groups were added in order to rank the solutions, refer to Appendix G.

Solution matrix

Farmers Solution	A	B	C	D	Total	Rank
Address the problem of water	5	5	3	4	17	1
Attention For forest and maintain of vegetation cover	4	4	5	4	17	2
Study and analysis of the soil befo Planting the crop	3	3	2	2	10	6
Support and develop the agricultural association to serve the farmer	2	3	4	3	12	3
Support and incentives to farmers by the Agricult-ural Bank	2	3	3	4	12	5
Establish-ment of solar power plants espe-cially in the agricultural land	4	2	3	3	12	4

Figure 57: Solution ranking by respondents using Solution Matrix method.

Source: Developed by the farmers during Fieldwork August and September 2013.

As Figure 57 above shows, out of the six solutions, “the establishment of desalination plant on the sea and maintenance of vegetation cover” receive higher score of 17 each and were ranked as 1st and 2nd respectively. However, the lowest score of 10 was on “the study and analysis of the soil before planting the crops” which occupied the 6th position. On the third, fourth and fifth positions were respectively “development of agricultural association”, “Establishment of Solar power plants” and “improvement of agricultural bank”

There is agreement between the results of the bean counter and the solution matrix. In the two instances, the most important solution is to do with water quality and quantity which the farmers said needed a great improvement if there was to be meaningful positive changes in agricultural production. The solution with the least score is the need for soil study and analysis of the soil before planting the crops.

7.4 Chapter conclusion

The PRA techniques that were used to gather qualitative data in Qarabulli area revealed a number of issues and confirmed that the study area is indeed a predominantly agricultural area that has got great potential to positively impact the agricultural sector in Libya. However, the farmers have raised many issues that have detrimental effects on the farming sector including water quality and quantity, labour shortages, and energy issues. The farmers, among others, blamed the government for not being supportive of their cause saying that the government does not provide farmers with subsidies which would help the farmers to increase the volume of their agricultural products. Some farmers have said that agricultural equipment such as fertilizers and seeds are very expensive on the market. Because their income is affected by government policies, some farmers engage in cutting trees and building houses which may provide them with additional income.

The farmers also stated that there is wanton cutting down of vegetation which is having negative consequences including erratic rainfall. Farmers also revealed that some farmers

are selling up their farms to people who are looking to build houses, as the city of Tripoli is growing outwards.

Farmers in this chapter also suggested solutions to the problems they are encountering including energy problems. To avoid such an incidence, regular power generation is needed to keep crops healthy.

In addition to the lack of support by government, the farmers raised the issue of the Agricultural bank which does not support farmers. The initial mission of the agricultural bank was to provide equipment, seeds, fertilizers and pesticides that would help farmers. However, the bank seems to have changed its priorities as the bank provides farmers with money to build houses not for farming activities. The challenges covered in this chapter, as stated by the farmers, are having a profound impact on the farmers which in turn have profound impacts on the country. Policy makers have to start considering methods of mitigating some of the more worrying problems that might emerge as a result, namely national food and water in security.

Chapter 8: RESEARCH FINDING

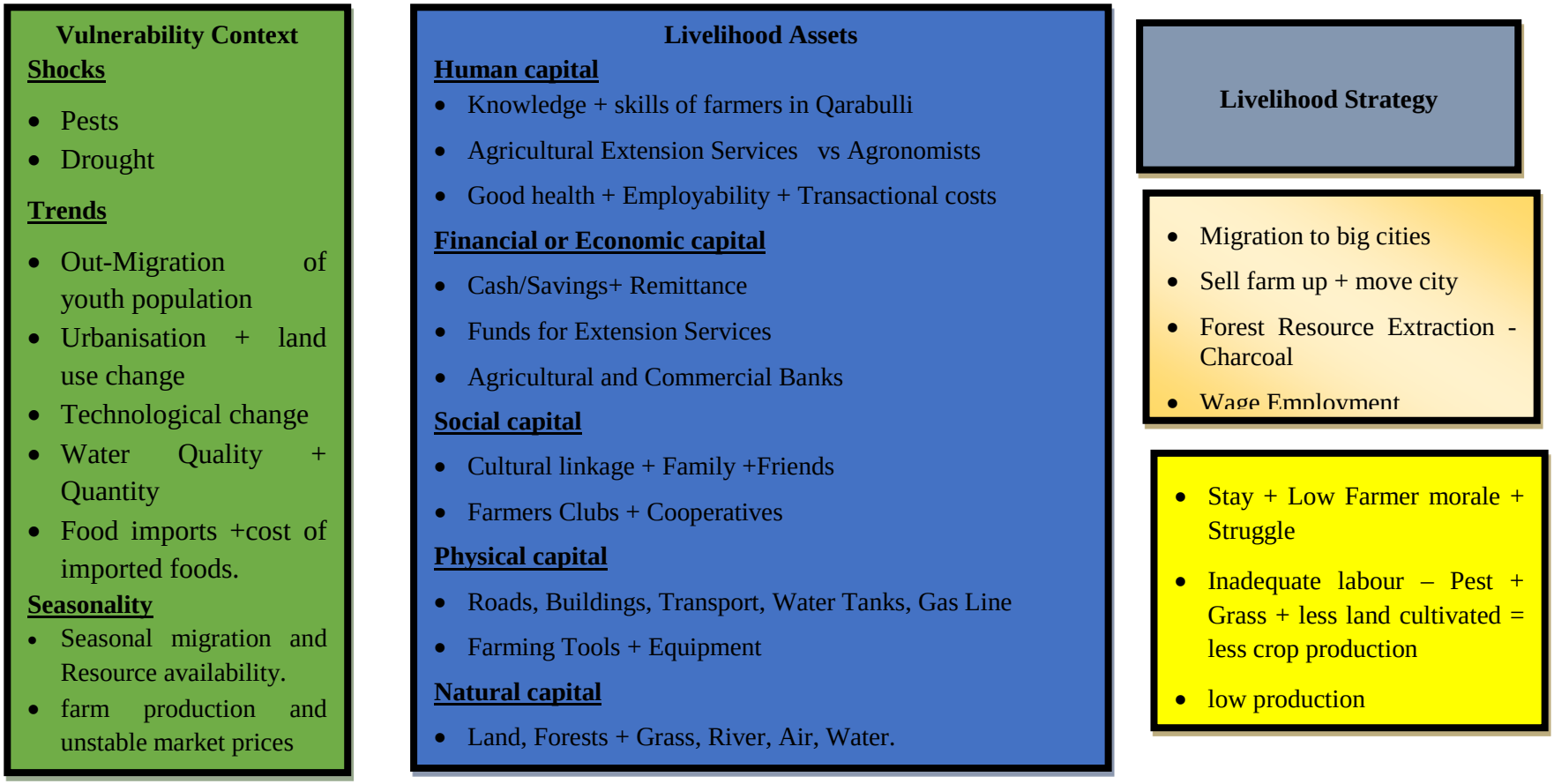
8.1 Introduction

The research data was collected in order to fully understand the livelihood choices facing farmers in Qarabulli district, a peri-urban area of Tripoli the capital city of Libya. The guiding framework during the data collection process was the Sustainable Livelihood Framework (SLF), as shown in Figure 10 on page 79. The evidence from the previous chapters allows the researcher to consider the data gathered in the field within this framework.

This chapter presents findings gathered during the data collection process and addresses the constraints and vulnerabilities that farmers in peri urban face while pursuing their livelihoods. The chapter discusses the various forms of capital assets available for the peri-urban farmers and their households.

Key findings of this research are presented in Figure 58 below. Through the paragraphs that follow after Figure 58, he researcher tries to further expound the research findings.

Figure 58: **Summary of the main findings**



8.2 Vulnerability Context

The impact of expanding cities on surrounding agricultural areas and its implication on farmers' livelihoods cannot be fully studied without considering the vulnerability context under which rural livelihood activities are conducted. In the Sustainable Livelihood Framework, presented in Figure 10 and adopted as the conceptual framework for this research, the vulnerability context includes all the exogenous factors that affect livelihoods either directly or indirectly. This section presents elements of the Vulnerability context with regards to Qarabulli district where just as literature accessed by this researcher has indicted, the Qarabulli vulnerability context manifests itself in the form of shocks, trends and seasonality.

8.2.1 Shocks

Ellis (2000) defines shocks as those unpredictable events that can directly destroy assets. This definition mirrors that of Chambers and Conway (1992) that indicates that shocks are sudden, unpredictable and traumatic occurrences that negatively affect people's way of living. In line with Ellis (2000) statement, shocks take a variety of forms and can either be natural or man-made. This research found that peri-urban farmers and their households in Qarabulli are faced with multiple shocks but the damage and constraints imposed on households by these shocks vary from one household to the next.

The paragraphs below illustrate the nature of shocks households are facing in Qarabulli.

8.2.1.1 Ecological shocks

Being an area where the majority of households are engaged in agricultural production and farming is the only livelihood for majority of inhabitants in Qarabulli, it was anticipated that households in Qarabulli might be prone to ecological shocks such as drought and pests. This anticipation was based on studies by Asiimwe and Mpuga (2007),

Pandey et al., (2007) and Tongruksawattana et al., (2008) that revealed that communities highly dependent on agriculture are often affected by ecological shocks that are more damaging for the poor households as these households are less insured against such shocks.

Shocks that farmers in Qarabulli are experiencing are often associated with damage caused to crops and agricultural production. One key ecological shock experienced by farmers comes in the form of natural pests.

Over 70 percent of the respondents to this study indicated that crop production (particularly Chilli, Lettuce, Potatoes and Aubergine) often comes under attack by a variety of leaf eating pests. Although farmers were aware of pesticides that could be used to mitigate such damage, most farmers could not afford the high costs of these products.

“I know a certain chemical fertilizer that one rich farmer is using to kill the pest but it is very expensive. Now as a father, I need to decide on whether to go and buy the chemical fertilizer and kill the insects or keep the money and buy food for the household members. A good father will prioritise using the money to buy food over the chemicals” said respondent number 4.

8.2.1.2 Economic shocks

Low levels of agricultural production were attributed by the majority of respondents to small farm sizes, poor water quality and the prevalence of leaf eating pests. This results in food scarcity in Qarabulli, a significant shock to which most households are vulnerable. Locally produced food stuffs favored by many local people are not being produced in sufficient quantities to meet demand and hence their price is high. The high economic costs of production are also a key factor in this problem.

To ensure food availability, the Libyan government has, since the early 1970s, been importing food supplies, and that also creates dependency vulnerability. In addition, many Libyans are not happy with the type or taste of the food imported. Although the policy has assisted the meeting of the food needs of the population, the policy was blamed as a factor contributing to soaring unemployment rates in Qarabulli. This is because farmers in the area cannot sell their products at competitive prices, as the imported products are cheaper, and as a result farmers make up for their economic loss by selling land.

> "Even if I was to harvest enough from my farm and I had some to sell, I cannot make a lot of money as the imported food is cheaper. That's is why selling the land is a better option than working on and get nothing at the end of the season" (F 7).

Commenting further on the economic impact of pests on the livelihood of farmers in the area, farmer number 3 indicated that:

> "It is very strange that these pests are increasing not just in number of pests attacking our crops but the types are also becoming many. In the old days, we used to have pests that only attacked lettuce but nowadays almost every crop we are growing has its own kind of pest which is quite disheartening. We are having so many problems with farming nowadays and it is better to just sell the land than waste time and resources working in the farm where the yields will not even feed the family". (F3)

Livelihood stress is described as those predictable pressures which tend to be continuous and cumulative and are gradual in the way they affect livelihood asset accessibility (Chambers and Conway, 1992). Uncertainty and fear among peri-urban farmers is a form of livelihood stress which was also picked up in Qarabulli. Since the growth of the city is an ongoing process, it is anticipated by many of the respondents that more and more

farmland will be converted into urban areas, and the anticipation of this is creating stress amongst the farmers. Farmers feel that land can still be lost as a result of enforced government projects. For example, many farmers had land taken off them when a new gas line was developed. The farmers fear that similar projects will take place, and feel that they have to sell their land now, so that they do not lose out financially if changes are enforced on them, without financial recompense.

The combination of the effects of these various shocks and stresses expose farmers to economic shocks which affect the health of farmers and their families, as was the case with studies conducted by Pandey et al., (2007) and Tongruksawattana et al., (2008).

8.2.1.3 Environmental shocks

Pagiola and Holden (2001) argue that agricultural livelihood is closely linked with, but also dependent on the environment. The authors add that, although agricultural activities do shape events that occur in the environment, the environment also plays a critical role in the yields that people can get from their farms. Kruseman et al., (1996) indicate that although some environmental shocks are caused by natural processes with little influence of human activities, there are some shocks that are induced by human acts which set in motion events that trigger actions leading to disaster. Analysis of the data that the researcher gathered through the utilisation of PRA methods employed in this study revealed that Qarabulli has, over the years, witnessed an increase in environment related shocks.

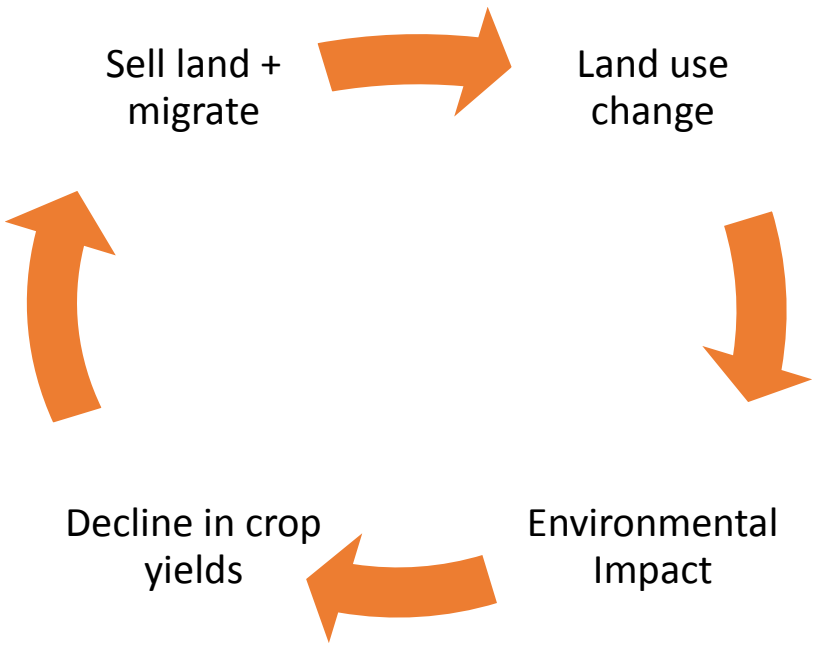


Figure 59: How different shocks are related to one another

Source: Developed by the Author

In Qarabulli district, conditions for agriculture production have become increasingly challenging with each passing agricultural season. All participants to this study stated that they have been experiencing a dramatic change in recent years with regards to the amount and predictability of rainfall which has been falling in the area. The respondents indicated that rainfall patterns are no longer predictable and that the amount received is lower than previous seasons and this has created extreme hardship for people living in Qarabulli. As a semi-arid area with insufficient rainfall, the farmers believe that exposure to natural shocks like drought will heavily reduce the productivity of crops they have planted. Further to this, a number of respondents revealed that there have been cases in the past decade where the entire crop was lost due to lack of timely rainfall. Respondents

described increasing sunshine and temperatures along with reduced and more unpredictable rainfall as being the most significant influences on their ability to survive.

When the respondents were asked to propose solutions to the many and adverse effects that the expansion of Tripoli was bringing on people in Qarabulli, the majority of the respondents could not propose solutions beyond suggesting that government had to do something. While all the respondents looked at drought problems as something that is largely uncontrollable, about half of the respondents felt that drought can best be tackled by identifying new water sources that are salt-free and that crop production should be conducted in areas close to such water sources.

The above responses indicate that the farmers are waiting for the government to come to their rescue. This could be an indication that the people of Qarabulli are resigned to their fate having lost hope in an improved livelihood. The fact that people are only looking to the government as a solution provider is practically not possible if the current instability in Libya is taken into consideration. Agriculture is not a priority for government at the moment, while there is still uncertainty, civil war and fighting happening between different factions in the country.

This dependency on government seems misplaced and is out of step with findings from other parts of the world, where farmers and communities engage in self-help, rather than awaiting rescue. For example, people in Ghana who had been affected by the expansion of the mining sector in Wassa Mining Region, Ghana were found to be working on a number of solutions in response to challenges the mining sector was having on their livelihoods and these included diversifying their livelihoods to include the keeping of small farm animals like goats and chickens (Adjei, 2007). It should be noted that unlike farmers in Ghana, who have come up with some proposals to resolve challenges they have faced, Libyan farmers in Qarabulli were depending entirely on the government to come up with solutions. In fact, this is not something confined to this area, but all over

the country. The government control and imposition of decisions over people for decades has made people passive towards tackling their own affairs. This copes very well with criticism made on the SLF regarding lack for sufficient consideration in respect to the impact of local culture on livelihoods (Bebbington, 1999; Knutsson, 2006).

8.2.2 Trends

Farmers in Qarabulli have over the years observed a variety of trends and activities taking place around them. The following section comments on the common trends experienced by these farmers.

8.2.2.1 Physical trends: Land use and land cover changes

Qarabulli has experienced rapid land use changes on a large scale. Analysis of data collected using Remote Sensing (RS) and Geographical Information System (GIS) equipment indicate that land use change has been taking place at a faster rate thus creating a genuine scarcity of agricultural land in areas peripheral to the Tripoli City. These findings are consistent with studies conducted in Bangladesh which revealed that peri-urban areas are affected by urbanisation because the process brings with it land use and land cover changes which often result in reduced amounts of agricultural land (Alam et al., 2016). Similarly, Thi Van (2006) in Vietnam found that when in Hochiminh city was expanding, a great proportion of agricultural land in the periphery of the city was transformed into urban areas to accommodate infrastructure such as roads and buildings.

In addition to the above, analysis of the three sampled satellite images used in the quantitative data collection phase revealed a trend of four classifications of land in Qarabulli, "Urban land" class grew in size when the 2009 photo was compared with the 1986 photo. This change is a direct result of the negative changes (reduction in size) in the areas that were originally classified as agricultural and forest lands.

Additionally, the findings from the photo analysis further reveal serious vegetation degradation and high levels of vulnerability between the periods the three satellites images were captured, as confirmed by SAVI analysis results above. Vegetation degradation and high rates of vulnerability have got many implications including potential food insecurity. Human activities including the wanton cutting down of trees by community members are also indicated as some of the critical drivers of the high rates of the vulnerability of land use/land cover change. Furthermore, the human activities have been indicated as a cause of deforestation as they not only damage the environment now but are also putting a huge risk on the availability of future natural resources. The output from SAVI model indicates further worsening of the degree of vulnerability if human activities continue at the current trends.

8.2.2.2 Environmental trends

Interaction between the researcher and research respondents via the various PRA methods employed in this study reveals that Qarabulli is witnessing an increase in land degradation and a decline in soil fertility. To the majority of the poor households in the area, the trend has heavily contributed to the decline in the yields they are getting from their small sized farms.

The continued trend in declining soil fertility has been identified as a critical factor that is responsible for reducing crop production which is also affecting the ability of most farmers to diversify their livelihood as they are unable to raise enough funds through sales of crops to re-allocate into other supplementary livelihoods.

Further to the above, another notable trend in this study is the declining water quality and quantities and this is not only adversely affecting farmers' ability to produce enough in Qarabulli but is also creating fear among the farmers. As an area that receives less rainfall, irrigated agriculture seems to be the alternative way of getting water into the

fields. However, the quality of water in the area has been decreasing over the years and farmers indicated that the water now contains too much iron and sulphur which makes irrigation an expensive adventure as irrigation pipes get corroded quickly making them unusable unless replaced.

The poor households cannot afford costs associated with desalination or any water treatment process hence they are forced to implement coping strategies that include using unprotected water sources yet these have consequent knock-on effects that include waterborne diseases and diarrhoea.

> "The frequency at which we have to change the irrigation pipes due to corrosion and rust has forced some of us to lose interest in irrigation. It is too expensive for a poor farmer like myself to change a lot of pipes in my field and when I harvest the crops I cannot even obtained half the investment I made", complained respondent 3.

In an attempt to cope with the water situation, some farmers proposed water desalination processes to resolve the problem of water supply, including irrigating. However desalinating water is proved to be an expensive process. The high costs associated with the process means that farmers are failing to improve their livelihoods as they do not have a reliable source of funding that they can use to procure the needed skills and tools to conduct desalination.

8.2.3 Seasonality

In Qarabulli district as is the case in many rural and peri urban areas of Libya, livelihoods of most households have for generations been originally characterized by crop farming as the single activity that households live on. As is often the case with such types of dependence on a single activity, the seasonality of harvests and the singleness of the

activity pursued has rendered households highly vulnerable and exposed to shocks and their associated effects.

The seasonality of farm production and unstable market prices which were described by the majority of the respondents make households more vulnerable in Qarabulli. The ever-fluctuating prices of agricultural products account for seasonality of income that households are able to gain. It was indicated by the respondents that prices are always changing due to the government policy, where imported agricultural products are cheaper than locally produced foods. Households in peri urban areas cannot fully forecast how much they would yield from sales of their products. This then makes planning for new and better livelihoods difficult, hence there are very few farmers in the area that have diversified their livelihoods.

From a cultural perspective, most of the households in Qarabulli depend on the head of the household as the core leader and decision maker on the nature of livelihoods they pursue. With such importance attached to the role of head of the household, when the head of the household migrates to urban areas in search of better and regular source of income or new livelihood, the livelihood of the entire household crumbles, until a time when the migrated head of the household starts remitting funds to the family in Qarabulli. The researcher also noted that seasonal migration of heads of households not only resulted in economic and social suffering of the remaining members of the household, but the most critical is the loss of land. Respondents revealed that migration is responsible for making some heads of households in Qarabulli to sell their land to gain money in order to make migration to Tripoli or other urban areas possible.

Most farmers practice rain fed agriculture, and the associated seasonality therefore becomes a component of vulnerability since crop production can only be attained during specific times of the year, thus making households more vulnerable to seasonal shocks and disasters such as drought.

> "It is sad that even after a season of great harvests, as farmers in Qarabulli we are still faced with the challenge of unstable market prices. It is so disempowering that after spending months working in the field the prices that our crops fetch on the market does not compensate enough for the resources used and time spent. The government seems to care more about products from outside Libya as they are cheaper than does it with its own locally grown crops" complained farmer number 13.

Resource availability, especially financial resources is another factor that has negatively affected peri urban livelihoods in Qarabulli. While the construction of infrastructures that comes with city expansion, like roads and bridges, brings new sources of income as rural labourers are recruited, such jobs are short term and hence offer only seasonal and short-term relief to concerned households.

8.3 Livelihood Assets

The researcher isolated the five capital assets recognized by the DfID framework as the stock of livelihood resources available to the rural households in Qarabulli district in their pursuit of their livelihoods.

It was realised by the researcher that households in Qarabulli are relatively close to a number of natural, human and social assets like the great artificial river, roads including those leading to the capital Tripoli. (See resource map developed by respondents in Figure 40 and map of Tripoli showing location of Qarabulli-Figure 13). Proximity to such a set of assets is a critical factor that could theoretically facilitate both livelihood intensification and diversification.

Because farmers in Qarabulli are not far from the line of the great artificial river, one would have expected that more farmers would have been engaged in irrigated agriculture. This is because the original plan and aim of the Great Artificial River was to provide the

population of the area with both household use water and water for agricultural irrigation. However, the reality seems different. Qarabulli farmers indicated that they have only benefited from the Great River in terms of water used in the household, but not for irrigation purposes. This was because in terms of water supply for irrigation, the project was not successful and no alternative solutions were made available. The farmers proposed that the government should provide desalination plants, which did not happen. Qarabulli farmers seem to have been waiting for the government to invest in irrigation schemes in their area, something which did not happen. Almost all the respondents hinted at government's failure to provide solutions for water supply regarding agricultural irrigation.

Proximity to Tripoli has motivated members of some households to opt for migration as a livelihood diversification technique. This could be classified as one of the benefits of urban expansion in Qarabulli. On a negative note, despite the income that urban dwellers are able to remit back home, migration has created challenges in that less labour is available to work in agricultural fields as more and more youths move to urban areas to engage in non-farm activities which not only promise stable and predictable income but are also considered better because of the uncertainty that comes with farm work. Unequal distribution and limited access to assets constrain households in Qarabulli from improving their economic conditions which forces poor households to overexploit natural resources as they seek new modes of survival.

8.3.1 Human capital

Like in many developing countries, smallholder farming relies primarily on traditional and non-sophisticated tools such as hoes and panga knives. As such, farming is one activity that is labour intensive, especially for farmers in rural and peri-urban areas. The availability of labour, especially if available in the desirable quantity and quality to the farmer is a very strong determinant that affects crop and animal production at household

level. The migration of youths to urban areas in Qarabulli deprives the agricultural sector of the necessary human resources that could have been used in crop production.

Out of the frustration coming with accessing water of poor quality, poor soils and the lack of access to financial services, rural farmers in the study area also identified the lack of training in how to best conduct agriculture as another discouraging factor. They have not been fully trained in new methods of agriculture that are climate smart. Respondents felt that accessing agricultural training opportunities was very important. Through such training sessions, farmers would gain new skills for handling agricultural issues but unfortunately the farmers indicated that the government does not currently provide any such capacity building support to farmers in the area. Training would also help increase their understanding of water distillation that has the potential to help sort out the issue of water. As in any other sectors, training helps people to improve their knowledge, skills and become efficient in whatever thing they are doing. Efficiency will bring about confidence and higher productivity. The failure by the Libyan government to provide training to farmers creates problems and will eventually reduce agricultural productivity.

Literature has reflected on the vital importance of training to raise awareness and to build farmers' capacity regarding agricultural skills and strategies. For example, Adato and Meinzn-Dick, (2002:16-18) referred to some examples from four countries; Kenya, Zimbabwe, Bangladesh, Mexico. This study concluded that such training contributed to increased skills and consequently increased productivity; "Training programme in fish or vegetable production in Bangladesh was clearly a valued addition to local human capital" (Adato and Meinzn-Dick, 2002:16). In Kenya training proved to have a positive impact on farmers by creating new skillful local groups who were innovative in dealing with new agricultural technology and dissemination of the use of such technology among villagers. If farmers in Libya were able to access such training, they would be equipped with agricultural strategies and means that could help improve the quality of the soil, and hence their productivity. In addition to the lack of training, the farmers also felt that the

Libyan government has not provided subsidies to make the farmers more competitive and productive so that they can ably compete with products being imported into Libya.

8.3.2 Physical capital

Infrastructure such as roads, irrigation facilities and electricity constitutes the physical capital on which farmers build their livelihoods. However, access to such assets is limited for the farmers in the study.

The Agricultural Bank was established by the government of Libya to help farmers through the provision of loans but over the years the bank changed its policies. The bank now operates like a normal commercial bank where loans are only provided to those with tangible collateral. Since land in Qarabulli is gained through inheritance, it is difficult to determine who truly owns the land hence using land as collateral is difficult. On top of this, rich politicians are using the bank to obtain mortgage loans at the expense of poor rural farms.

For example, one respondent indicated that:

> "You might have noticed that there is a large gas line that goes through our district. Although we are not sure how we benefit from that gas line, that line ate part of people's farmlands and government indicates that we cannot cultivate close to the gas line as such areas are now classified as protected area and one can get arrested for farming on such land. People whose farms were in what now is called the gas line area lost part of their livelihood when the land was changed from farmland to gas line area" F16.

8.3.3 Social capital

The study found out that the majority of people in Qarabulli belong to the same tribe and religion, such that the researcher was informed that as times get tough people have been relying on the social relationships prevalent in the area to support one another rather than seeking help through formal structures, such as trade Unions or agricultural cooperatives. While this evidences the availability of social capital, arguably the lack of formal structures of social capital has added to the vulnerability of the farmers in Qarabulli area.

Respondent 9 hinted that:

> "We look after each other in times of plenty but also when things are not working as per our expectation. Our religion teaches us that we need to support the poor and oppressed when we have anything that we can support them with" (F 9).

In an attempt by the researcher to investigate the existence of any formal groupings that could be used as collateral when accessing credit from the Agricultural Bank or other lending firms, respondents indicated that in the past there were effective formal groupings for rural farmers in the area. However nowadays, these formal groupings either no longer exist or have become very weak. This is a missed opportunity for these farmers since the presence of a credit-accessing group would have been a social asset as the farmers would have been better organised to negotiate for financial funding in the form of loans that could be used to access equipment, for example, desalinating equipment and corrosion resistant irrigation pipes. These could have been used to supply water to ensure all-year farming of crops. This could have helped improve household dietary needs in addition to bringing about more financial assets.

However, as indicated in the literature review section in chapter two of this study, use of social capitals is flawed to some extent as the reliance on social connections can create

coping strategies that induce dependency on others. Such dependency, while seemingly a good thing, could lead to over-reliance on that support and could prevent households from developing their own independent resilience. Also, in times of disaster, such as drought, each household will be struggling to manage their own needs and such support may not be forthcoming. Grootaert (2001) indicates that it is difficult to measure how much of a livelihood capital an affected household can draw on during periods of crisis that impact on whole communities.

8.3.4 Financial capital

One of the most pressing issues many farmers, especially small holders in developing countries, are confronted with is the availability and access to formal credit. As indicated above, failure of farmers to access credit from the Agricultural Bank is denying Qarabulli farmers the opportunity to increase crop production. By receiving loans, farmers would have been able to hire additional labour that could, for example, be used to cut out the grass and cultivate the farms that are idle thus, increasing agricultural productivity and enhancing livelihoods.

In addition, the lack of agricultural extension workers in Qarabulli impedes opportunities for investment and access to more profitable activities by the farmers which lead to reduced production at household level, even for those with large land holdings.

The expansion of Tripoli into its periphery has, according to the respondents, also come with increased cost of living which is making life difficult for the poor farmers to deal with, especially those who only have agriculture as the means of living.

Using PRA methods, the researcher discovered that most households are gaining very low profit from agriculture which is creating low motivation for many households to invest both time and finances into farming. Financial investment in agriculture remains exceedingly low in the study area because of high levels of poverty that exists in addition

to the absence of lending institutions. Although a number of households are still investing their time and energy on the small plots of land, the lack of affordable mechanized support to expand crop production means that incomes are decreasing each passing year.

It was highlighted by one of the respondents that farmers' requests for agricultural loans regarding expansion of agriculture from the Agricultural Bank, was refused as the farmers have no tangible collaterals. There is a change in mandate and policies for the Agricultural Bank, which now is unable to provide loans/credit to farmers. This has negatively affected the majority of farmers in a sense that they now cannot adopt new farming technologies such as desalination, irrigation, or experimenting with new crop varieties. These initiatives would have helped mitigate the damage from the shocks and could help households to cope with their vulnerabilities. The need to have channels that could enable farmers to access loans by the Agricultural bank was seen as a possible solution to people's lack of financial stamina to intensify crop production among other modes of livelihood.

8.3.5 Natural Assets

Since farming is a natural resource based activity, the need and critical role of natural resources, such as land size, soil quality, air and water, cannot be overemphasized. These resources help in ensuring that households are able to build better livelihoods that have better resilience to shocks and contribute to reduced vulnerability. Results of this study indicate that soil quality is getting poorer and poorer with the passage of each year. The poor soil quality, the result of erosion and deforestation, is rendering more and more households in the Qarabulli area vulnerable to shocks of various kinds as they have no reliable assets on which to build sustainable livelihoods.

While there are many examples of natural assets in Qarabulli, the sections below present natural assets that have a real impact on the livelihoods of the population.

8.3.5.1 Land as an asset

Urban structures like roads, shops and residential buildings that come with city expansion affect the livelihood of farmers by eating into the land on which they undertake their farming activities. Almost all the respondents during the one-to-one interviews said that that more than half of the households in Qarabulli have in one or the way or other suffered the loss of farmland as land use changed to accommodate city expansion.

8.3.5.2 Land use and land cover changes in Qarabulli

Land use change and loss of farmland constitutes a deprivation of one of the most basic and critical physical assets on which farmers secure their livelihoods. Loss of land means loss of income households could have generated from sales of crops and other farm related products. Evidence of land loss was clear and the study findings reveal that current farm sizes are generally small in Qarabulli, ranging from about 2 hectares - 10 hectares compared to previous farm sizes of up to 26 hectares in 1982.

When the researcher asked the respondents why people were complaining of having no land while there was evidence of some pieces of land laying idle, the respondents indicated that the owners of those farms had migrated to Tripoli.

> "Apart from those that have migrated to Tripoli, people in urban areas have also bought plots that were previously agricultural land and are turning them into dwelling places. As people await the constructions of houses and shops, these fields are often left uncultivated." narrated Farmer number 10.

The apparent loss of land entails a huge disturbance and sometimes destruction of livelihoods manifesting as loss of source of food and/or employment which creates a strain on poor households' livelihoods. Further to this, small land holdings affect

agricultural production resulting in hunger at household level as well as the emergence of other hardships that come with food insecurity and lack of income.

Probed further on why there seems to have been a number of changes that are having an adverse effect on people's lives, most, farmers, could not directly explain whether there was any link between the disappearance of trees in the area and the climatic difficulties people are currently facing. But there seemed to be a consensus and acknowledgement among the agronomists who participated in this study that the description of the reasons for changes that farmers have been noticing in Qarabulli can indeed be attributed to the influence of human activities. Almost all the agronomists pointed out that the reduction of forest cover in the district to accommodate new infrastructures such as roads and building could be one potential cause of poor rains that the area is now receiving.

> "Even though we lie in a desert like climate, the amount of forest cover that we have cleared out has in my opinion greatly affected the amount of rainfall being received in the area. Added to this, because we are receiving not enough rainfall, it means the amount of soil moisture is always low thus forcing the sea water which is salty to move onto our gardens replacing the original water table therein." Farmer 15 who is also an agronomist.

The agronomists also blamed the reduction in the amount of rain and water availability in the area on the massive increase in local charcoal production the area is experiencing. The agronomists suggested that the booming charcoal production industry needed to be controlled otherwise farmers in the area will face the repercussions of the charcoal industry. The existing evidence in literature and comments made by respondents in this study support the conclusion that charcoal production represents a significant challenge in the Qarabulli area. The results indicated above are supported by the documented

evidence on how declining forest cover affect people's livelihoods and patterns of rain that the area gets (Mwampamba, 2007 and Kashaigili et al, 2011).

8.4 Livelihood Coping and Adaptation Strategies

Faced with the various challenges highlighted above, this section will explore in detail how affected farmers cope with and/or adapt to the conditions they are living in.

Livelihood coping strategies include the assets whose nature could be natural, physical, financial, public, social, and human but also the activities households are engaged in either on or off the farm plus the end results called livelihood outcomes that may include food security (Chambers, 1995, Winters et al. 2002 and Ellis et al. 2003). Further to this, coping strategies include the ways through which a household gains access to the assets that help the particular household determine the living standard of an individual or households (Chambers, 1995, Winters et al. 2002 and Ellis et al. 2003).

In view of the diverse impact urbanisation is touted to have on peri-urban farmers' livelihoods, data gathered from the study area shows that households in the area use a set of diverse coping strategies. The researcher has categorized measures employed by the farmers in Qarabulli when coping with livelihood difficulties into four thus; natural resource based strategies, and non-natural resource based strategies, social networks and migration. It needs mentioning that some of the strategies employed are on a temporary basis as the households tries to figure out new ways of responding to the shocks while other adapting methodologies employed entail a complete change in the direction.

8.4.1 Selling of farm land as coping strategy

Faced with the challenges discussed above, many farmers are now abandoning farming and selling their farms to get money that they can invest in other areas where the concerned household could be earning a new livelihood. This is an example of a natural

resource based coping mechanism. Although this does provide short-term financial and social relief, the respondents agree that selling land is not a sustainable way of dealing with shocks and challenges arising from the expansion of Tripoli. It was noted that selling of land immediately reduces the amount of land available for agriculture in the area and this not only will, in the long run, affect the availability of food in Qarabulli but also in Libya as a whole. As previously opined by Lei and Bin (2008) and Satterthwaite et al., (2010) in the literature review section, the process of urbanisation helps in increasing the value of land in peri urban areas which often times motivates peri-urban farmers to sell their farmland, despite land being the only asset on which their livelihood was dependent.

Respondents indicated that farmers either voluntarily sell land to others, often these are people from urban areas who are looking for cheaper land on which to construct a dwelling and business structure. In addition to this there are other farmers who are enticed or threatened with prospects of losing their land without any compensation once the city's demand for land reach Qarabulli. Despite the mode and reason for selling the land one respondent said this:

> "The greatest problem I can foresee is that the whole country will feel the challenges that are coming from the sale of land by farmers in Qarabulli. What is scarier is that the people who are buying our farms do not continue using the farms for agriculture but rather are constructing on it new urban building" commented respondent 13 who also works as an agronomist in Qarabulli.

The fears allied by the above study respondent align with views of Jun Jie Wu (2008) who indicates in the literature this researcher reviewed that land is one of the three major factors of agricultural production. The argument put forward by respondent 13 above that Libya as a country will feel one day feel the consequences of the land selling practice in

Qarabulli since in where in most cases challenges since new land owner do not use the land for agricultural purposes. Though unpacked by respondent 13, the consequences could be Jun Jie Wu (2008) points out that being a land based activity, anything that happens to the land in terms of quantity/size or quality will always impact agricultural production including yields farmers. The reduction in crop yield for instance will entail emergence of hunger and starvation not only in Qarabulli but in Libya in general.

Eyob (2010) specifically writing about the process of urbanisation and how farmers' livelihoods are impacted in Ethiopia, points out that families that look up to agriculture as a only source of livelihood consider land as the biggest physical and natural capital on which their entire lives depend. This research affirms this statement to be true even for the people in Qarabulli where urbanisation is indicated as the number one factors that is creating multiple negative consequences on the land owned by poor and peasant farmers thus negatively affects entire lives of Qarabulli dwellers.

8.4.2 Migration as a Coping Strategy

Migration, which according to Cali and Menon (2009) is the movement of people often from a rural area to an urban area is one of the coping strategies adopted by households in Qarabulli. Faced with the numerous adversities caused by the expansion of Tripoli on their livelihoods, many people, especially the youth, have migrated to urban centres in search of better livelihoods rather than spending time on the farm. Nearly 50% of respondents indicated that they knew of at least one person who had migrated to Tripoli.

Respondent 11 indicated that:

> "Most of the youths, including my own nephew have gone away to the city in search for better ways of getting money. The jobs our sons are doing in town like cleaning, washing of cars and floors of offices and other manual tasks in the oil industry do not require very high

> education qualifications and skills. Nobody can blame these young people for leaving their households opting for a new life in Tripoli. These youths have grown up in this area and have seen for themselves that the benefits we are getting from agriculture are going down each passing year and that is surely a demotivation to these tender age group. The logical question that poses itself in this regard is who can be interested in working hard on a farm that one would see as producing less and less over years"

The above sentiment expressed by respondent number 11 matches with the views of Dyson (2011) who while concurring with Aluko (2010) indicates that push and pull factors are responsible for making people migrate from rural areas and key among the push factors are the deep-rooted hardships prevalent in many rural environments. Failure by many households in Qarabulli to grow enough for household consumption and for commercial purposes is an example of a rural environment hardship that would push away people, especially youths, as confirmed by the researcher in Qarabulli.

The respondents indicated that some households whose sons (no single respondent indicate any females being involved in migration unless in the company of the husband or father) have been in Tripoli for some time have had their household economic outlook improved through funds that their sons are remitting. However, accessed literature including thoughts of Cali and Menon (2009) and Scoones (1998) puts in a word of caution arguing that although the use of migration as a livelihood coping strategy could bring change in the financial capital of affected households through the flow of regular income remitted by the immigrants, migration is risky as it is often based on hope and faith that there is a better life in the place one is migrating to, which sometimes might not be true.

A number of respondents indicated that such migration had wrecked social and economic ties in the area especially in instances where the head of the house (a man) is the one who has migrated, a common occurrence in the area.

> "When these youths migrate to town, we lose contact with some of them. The situation is even worse when there is a wife and children left behind with no support of any kind. Although people say it does help, personally I discourage all my relatives to consider relocation to Tripoli as that ruins marriage and the entire family ties that makes us a unique people", stated respondent number 14.

8.4.3 Forest Resource Extraction – Charcoal production as a coping strategy

In addition to selling agricultural land, some households have ventured into natural resource extraction activities, mainly the production of charcoal. Charcoal production is seen by many households in the study area as a lucrative means of generating additional and frequent household income as households involved in the charcoal production are gaining income on a monthly or weekly basis unlike farmers whose crops are only sold once or twice a year. The frequency at which a charcoal producing household makes cash income is the key motivation why many households are involved in charcoal production in Qarabulli.

During the data collection period, the researcher personally witnessed how much charcoal is being produced in Qarabulli and the extent of the damage the production is causing. Being an area where most of the trees are indigenous, re-generation of the stumps from the trees being cut off is too slow, hence land is left bare for long periods of time and is consequently vulnerable to erosion. As can be seen in Figure 21 above hundreds of bags of charcoal have been produced in the area and farmers indicated that charcoal production is not only economically benefiting the concerned households in Qarabulli but

households beyond Qarabulli are also benefitting from the product since charcoal is now the most reliable source of energy for heating and cooking in most areas.

> "We know that we are not supposed to cut down trees in the way we are doing when producing charcoal but do you know that charcoal produced here is also helping people in Tripoli where electricity is not available all-day long. Yes, we are making money through charcoal selling but what will our friends in Tripoli use for cooking when electricity is not made available to them all day long" reacted farmer number 8 when asked if he was aware that charcoal production will bring environmental damage to the area (F15).

According to literature accessed in this study, Craul (2003) argues that changes in land use and land cover including the conversion of farmland and forest land into urban areas create multiple environmental challenges which impacts human life especially for peri-urban dwellers. It is therefore not surprising that among the environmental challenges that people in Qarabulli are facing and shared with this researcher, soil erosion and water pollution have been identified as the chief challenges within the agricultural sector in the district.

Surprisingly, the researcher noted that despite acknowledging that human activities such as the charcoal production, are at the core of forest destruction hence linked to poor and unreliable rains received in the area, all the respondents indicated that the lack of external support particularly from the Libyan government was limiting people's capabilities to improve or change their current situation.

While natural forces such as change in water quality and drought were singled out as shocks that nobody has control over, the responding farmers to this study feel that all

challenges require external initiative and action, especially from the Libyan government. It was therefore not surprising that personal or communal actions that people in Qarabulli can use in managing their natural resources was not mentioned by the respondents as one of the ways of reducing the negative impact of urban expansion on their area. Even after one agronomist had indicated to the group during the transect walk that unnecessary cutting down of trees and the impact of charcoal production was one of the key factors that was negatively affecting the rainfall pattern in the area, none of the respondents indicated that local population need to change this behavior.

Because of the above scenario, the researcher concluded that farmers in Qarabulli think that the Libyan Government has solutions to the many problems people are facing in the area and hence is to be blamed for failing to come to their rescue. It was noted that even small and manageable actions that would require implementation by local community leaders and farmers were not undertaken because of the belief that the government should be involved. For instance, the farmers seem not to be aware that as a community they could overcome the unnecessary cutting down of forest either for firewood or charcoal production by designing and enforcing community by-laws that would be used to punish people for doing so.

Contrary to the thinking above, when asked on what can be done to stop the booming charcoal industry in the area, respondents framed their suggestions with the “support from Government” ideology in mind as many indicated that the Libyan Government needs to develop and implement education and training programs through which people could be educated on the effects of forest destruction. It would appear that the concept of local management of natural resources through local communities has not yet been accepted and internalized by people in Qarabulli.

8.5 Livelihood outcome

A livelihood outcome that a household attains or desires to attain is the sum of the interaction of processes, policies and institutions as well as the vulnerability context under which a livelihood strategy is employed (Carney, 1998). Specifically, it has been stated that under the Sustainable Livelihood Framework, good and sustainable livelihood outcomes are achieved when proper and good livelihood strategies are employed by farmers where livelihood assets are accessed and utilised under conducive transforming structures and processes (DFID, 1999; Farrington et al., 2002). Applying this to Qarabulli, one could note that the livelihood outcomes that most farmers were aspiring to have not often been met. This was because farmers failed to fully access and utilise livelihood assets that could have helped them to attain desired outcomes.

For instance, the study results reveal that financial capital that could have been used in intensifying farming at household level or when engaging in a new form of livelihood, is not fully accessed by peri urban farmers due to changes in the policy of the Agricultural Bank in Qarabulli. This lack of access and utilisation of assets has increased farmers vulnerability and exposure to shocks such as pests and droughts which are prevalent. This is something which relates to government policies. Providing that farmers remain passive towards coming up with proposals for resolving problems they face coupled with the current political instability and social unrest in Libya, it seems that there would be no solution for this problem, at least in the near future.

Further to the above, while pests and other shocks could be managed through genuine and proper government policies, actual expansion of Tripoli means that land originally for farming is being converted into urban land a process that is negatively affecting livelihood outcomes in the study area. The researcher noted that there are direct consequences of loss of land due to urbanisation on farmers' livelihood outcomes. The reduction in agricultural land reduced farming activities, which in the case of Qarabulli

was responsible for low food production. Coupled with continued changes in soil quality due to contamination (pollution), where salinity levels are annually increasing, farmers are getting lower yields each passing year. This scenario presents a contradiction with the ultimate objective of the SLF whereby the desire for households is to improve food security.

The study results further revealed that livelihoods in the study area are characterized by single activity, which is crop farming. However, the researcher noted that seasonality of crop harvests and the singleness of the activity have been and continue to be making peri urban households highly vulnerable.

Despite the challenges indicated above, the study also found that a minority of households have been able to obtain greater well-being in general despite the obvious challenges urbanisation is bringing to households in the area while the majority of the households have not. For example, while city expansion is blamed for loss of labour through migration, for some fortunate households, this has resulted in the development of new livelihood activities through the investment of the remittances the migrants are sending. These investments into new livelihoods, such as retail shops along the newly constructed roads towards the cost and charcoal production are very positive as it helps the concerned households to diversify their income and become more capable of dealing with shocks that the household might be exposed to.

The model in Figure 60 below summaries the research finding by linking the process of urbanisation and livelihoods of people of Qarabulli. The model further shows the identified effects and the ways through which the livelihood issues and changes this researcher has uncovered, impact on the people in Qarabulli and how these are linked to urbanisation. Lastly the model also presents identified causes of the challenges faced plus the consequences the changes are having on people in peri-urban areas of Tripoli, a city that is continuing to grow towards its peripheral areas.

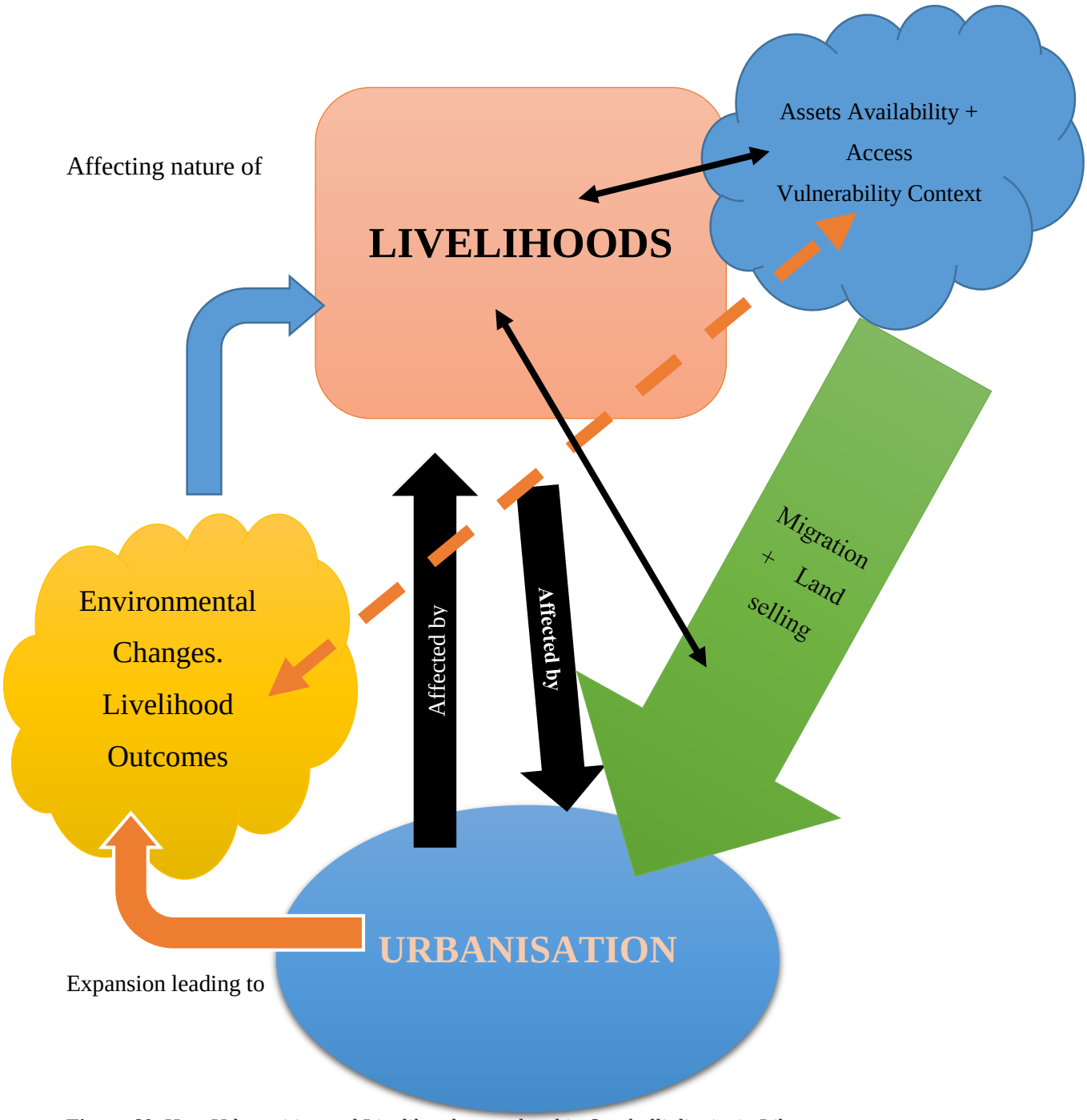


Figure 60: How Urbansaition and Livelihoods are related in Qarabulli district in Libya

Source: Developed by the Author using research findings

The above model presents a complex relationship that currently exists in Qarabulli. Based on the research findings of this study, there is no single route of relationship between urbanisation and livelihoods that peri urban farmers in Qarabulli are pursuing. From Figure 60 above, one notes that urbanisation has an impact on the nature of the livelihoods in which farmers are involved in the study area. While this is the case, livelihoods that people in Qarabulli are pursing also impact the process of urbanisation. For instance, while it is a perquisite condition that a city grows only where land is available, in Qarabulli the availability of idle land and land that is easily sold out by farmers act as conducive factors for the growth of Tripoli. Further to this, access to assets that could be used in earning a livelihood is affected by the levels of vulnerability of particular households.

While other households resort to selling land and migrating to Tripoli, searching for non-farm jobs, the process of urbanisation in this case acts as a pull factor to people in Qarabulli. The model also reveals that the process of urbanisation is impacting the environments in peri-urban areas. Since livelihood is environment based in peri-urban areas, this is negatively impacting many households in Qarabulli. As indicated above, the loss of trees in the area either through charcoal that is used to fuel the growing urban area and scarcity of non-salty water in the region seem to be greatly impact the amount of yields a household can get. Coupled with the fact that farmers in Qarabulli cannot access any type of loan, the amount of yield and investment that a farmer can make keeps decreasing with the passage of time.

8.6 Chapter conclusion

Using the SLF approach as the overarching research framework, this chapter has presented research results from both the first and second stages of the data collection process. As concluded by Carney (1998), Scoones (1998) and Ellis (2000) the five capital

assets referred to in the SLF in Figure 8 have been affected by a number of factors that are natural but also man-made. The failure to create or access these five sets of assets is directly impacting on the ability of farmers to increase production and to acquire higher additional and sustainable income.

The thesis confirms what the literature review presented that the process of urbanisation is a 'transforming factor' that presses both positive and negative impacts on people's livelihoods especially in peri urban areas. The process according to the research findings suggests that urbanisation has actively shaped the nature and magnitude of livelihoods that people in peri-urban areas are able to pursue. It has been found that among others, the expansion of Tripoli means that land use is changed, often from agricultural use to urban settlement thus making the farmers lose the land on which rural households depend.

The land use and land cover analysis has shown that city expansion is characterized by horizontal physical expansion against agricultural, forest and bare land.

Using the SLF as the conceptual framework, this chapter linked the research findings to the research frame and through this linkage, this section highlighted the impact, both positive and negative, that the expansion of Tripoli has had on the livelihoods of these rural households in Qarabulli. It further identified ways that farmers attempt to cope with the effects of urbanisation. The context in which the poor rural households pursue their livelihoods and the factors which make their livelihoods vulnerable have also been covered in this section. The forms of capitals, namely livelihood assets, available to the rural households were discussed.

Chapter 9: RESEARCH CONCLUSION

9.1 Introduction

Although a number of research works have been undertaken in Libya exploring the impact of urbanisation and the expansion of urban areas into peripheral areas, no studies have been undertaken, using GIS and Remote Sensing technologies and Participatory Rural Appraisal methodologies. This study thus offers perhaps one of the most comprehensive documentations to date in Libya of the effects of urbanisation and city expansion on land use and the livelihoods that peri urban farmers pursue.

This study had six main objectives: firstly, it aimed to identify land use/land cover changes that were emerging from recent urbanisation processes in the eastern part of Tripoli. Secondly, it aimed to examine and identify the nature of lands that have experienced the most change due to urbanisation. Thirdly, it aimed to identify the factors associated with the urbanisation processes that act as drivers of land use changes. The study sought to examine the effects of urbanisation on farmers and the challenges they face plus the decisions farmers make in order to manage these challenges. Finally, the study wanted to find out how farmers are responding to the challenges they are facing as they engage in agriculture.

Using the DfID SLF livelihood model, the key findings of this study are presented.

9.2 Land use and land cover changes

Analysis of satellite images used in this study revealed that land classified as urban land has been increasing in size at the expense of agricultural and forest lands, which have been shrinking in size. The study further reveals that over the past two decades, the eastern part of Tripoli, where Qarabulli district is located, has experienced some sizeable land use changes. Land classified as urban areas has been increasing in size resulting in

the reduction in size of agricultural and forest lands. This finding concurs with accessed literature that indicates that urbanisation imposes demographic and economic pressure on peri urban areas when farmers lose agricultural land to accommodate infrastructures that come along with urban expansion. The often-non-stop movement of people from rural areas to urban areas creates demand for more land to meet infrastructure developments, thus leading to encroachment onto land that previously was not assigned for human settlement, including fertile lands where peri urban farmers could have been conducting agriculture.

This result means that city expansion and the urbanisation process in general affects in a negative way the nature of the livelihood farmers rely on, as the reduction in farm sizes is directly reducing crop production. The reduced crop production entails that some households end up being insecure in terms of food and have no other means than exploring new livelihoods outside agriculture.

This finding is consistent with what Tran Thi Van (2006). He concluded that a great proportion of agricultural land was transformed into urban areas. Furthermore, similar results are indicated in studies that Ali et al., (2008 and 2011) conducted on land use/land cover changes where the SAVI was used to assess the degree of change of vegetation cover. It was Ali's et.al, (2011), which indicated that the area under investigation experienced serious vegetation degradation and vulnerability over time and this has been affecting agricultural production leading to increased food insecurity in peri urban households.

Based on the analysis of the satellite images used in this study, land originally marked for agricultural and forest in Qarabulli district has experienced the most change due to urbanisation. For instance, about 2381 hectares of land have been changed from agricultural usage to urban use during the period 1986 to 2009. Furthermore, satellite

image analysis revealed that land classified as farmland area has experienced the most change compared to other land classes.

Change in land use is not only evident in the size of land gained or lost by a particular land class. Other factors contribute to land use change in the study area. These are soil degradation, which seems to be stemming from human actions such as land clearing and deforestation by people who are engaged in charcoal production and/or continuous cultivation of land without following the agricultural cycle.

9.3 Changes related to urbanisation

The expansion of Tripoli into the Qarabulli district is not always negative. It helps in improving the human as well as financial capital through the provision of markets where farmers can earn more money. This, in theory, could then help them diversify their activities, which according to the DFID SLF, would help farmers venture into new and more sustainable livelihoods. However, to counter that, as more people, especially the young, leave Qarabulli for Tripoli in search of new sources of income, urbanisation is responsible for the destruction of the human capital on which rural farm household survival is based. Additionally, the change in lifestyle for many people who leave rural areas and start living individualist lifestyles also affects the social capital that households can access in times of need. More positively, literature (Narrain & Nischal, 2007; Thuo, 2010) has shown that despite leading to new lifestyles, urban life still provides space for households to have social interaction through friendship and new religious and professional groups through which people can still gain social and financial capital that they can rely on.

Analysis of the urbanization process in Libya, indicates that the theory of Modernization (Fox, 2012) can be used to explain factors leading to urbanisation in Libya, but the Urban Bias Theory (Dutt and Noble, 2003) is judged by this researcher as the best theory that can be used to explain the urbanisation process in Libya. While the Modernization

and Dependency theories focus on economic factors as fuel for urbanisation, the urban bias theory views urbanisation as a product of political policies and interferences (Fox, 2012). A closer look at Libya reveals that since Tripoli is a political and administrative capital, most policies are developed in favour of the city which in turn makes the city to have more amenities and facilities which act as pull factors for people living in the peri urban areas. Coupled with the lack of support from the government, the respondents feel that there is a bias by various government agencies for urban dwellers, which entail that there is a limit to the nature of livelihoods that rural farmers can pursue.

The study findings also indicated that in the eastern part of Tripoli, farmers are not able to produce more crops due to low and erratic rainfall. The farmers attribute this to environmental damage that has been happening in the area, including the expansion of urban land. Morse and McNamara (2009) pointed out that being a 'multiple capital' approach, the SLF demands that sustainability of a household outcome is only guaranteed when the household has at its disposal natural, human, social, physical and financial capitals as this helps reduce vulnerability to negative trends, shocks and stresses that damage progress towards a desired livelihood. Clearly farmers in Qarabulli are not in possession of all the relevant capitals that can assist in sustaining their livelihood let alone help the farmers to diversify the nature of livelihoods they are pursuing.

Another issue, which emerged from the study, was the appropriation of social capital. The concept of social capital generally refers to the quality of social relations and their impact on lives. Unlike other forms of capital, social capital is based on the structures of relationship that exist between actors and among actors (Coleman, 1988). In this study, it was discovered that although there are strong links among households in Qarabulli, based on tribal or religious affiliations, there are no formally established forms of social networks or associations through which farmers can access social capital for use in intensifying or starting a new livelihood.

In addition to the above factors, land use changes in Qarabulli are also being influenced by outward migration where a number of youths are moving out of the district having been lured into urban centres with prospects of non-farm and well compensating jobs. The research reveals that although the majority of the respondents seem to look at migration to Tripoli as negatively affecting livelihoods in Qarabulli there are some pockets of households that are positively affected by migration as some people have managed to secure jobs in Tripoli and send remitting funds to their relatives in Qarabulli, which have then been used to meet the daily needs of the households. These remittances have enabled some of the affected households to diversify their livelihoods as the remittances are viewed as new sources of income. This new source of financial capital is helping households to sustain livelihoods. On the contrary, other farmers consider migration as responsible for increasing numbers of idle plots, because the owner or head of household has migrated to Tripoli and the remaining members do not have the capacity to farm on the land.

Migration is therefore having both negative and positive impacts on Qarabulli farmers, depending on their circumstances.

Other studies of farmer behaviour in peri urban areas found that farmers losing land due to urbanisation engage in petty trading and rearing of small livestock like chickens (Takasaki et al., 2006; Adjei, 2007). In Qarabulli the situation is different as only very few respondents indicated that they were able to venture into new forms of livelihoods, but the majority were not because they did not have capital. Although there were varying views and thoughts on how to mitigate the challenges, it appears that the majority of the participants think that the Libyan government needs to be highly involved in supporting rural farmers.

Additionally, the farmers would want to see the Libyan government provide subsidies to rural farmers that would help increase the farmer's potential to produce farm products

that would compete with those currently being imported from other countries. The researcher feels that if the Libyan government does not deal with the issue of providing agricultural training and support to farmers as a matter of urgency, there will be more negative consequences on the farmers and productivity levels will continue to go down thus increasing vulnerability and poverty levels for most rural households.

9.4 Conclusion

Expansion of cities around the globe, as an indication of urbanisation, has been at the centre of debates involving development experts for many decades. It is generally agreed that city expansion in terms of physical size is an indication of modernization and economic prosperity. However, the expansion of cities comes at a cost as it is alleged that the process influences agricultural areas and particularly the livelihoods of farmers, especially those living in fringe areas of the growing cities. The expansion of cities is said to be responsible for causing environmental damage and reducing land sizes as agricultural land is being transformed into other uses that serve the needs and demands of urbanization. In Libya, there is a high concentration of population in the northern part of the country as a result of the movement of the rural population to the cities leading to high demand for land where residential buildings have to be constructed in the area.

As argued by Scoones and Wolmer (2003) supported by Morse and McNamara (2009:4) the DFID SLF indicates that a livelihood is only classified as sustainable if it is able to "cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base."

From the study findings, it can be concluded that although Qarabulli is an area that relies on agriculture, the expansion of Tripoli has made agriculture an unsustainable livelihood for most households. It is only through the critical examination of the challenges that farmers are facing and provision of long term solutions to such challenges that agriculture would be a sustainable livelihood for households in Qarabulli.

9.5 Study recommendations

The study findings have revealed that the horizontal expansion of Tripoli is having some far-reaching consequences on the agricultural sector within the surrounding area. There is need to mitigate the effects of city's expansion on agricultural land and there are some fundamental agricultural reforms that the Libyan policy makers have to work on in order for farmers to benefit more from their engagement in the agricultural sector.

There is a need for deliberate efforts and policies to be made that would help enhance the capacity of the farmers in Qarabulli district to make better and well informed decisions so that they are able to improve their household's well-being.

Policies that will help increase farmers' financial capital are required. Efforts to make tailor-made financial assistance to poor households could take the form of a soft-loan that would help the households to expand and diversify livelihood activity for greater well-being. In addition to the soft loan, more financial assistance could be given to farmers with large land holdings that will facilitate their farming by helping them to venture into mechanized farming by enabling them to purchase agricultural inputs like hybrid seeds and fertilizers. Agricultural mechanization and the use of hybrid seeds will help to reduce human effort while increasing per hectare production. Thirdly, assistance in the form of capacity building sessions in business and financial management, plus the availability of loans, need also to be rendered to households in Qarabulli so that they can diversify their livelihood through livestock rearing and petty trades to supplement their current livelihoods.

As a result of this study several recommendations can be made:

a. The Libyan Government should put in place proper planning for urbanization in order to avoid the housing development activities taking place in the agricultural lands and have proper control of the expansion of the cities.

b. The Agricultural bank should return to its mission of providing support to farmers and should have regular interaction with the agricultural sector and involve farmers in the decision making process.

c. Government should introduce and implement a reform programme within the agricultural sector- including, among others, tough regulations, which would help regulate the pricing of locally grown crops. Further to this, the reform should incorporate strategies and guidelines on how the capacity of peri-urban farmers can be enhanced so that they are able to access and utilise fertilizers, pesticides and seeds but also be able to effectively manage available natural resources. This means farmers need to organize themselves in some sort of associations to engage in constructive dialogue and negotiation with the government so as to come up with their own proposals and to be an integral partner in tackling these problems/ challenges facing the agricultural sector in general and Qarabulli area in particular.

d. In collaboration with the farmers, government should design awareness programmes and tough regulations in relation to the preservation of forests and immediately stop cutting trees. Reforestation and planting of trees should be encouraged in areas where deforestation and desertification are most evident. Tackling the above-mentioned issues needs awareness and capacity building programmes that could help to change the reality of farmers from entirely depending on government to resolve the challenges they face. Establishing associations and trade unions would help to encourage self-help ability rather than waiting for the government to come up with everything. The long lasting government control and top-down approach of policy initiation and implementation could only be changed through pro-active involvement of the farmers themselves.

9.6 Study limitations

The ultimate goal of this research was to use quantitative and qualitative research methods to examine the effects of city expansion on surrounding agricultural areas and the implications the changes are having on farmers' livelihoods in Tripoli, Libya. Although this was largely achieved, the research process, as is always the case (Denscombe, 2014; Bryman & Bell), has some limitations.

The first limitation rests on the period when the study was conducted. The study was conducted at a time when Libya was undergoing a number of institutional and political changes following the now infamous Arab Spring. The tension that is still prevalent in Libya and the fear that the Arab Spring has had on people acted as constraints that considerably limited the way the researcher and respondents could interact. This meant that many people in the study area were nervous and uncomfortable about engaging in groups or meetings that might be misconstrued as political meetings.

Secondly, the uprising and the change of the regime heavily affected operations of the Libyan government and its ability to offer critical and essential social services. Frustration on the part of people due to their failure to access such services made some refuse to be involved in data collection. Those who backed the study indicated that they were looking for something that would quickly satisfy their households needs like money and food not just conversation with a researcher. Based on the fact that the researcher only managed to interact with 16 farmers who participated in the one-to-one interviews, the research finding could be questioned with respect to validity as the sample size seems to be small but the researcher argues that the results then should be understood based on this context and limitation.

Thirdly, this study has made use of Remote Sensing (RS) and Geographical Information Systems (GIS) technology in the first stage of the data collection exercise. As is the case with the use of technology when conducting data collection, there are issues of accuracy,

such as the satellite image data, which could have limited the accuracy of the findings on the changes that have taken place in the area subject to some limitation issues. However, there is no evidence to suggest that this is the case with this study.

Lastly, the current study design was also limited. Apart from the security issues indicated above, the geographic and demographic scope, financial and material resources and time were identified as additional constraints. As indicated above, the study only focused on Qarabulli district in eastern part of Tripoli. This was mainly because it was identified as a vulnerable area after analysis of the satellite images. Within Qarabulli only those who were actively earning a living through agriculture were involved. Due to this narrow geographic scope the generalization of the research findings will always be affected by such limitations. It needs to be noted that with more time and resources, the researcher would have wished to expand the study to include other cities in Libya and access more satellite images for a better and more in-depth analysis to be conducted.

9.7 Future research work

The researcher would like to take this opportunity to offer an advice on what other related research works can be conducted to complement this study. Research of the following magnitude and nature would be critical:

- Research using the PRA tools should be undertaken to include migrants who have moved from rural areas into the city and women and children who may have different opinions and insights. The experience of this research shows that there is a need for qualitative surveys with a wider sample that should cover all segments of the farmers' community, especially women and children.
- Another area of future research which seems to be very relevant to the area and the community in the area of the study is ethnographical research. Ethnographical studies mainly use observation to collect data and directly involves with

communities which would reflect different aspects of social processes and implications of changes on livelihood.

- Research should be undertaken by exploring the changes that migrants from rural to urban areas have experienced.

9.8 Contribution to knowledge

Although considerable studies have been conducted on impact of urbanisation in North African countries, little or no research has been explicitly conducted to examine the effects of expanding cities on the agricultural areas in peri-urban zones in Libya, which was the focus of this study. This represents an important aspect of contribution to the current levels of knowledge. In particular this study provides a fresh perspective on how urbanisation processes affect livelihoods of local farmers in peri-urban zones and the nature of strategies that farmers have employed for coping with the changes emerging from urbanisation. The empirical knowledge that has been developed through this study, the first and only one of its nature conducted in Libya, is one key element of the study's originality. It is a bare fact that other future studies will learn from this research.

Apart from showcasing originality through the location where this study was conducted, this research further demonstrates a unique dimension of study originality through the blending of Remote Sensing research methods and participatory social sciences methodologies in one research. This research seems to have managed to bridge a long standing gap where studies that failed to incorporate Participatory Rural Appraisal approaches (PRA). The incorporation of PRA approaches in this study was critical as through the approaches the researcher managed to gather and highlight issues that have previously been ignored when researchers studied land use and land cover changes through the use of mainstream methods only like Remote Sensing. This said, it can also be indicated that this is the first known study not just in Libya that has endeavoured to explore implications of land use/land cover change on farmers' livelihood in Libya by

using this type of method (PRA). By employing PRA in data collection, this study generated information that will tell more about the human, or livelihood impacts, of land use and land changes. The use of PRA in Libya has not been recorded prior to this study, and again, it represents a significant contribution to understanding how Libyan farmers are responding to change, in their own words.

Lastly, though not the least amongst the through which this study has demonstrated originality, lies in the model in Figure 60 (above) which is a product of the SFL but has been used to conceptualize the consequences of urbanisation on the nature and magnitude of livelihoods in which people are involved in Qarabulli.

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Appendices

Appendix A: Sample Ground points chose study areas which cover by layers

Images captured by satellite in 1986, 2003 and 2009.

X (E)	Y (N)	Plot no	1986	2003	2009
343773	3632745	1	0.6	0.4	0.2
342453	3633090	2	0.4	0.3	0.1
341133	3633235	3	0.6	0.2	0.1
340023	3633660	4	0.6	0.3	0.1
338613	3632850	5	0.6	0.4	0.1
338133	3633210	6	0.7	0.4	0.3
339003	3635265	7	0.5	0.3	0.1
340233	3635370	8	0.4	0.3	0.1
340923	3635775	9	0.5	0.4	0.1
341838	3635910	10	0.7	0.3	0
339648	3636705	11	0.4	0.3	0
342033	3637335	12	0.8	0.4	0.2
340698	3638340	13	0.6	0.4	-0.01
330044	3639079	14	0.5	0.2	0.1
329219	3640032	15	0.4	0.3	-0.01
330539	3640354	16	0.5	0.4	-0.04
331134	3640632	17	0.7	0.2	-0.05
331338	3637410	18	0.4	0.2	-0.2
333513	3638805	19	0.5	0.4	0.1
342917	3637981	20	0.5	0.3	0
343540	3638439	21	0.7	0.2	0

344082	3638890	22	0.4	0.1	0
343786	3638890	23	0.4	0.2	-0.1
343719	3639167	24	0.6	0.04	-0.04
350020	3643178	25	0.4	0.2	0.08
350170	3643088	26	0.5	0.3	0.2
332680	3635648	27	0.5	0	-0.1
331540	3634448	28	0.6	0.3	0
329770	3633728	29	0.5	0.4	0.3
330910	3632108	30	0.4	0.1	0
330610	3631718	31	0.5	0	0
330580	3631088	32	0.6	0.5	-0.1
329260	3630548	33	0.4	0	0
330890	3629987	34	0.4	0.2	0.1
330826	3629646	35	0.4	0.1	0
330830	3629410	36	0.5	0.5	0.1
330372	3628900	37	0.4	0.2	0.1
331149	3627636	38	0.4	0.2	0
331572	3627433	39	0.4	0.4	0
332352	3627640	40	0.4	0.2	0.1
332742	3628195	41	0.4	0.3	0
332926	3627696	42	0.3	0.2	0.1
334036	3627171	43	0.2	0.1	-0.2
334842	3628978	44	0.5	0.4	0
342460	3639308	45	0.5	0.3	0.07
344410	3637628	46	0.4	0.3	0.1
342490	3637118	47	0.6	0.3	-0.06
341980	3637184	48	0.6	0.5	0.1

344320	3637748	49	0.5	0.3	0.2
342010	3638108	50	0.7	0.4	0.1
342730	3635948	51	0.4	0.2	0.1
341740	3636248	52	0.5	0.5	0.2
343210	3633848	53	0.2	0.1	0.09
343150	3633908	54	0.2	0.05	-0.2
344290	3637658	55	0.6	0.5	0.1
339280	3635768	56	0.5	0.5	0
336700	3630248	57	0.4	0.3	0.2
338410	3639218	58	0.5	0.3	0.2
342100	3638618	59	0.4	0.2	0
350170	3642728	60	0.4	0.3	0.1

Appendix B1: Summary of Interview Questions:

Interview question	Answer
Occupation	
Age of farmer	
Acquisition type	
How many hectares	
Which type of irrigation do you use?	
As a farmer, what kind of problems do you face in your area?	
What are the causes and effect of deforestation in your area?	
What are the reasons that promoted farmers to sell the entire farm or part of it?	
Was the farmland that has been sold produced crops? Did the productivity of the land change?	
What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli? How they deal with these changes?	

Appendix B2: Questions and answers interviews with KI in Qarabulli, 12August-20 Sp.2013

F1	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer
	Age of farmer	50 years
	Acquisition type	Private
	How many hectares	4 hectares
	Why do you grow crops?	Commercial
	Which type of agriculture do you use on this land?	Rainfed and irrigated farming
	What kind of problems do you face in your farming area?	There are many problems: • Soil quality and water shortage • Government does not encourage farmers as a result there is failure to combat agricultural pests and diseases. • Government does not to establish agricultural associations • Some farmers don't use drip irrigation. This is because the government has sponsored an agricultural plan to enable farmers in the area to practice irrigation fed agriculture. 'Qarabulli Agricultural Project' was one of the very successful project in whole Libya. Both, the government and the farmers benefitted from it by cultivating crops and breeding animals. Shortage of water in the area have compelled most farmers to depend on rain-fed agriculture, though rain-fall is fluctuated and not dependable. Some farmers use salty water for irrigation, however salty water blocks irrigation pipes, which are expensive to replace.
	What is the effect of deforestation and what are its causes?	The following are the effects: • Negative impact on the vegetation cover leading to degradation • Sand drift movement happening • Increase of temperature • People would like to get too much money and forget about the public interest. Department of Agriculture is doing a good job by sending agronomists from time to time to provide farmers with technical support such as, new farming techniques. The role of the agronomists is diminishing. When we asked why, they told that the Government reduced supporting them financially to do their job and they are no longer receive training.
	What are the reasons that prompted farmers to sell the	Expanding cities and urbanisation activities push farmers to sell their farms and turn them into buildings with no proper study of the

	entire farm or part of it?	state and the existence of solutions.
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	It is true that the productivity of the land changed. Land change has a negative impact on farmers. Hence, the lack of interest from agriculture caused by the government not supporting farmers, led to a clear negligence by the farmers to this agricultural land and as a result they sell the lands or not simply exploit it.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	• The expansion has a negative impact on farmland due to urbanization • However, it has a positive impact on improving the level of living standard of individuals to solve their social problems. • The other positive effect is that it provides services to people, whether commercial and service.
F2	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer
	Age of farmer	55 years
	Acquisition type	Self-sufficiency
	How many hectares	5 hectares
	Which type of agriculture do you use on this land?	irrigated farming
	What kind of problems do you face in your farming area?	Water problems include: • lack of water for irrigation made farmers increasingly dependent on rainfall, which is fluctuated and unreliable. In this respect, we are aware of the government plans for irrigated farming projects to help farmers in rural areas, however these plans have not been implemented. One-day Qarabulli hosted one of the best and most successful Government-owned Agricultural project, which was 'Qarabulli Agricultural Project', but this project was dismantled and became only history.

		• decrease of water table • increase of the percentage of sulphur in the water wells Soil problems include: • Lack of nutrients in the soil • Increase agricultural pests All of these problems have contributed to the decline in agricultural production. Sometimes ago the Department of Agriculture was able to contribute to resolve this problem by sending Agronomists to provide support for the farmers; to improve farmers' capacity and knowledge of new farming techniques, including the use of chemical fertilizers. However, these days there is no support from the government.
	What is the effect of deforestation and what are its causes?	The effects are: • increase soil erosion • increase sand drift movement • increase of temperature Reason behind this is that people need money and people are not taking into account the public interest
	What are the reasons that prompted farmers to sell the entire farm or part of it?	The main reason is the difficulties faced by farmers including: • water shortage • Lack of productive capacity of farm Material benefit
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	Although most land in Qarabulli area was good, the farm lacked productive capacity.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production
F3	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer

	Age of farmer	48 years
	Acquisition type	Commercial
	How many hectares	10 hectares
	Which type of agriculture do you use on this land?	irrigated farming
	What kind of problems do you face in your farming area?	Water problems including: • lack of rainfall; this is one of the biggest problems. The government promised to resolve this problem by providing water reservoirs and by constructing the Artificial Libyan Great River. If such plans were successful, there would have been some irrigated agricultural projects. I heard from my father that the situations were much better in 1970s. I remember he spoke with admire regarding Qarabulli Agricultural Project that was established during King Sanussi's government and was further developed later by Gadaffi government. Right now, the government is not supporting irrigated agricultural projects. We only depends on rain, which is fluctuated and completely not reliable. • decrease of water table • increase of the percentage of sulphur in the water wells Financial problems including: • Lack of support from the state for farmers • Rising prices of seeds, fertilizers, pesticides and agricultural equipment. The frequency at which we have to change the irrigation pipes due to corrosion and rust has forced some of us to lose interest in irrigation. It is too expensive for a poor farmer like myself to change a lot of pipes in my field and when I harvest the crops I cannot even obtained half the investment I made. • The government does not control seeds, fertilizers, pesticides. It is very strange that these pests are increasing not just in number of pests attacking our crops but the types are also becoming many. In the old days, we used to have pests that only attacked lettuce but nowadays almost every crop we are growing has its own kind of pest which is quite disheartening. We are having so many problems with farming nowadays and it is better to just sell the land than waste time and resources working in the farm where the yields will not even feed the family All of these problems contribute to the lack of agricultural production. The lack of financial support from the Libyan

		Government to the department has over the years been the main constraint towards efforts to improve farmers' capacity and knowledge of new farming techniques.
	What is the effect of deforestation and what are its causes?	The effects are: • increase soil erosion • increase sand drift movement • increase of temperature Farmers are doing this for financial reason and people do not take into account the public interest
	What are the reasons that prompted farmers to sell the entire farm or part of it?	Reasons are the difficulties faced by farmers: • water shortage • Lack of productive capacity of farm • Material benefit
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	Yes most land in Qarabulli area was good. But there is lack of productive capacity of farm and there are several factors behind it such as • rainfall shortage • groundwater unfit for agriculture
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	• Expanding cities Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production • They also have a positive impact on improving the level of living individuals to solve their social problems and Provide services to people, whether commercial and service.
F4	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer
	Age of farmer	71 years
	Acquisition type	Private
	How many hectares	15 hectares

	What is the purpose of agricultural?	Commercial and for self-sufficiency.
	Which type of agriculture do you use on this land?	Rainfed and irrigated farming..
	What kind of problems do you face in your farming area?	The problems are as follows: • Water resources are not available with failure to maintain and rationalize the use of water. We heard and have seen some genuine efforts made by the government to resolve this problem, such as constructing the Artificial Libyan Great River. However, such plans did not work. Qarabulli Agricultural Project was very useful for small farmers and the government as well. But, nowadays there is no such project. • Lack of technical support: For the last three decades, the Government financial support to the Department of Agriculture significantly reduced and hence efforts to raise farmers' awareness and to improve their capacity and knowledge regarding new farming techniques and soil preservation have stopped. • Lack of soil quality due to excessive use of chemical fertilizers and pesticides • Lack of rain led to failure of rain-fed agriculture • increase spread of agricultural pests The above problems led to: • Low agricultural production • Reluctance of farmers for agricultural • May encourage farmers to leave farming activity
	What is the effect of deforestation and what are its causes?	Effects of deforestation are: Its impacts on the vegetation cover causing degradation sand drift movement. The reason behind it is to get too much money and people do not taking into account the public interest. Social and financial implications include: Increasing population density and high land prices.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	• High land prices encouraged farmers to sell it and to get money. • The population density in cities and on the coast expands rapidly over the agricultural lands and that provides financial incentives to farmers to sell their farms or sometimes they turn them into buildings with no reference

		to the state.
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	yes this land were of farmland with good production yes change land Have a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or not exploited causes behind land productivity change such as lack protect the earth from different diseases • Lack of rainfall for long periods • Lack of groundwater
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	• Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production It can also have a positive impact on improving the level of living individuals to solve their social problems and provide services to people.
F5	**Place of Interview**	**Qarabulli area**
	Occupation	farmer
	Age of farmer	68 years
	Acquisition type	Private
	How many hectares	2 hectares
	What is the purpose of agricultural?	Commercial & self-sufficiency. the Qarabulli Agricultural Project was a good example of a mixture of commercial and self-sufficiency. This project was very good for the farmers and the country.
	Which type of agriculture do you use on this land?	irrigated farming, but we always suffering from shortage of water. The government has done very little to resolve the problem and support us.
	What kind of problems do you face in your farming area and What are the effects of these problems?	Farmers' problems: • Increasingly depending on rain-fed agriculture with fluctuation of rainfall and sometimes no rain at all. • decrease of water table • government does not support farmers:

		This is very clear in the recent years, the Government stopped providing financial support to the Department of Agriculture and to farmers. The agronomists complained that due to financial constraints, they cannot do their job in raising farmers' awareness and to educate them with regard to use of chemical fertilisers and improved seeds, etc. We as farmers are no longer receive loans from the Agricultural Bank to help us in carrying on the job. • agricultural bank does not encourage farmers • Rising prices of seeds, fertilizers, pesticides and agricultural equipment. Effects: Lack of agricultural production, Desertification in farmland, Construction on agricultural land, Causing the increased import of agricultural production Failure to protect agricultural production
	What is the effect of deforestation and what are its causes?	• Impact on the vegetation cover degradation • sand drift movement • increase of temperature Financial reasons push farmers to sell their farms or convert their farms into housing development. There is also lack of security and the spread of weapons everywhere in this time.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	• Financial reasons because of expensive land prices • Switch to trade rather than agriculture • lack of water table • lack of rainfall
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	• Yes this land was good in terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes change land has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers on this land. They then sell it
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization due to the increase in population and lack of land prepared for construction and the lack of specialist destinations to configure and residential units anchored to make people who build in agricultural Ground and increase the number of farmers' sons saluting everyone wants to build a private residence on this land then transformation to Residential Land

F6	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer
	Age of farmer	63 years
	Acquisition type	Private
	How many hectares	4 hectares
	What is the purpose of agricultural?	Commercial & self-sufficiency
	Which type of agriculture do you use on this land?	Rainfed and irrigated farming. However, water for irrigation is a big problem. We only depend on privately-owned wells. We need to dig deeper and deeper to get the water and sometimes it is salt water. So, the cost of irrigation has become higher.
	What kind of problems do you face in your farming area and What are the effects of these problems?	• lack of rainfall • decrease of water table • government is not support farmers No financial support from the bank to the farmers. No support from the agronomists; though they have been trying their best. the agronomists from their side blamed the government for cut off financial aid. So, prices of agricultural inputs (seeds, fertilizers, pesticides, agricultural equipment) increased to a very high level. • Lack of harvesting machines • Problems facing farmers how to sale or disposal their production also prices go up and down. Effects: Declining of agricultural production, Desertification in farmland, Construction on agricultural land, Causing the increased import of agricultural production Failure to protect agricultural production
	What is the effect of deforestation and what are its causes?	impact on the vegetation cover degradation sand drift movement, increase of temperature, Reason to get to much money, Increase the number of Family and people are not taking into account the public interest & the lack of security and the spread of weapons everywhere in this time

	What are the reasons that prompted farmers to sell the entire farm or part of it?	Expensive land prices Switch to trade rather than agriculture lack of water table lack of rainfall
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	• Yes this land was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes change land Have a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or not exploited
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to random expansion on Countryside in all directions around the city of Tripoli due to the increase in population and lack of land prepared for construction
F7	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer
	Age of farmer	50 years
	Acquisition type	Private
	How many hectares	26 hectares
	What is the purpose of agricultural?	Commercial & self-sufficiency
	Which type of agriculture do you use on this land?	Rainfed and irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• lack of rainfall • decrease of water table • government is not support farmers. We heard that the government made some very ambitious plans regarding irrigated agricultural projects, but has not been implemented. In past, the Qurablli Agricurtual project and the Libyan Artificial Great River. • agricultural bank is not supporting farmers; they are no

		longer provide loans or agricultural supplies, such as seeds, fertilizers and pesticides. • Rising prices (seeds, fertilizers, pesticides, agricultural equipment. Effects: Lack of agricultural production, Desertification in farmland, Construction on agricultural land, Causing the increased import of agricultural production. Failure to protect local agricultural production caused problems to farmers; even if I was to harvest enough from my farm and I had some to sell, I cannot make a lot of money as the imported food is cheaper. That's is why selling the land is a better option than working on and get nothing at the end of the season.
	What is the effect of deforestation and what are its causes?	Impact on the vegetation cover degradation sand drift movement, increase of temperature. Reason to get to much money, Increase the number of family and people are not taking into account the public interest & the lack of security and the spread of weapons everywhere in this time
	What are the reasons that prompted farmers to sell the entire farm or part of it?	• Labour shortages • Expensive land prices • Switch to trade rather than agriculture
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	• Yes this land was good in terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes land change has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or not exploited
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization due to the increase in population and lack of land prepared for construction and the lack of specialist destinations to configure and residential units anchored to make people who build in agricultural Ground and increase the number of farmers' sons saluting everyone wants to build a private residence on this land then transformation to Residential Land
F8	**Place of Interview**	**Qarabulli area**

	Occupation	Farmer
	Age of farmer	29 years
	Acquisition type	Commercial
	How many hectares	15 hectares
	Which type of agriculture do you use on this land?	irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• government is not supporting farmers. We depend on our own to make water for irrigation available by digging well and building reservoirs at our farms. The government kept talking about encouraging farmers and resolving irrigation problem, but nothing as materialized in a concrete applicable plan. • agricultural bank is not encouraging farmers. Though it was the government that established the first agricultural project in this area; Qarabulli Agricultural Project was very useful for small farmers and the government as well. But, nowadays there is no such project. • Rising prices of seeds, fertilizers, pesticides, agricultural equipment. Farmers were let down by the government; the government is not subsidizing the agricultural inputs and the banks provided no loans to farmers. The agronomists, who used to be very helpful and supportive to farmers, are no longer active in doing their job. They provided that the government is no longer supporting their role. • Power outages • Lack of manpower • The absence role of Agricultural Extension and media. • There is no protection for domestic agricultural production All of these problems contribute to the lack of agricultural production and food.
	What is the effect of deforestation and what are its causes?	• increase soil erosion • increase sand drift movement • increase of temperature Reason to get to much money and people are not taking into

		account the public interest.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	Reasons are the difficulties faced by farmers • water shortage and Seawater intrusion with groundwater • Lack of productive capacity of farm • Material benefit
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	Yes most land in the study area was good in terms of Production such as Barley, wheat, potatoes vegetables and of kinds.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to random expansion on Countryside in all directions around the city of Tripoli due to the increase in population and lack of land prepared for construction.
F9	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer
	Age of farmer	80 years
	Acquisition type	Private
	How many hectares	5 hectares
	What is the purpose of agricultural?	Commercial. In the past, agricultural projects proved to be profitable and useful. For example, the Qarabulli Agricultural Project, a government sponsored project that was established in 1950 and further developed in 1970. This project provided new economic opportunities in the Qarabulli area. The local farmers benefited from it and the project was able to make positive contribution to small farmers' livelihood as well national economy. The project included cattle and sheep breeding and other

		agricultural products, such as potato, fruit trees, wheat, and vegetables.
	Which type of agriculture do you use on this land?	irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• Water problem. Sometimes ago this was not a problem, but from 1970s the problem increased due to decrease in rainfall. The successive governments in Libya, especially during Gaddafi's regime, spoke loudly about shifting to an irrigated agriculture instead of rain-fed agriculture. Yet, the problem of water availability remains unsolved. • Lack of manpower • Marketing problems • Lack of financial support agricultural bank is not supporting farmers. No support from the agronomists. The agronomists were saying it was the government that should be blamed about this. The government reduced the budget sharply in respect to agricultural development. The government also stooped subsidizing agricultural inputs such as, seeds, fertilizers, pesticides, and agricultural equipment. • Rising prices of seeds, fertilizers, pesticides, agricultural equipment. Effects: Lack of agricultural production, Desertification in farmland, Construction on agricultural land, Causing the increased import of agricultural production Failure to protect agricultural production and food. Now we left for our own values embodied in religion and traditions; we look after each other in times of plenty but also when things are not working as per our expectation. Our religion teaches us that we need to support the poor and oppressed when we have anything that we can support them with
	What is the effect of deforestation and what are its causes?	Impact on the vegetation cover degradation sand drift movement, increase of temperature. Reason to get to much money, Increase the number of family and people are not taking into account the public interest & the lack of security and the spread of weapons everywhere in this time.

	What are the reasons that prompted farmers to sell the entire farm or part of it?	Because of the problems faced by farmers then farmers go to sell the farm to improve the standard of living for his family (Labour shortages, Expensive land prices, Switch to trade rather than agriculture
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	(1).Yes this land was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds. (2). Yes land change has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or not exploited. (3). The reason behind land productivity change (lack for water, seeds, fertilizers, pesticides, agricultural equipments. (4). lack of cultivated area and lead to less income.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to random expansion on countryside in all directions around the city of Tripoli due to the increase in population and lack of land prepared for construction Have a positive impact on improving the level of living individuals to solve their social problems and Provide services to people, whether commercial and service.
F10	**Place of Interview**	**Qarabulli area**
	Occupation	Farmer
	Age of farmer	62 years
	Acquisition type	Private
	How many hectares	4 hectares
	What is the purpose of agricultural?	Commercial & self-sufficiency
	Which type of agriculture do you use on this land?	irrigated farming Irrigated agriculture in this area started long time ago, may be in 1950s. I was told that Qarabulli Agricultural Project was the first project. It was profitable for both, farmers and the government as

		well.
	What kind of problems do you face in your farming area and What are the effects of these problems?	• Water problem; shortage in water supply for irrigation and continuous deterioration and fluctuation in rainfall. • Lack of manpower • Marketing problems • Rising prices of seeds, fertilizers, pesticides, agricultural equipment. Farmers received no financial support from the bank to help them conduct cultivation and irrigation activities. Agronomists used to help farmers, but these days they are not helping anymore. The reason is the government stopped financial support to the Department of agriculture. Effects: Lack of agricultural production, Desertification in farmland, Construction on agricultural land, Causing the increased import of agricultural production Failure to protect agricultural production.
	What is the effect of deforestation and what are its causes?	• Impact on the vegetation cover degradation, sand drift movement, increase of temperature. • Financial reasons push farmers to sell their farms or convert their farms into housing development. • There is also lack of security and the spread of weapons everywhere in this time.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	• Financial reasons because of expensive land prices • Switch to trade rather than agriculture • lack of water table • lack of rainfall
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	• Yes this land was good in terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes change land has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers on this land. They then sell it.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization due to the increase in population and lack of land prepared for construction and the lack of specialist destinations to configure and residential units anchored to make people who build in agricultural Ground and increase the number of farmers' sons saluting everyone wants to build a private residence on this land then transformation to Residential Land.

F11 & A	Place of Interview	Qarabulli area
	Occupation	Agronomist and farmer in same time
	Age of farmer	40 years
	Acquisition type	Commercial The tradition of agricultural commercial farms was known in Qarabulli long time ago; may be with the establishment of the 'Qarabulli Agricultural Project' and because it was very successful, people in Qarabulli continued to practice agriculture for commercial purpose.
	How many hectares	5 hectares
	Which type of agriculture do you use on this land?	Rainfed & irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• Lack of water for irrigated farming. Rainfall is also not reliable, so agricultural productivity and quantity is negatively affected. • Agricultural pests • lack of natural elements contribute to the poor quality of the soil • Rising prices (seeds, fertilizers, pesticides, agricultural equipment. • The absence role of Agricultural Extension and media • There is no protection for domestic agricultural production All of these problems contribute to the lack of agricultural production and food. With lack of financial and training support, agronomists were unable to play their role properly-as before- and to provide the supports farmers need to improve their knowledge and capacity. Meanwhile, the bank is not providing loans and the government is not providing agricultural inputs for free or with subsidized prices.
	What is the effect of deforestation and what are its causes?	• increase soil erosion • increase sand drift movement • increase of temperature Reason to get to much money and people are not taking into account the public interest.
	What are the reasons that prompted farmers to sell the	Quick profit and the Material benefit Reasons are the difficulties faced by farmers

	entire farm or part of it?	• water shortage and Seawater intrusion with groundwater • Lack of productive capacity of farm
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	• Yes this land was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes change land has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers on this land. They sell it.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization due to the increase in population and lack of land prepared for construction and the lack of specialist destinations to configure and residential units anchored to make people who build in agricultural Ground and increase the number of farmers' sons saluting everyone wants to build a private residence on this land then transformation to Residential Land.
F12 & A	**Place of Interview**	**Qarabulli area**
	Occupation	Agronomist and farmer in same time
	Age of farmer	36 years
	Acquisition type	Commercial
	How many hectares	3 hectares
	Which type of agriculture do you use on this land?	irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• government is not supporting farmers; as an Agronomist and farmer I know this very well. The ideal role of the agronomists was to improve farmers' knowledge and to enhance their capacity with regard to new farming techniques, including how to use chemical fertilisers and irrigation methods. This was to be done with direct contact and direct involvement with farmers. However, lack of financial support from the Government to the agriculture and particularly to the Agronomists over the years was the main constraint towards efforts to improve farmers'

		capacity and knowledge and hence to develop agricultural sector. • water shortages & Lack of rainfall • Lack of soil quality due to excessive use of chemical fertilizers and pesticides. The increase in the cost of these elements has led to a high increase in the cost of agricultural products. Hence, agriculture has become not a profitable kind of profession. Unlike in the past when Qarabulli area was a focus of the government sponsored agricultural project. • Agricultural pests • Rising prices (seeds, fertilizers, pesticides, agricultural equipment. The above problems lead to • Low agricultural production • Reluctance of farmers for agricultural May encourage farmers to leave farming activity
	What is the effect of deforestation and what are its causes?	Effects of deforestation are: Its impacts on the vegetation cover causing degradation sand drift movement. The reason behind it is to get too much money and people do not taking into account the public interest. Social and financial implications include: Increasing population density and high land prices.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	Quick profit and the Material benefit. Reasons are the difficulties faced by farmers • shortage of possibilities for farms • water shortage and Seawater intrusion with groundwater • Lack of awareness • government is not help farmer for needs
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	• Yes this land was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes land change Has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or not exploited.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production. Have a positive impact on improving the level of living individuals to solve their social problems and Provide services to people, whether commercial and service.

F13 & A	**Place of Interview**	**Qarabulli area**
	Occupation	Agronomist and farmer in same time
	Age of farmer	47 years
	Acquisition type	Commercial
	How many hectares	5 hectares
	Which type of agriculture do you use on this land?	irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• Lack of water; there is scarcity of water for irrigated farming. Government plans in this regard ended up in complete failure. Farmers like me have become increasingly depend on our own regarding water supply. • government is not supporting farmers in a way that would improve their knowledge and the way they conduct agricultural practice. For example, as an agronomist, I acquired a lot of knowledge regarding agricultural techniques, however the problem was lack of financial support; the Agricultural Bank provides no loans for farmers, instead the Bank tends to provide loans to people who trade on buying and selling agricultural land rather than cultivate it. Hence, this has led to shortage of land for agricultural and animal breeding projects. The good example here is the Cows' Project. The cows' project is a viable project but the there is a lack of enough land on which the cows could be grazing. • Agricultural pests • Rising prices (seeds, fertilizers, pesticides, agricultural equipment and reduce in produce prices; It is sad that even after a season of great harvests, as farmers in Qarabulli we are still faced with the challenge of unstable market prices. It is so disempowering that after spending months working

		in the field the prices that our crops fetch on the market does not compensate enough for the resources used and time spent. The government seems to care more about products from outside Libya as they are cheaper than does it with its own locally grown crops • The absence role of Agricultural Extension and media. All of these problems contribute to the lack of agricultural production and food
	What is the effect of deforestation and what are its causes?	• The effects are: Increase soil erosion • increase sand drift movement • increase of temperature Farmers are doing this for financial reason and people do not take into account the public interest
	What are the reasons that prompted farmers to sell the entire farm or part of it?	Reasons are the difficulties faced by farmers: • water shortage • Lack of productive capacity of farm • Material benefit
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	Yes most t land area was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes, land change has a negative impact on farmers and they lost interest on agriculture, which led to a clear negligence by the farmers to this practice and start selling farmlands. • The reduced economic benefit from the farm as a result of a decline in crop production due to lack of possibilities.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production. Have a positive impact on improving the level of living individuals to solve their social problems and Provide services to people, whether commercial and service
F14 & A	**Place of Interview**	**Qarabulli area**
	Occupation	Agronomist and Farmer in same time
	Age of farmer	50 years
	Acquisition type	Commercial

	How many hectares	10 hectares
	Which type of agriculture do you use on this land?	Rainfed and irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• Lack of rain and limited water supply for irrigation. I heard a lot about the Libyan Artificial Great River Project, but with little impact on agricultural sector. • government is not supporting farmers. No loans are provided by the agricultural Bank to small farmers. Also, technical support is no longer provided. Agronomist would like to help and support small farmers, however they themselves are suffering neglect in terms of payment and training. Agricultural bank serves the "working class" only. By 'working class', I mean the civil servants employees. They used their influence and connections to get loans. • Agricultural pests • Rising prices (seeds, fertilizers, pesticides, agricultural equipments. • The absence role of Agricultural Extension and media. • Migration to urban centres When these youths migrate to town, we lose contact with some of them. The situation is even worse when there is a wife and children left behind with no support of any kind. Although people say it does help, personally I discourage all my relatives to consider relocation to Tripoli as that ruins marriage and the entire family ties that makes us a unique people The above problems lead to Low agricultural production, Reluctance of farmers for agricultural May encourage farmers to leave farming activity
	What is the effect of deforestation and what are its causes?	Effects of deforestation are: soil erosion, sand drift movement, increase of temperature. The reason behind it is to get too much money and people do not taking into account the public interest. Social and financial implications include: Increasing population density and high land prices.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	High land prices encouraged farmers to sell it and to get money. The population density in cities and on the coast expands rapidly over the agricultural lands and that provides financial incentives to

		farmers to sell their farms or sometimes they turn them into buildings with no reference to the state.
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	Yes this land was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes land change has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or not exploited. • The reduced economic benefit from the farm as a result of a decline in crop production due to lack of possibilities.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production Have a positive impact on improving the level of living individuals to solve their social problems and Provide services to people, whether commercial and service
F15 & A	**Place of Interview**	**Qarabulli area**
	Occupation	Agronomist and farmer in same time
	Age of farmer	42 years
	Acquisition type	Commercial
	How many hectares	5 hectares
	Which type of agriculture do you use on this land?	irrigated farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• Water resource problem and lack of rain • Weakness of electric power in the agricultural area • Agricultural non- application of laws • Rising prices (seeds, fertilizers, pesticides, agricultural equipments. • The absence role of Agricultural Extension and media. • Cut of trees; we know that we are not supposed to cut down trees in the way we are doing when producing charcoal but do you know that charcoal produced here is also helping people in Tripoli where electricity is not

		available all-day long. Yes, we are making money through charcoal selling but what will our friends in Tripoli use for cooking when electricity is not made available to them all day long" reacted farmer number 8 when asked if he was aware that charcoal production will bring environmental damage to the area All of these problems contribute to the lack of agricultural production and food
	What is the effect of deforestation and what are its causes?	• increase soil erosion • increase sand drift movement • increase of temperature Reason to get to much money and Lack of knowledge of the importance of forests and people are not taking into account the public interest also the absence of laws.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	Quick profit and the Material benefit. Reasons are the difficulties faced by farmers • water shortage • High salinity in some water wells • Lack of manpower • Marketing problems • Lack of awareness
	Following from the previous question, was this farmland that has been sold produced crops or did the productivity of the land change?	• Yes this land was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes change land Have a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or not exploited. • The reduced economic benefit from the farm as a result of a decline in crop production due to lack of possibilities.
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production. Have a positive impact on improving the level of living standards of individuals and provide services to people, whether commercial or social services.
F16 & A	**Place of Interview**	**Qarabulli area**
	Occupation	Agronomist and farmer in same time

	Age of farmer	80 years
	Acquisition type	self-sufficiency and Commercial
	How many hectares	3 hectares
	Which type of agriculture do you use on this land?	Irrigation farming
	What kind of problems do you face in your farming area and What are the effects of these problems?	• Water resource problem and lack of rain • Weakness of electric power in the agricultural area • Rising prices (seeds, fertilizers, pesticides, agricultural equipments. • Lack of manpower All of these problems contribute to the lack of agricultural production and food
	What is the effect of deforestation and what are its causes?	• increase soil erosion • increase sand drift movement • increase of temperature Reason to get to much money and Lack of knowledge of the importance of forests and people are not taking into account the public interest also the absence of laws.
	What are the reasons that prompted farmers to sell the entire farm or part of it?	• Quick profit and the Material benefit. • Reasons are the difficulties faced by farmers to obtain finance and technical support to cultivate the land. Also, the increase of the cost of agricultural inputs is another big problem. I remember the 'Qarabulli Agricultural Project' , which was a good example of how the government was so supportive to agricultural development. In 1950s and 1970, agriculture was at the top of the government priorities. Agronomists used to be care of in terms of payment and training. From their side, they used to love their job very much and keep helping small farmers all time. Today, this is not the case. Its neither the Government nor the Banks are supporting farmers. The agronomist lost the financial support and they are no longer able to support farmers.
	Following from the previous question, was this farmland that has been sold produced crops or	• Yes this land was good In terms of production such as Barley, wheat, oats, potatoes vegetables and of all kinds • Yes land change has a negative impact on farmers and the lack of interest from agriculture, which led to a clear negligence by the farmers to this topic land and sell it or

	did the productivity of the land change?	not exploited. • The reduced economic benefit from the farm as a result of a decline in crop production due to lack of possibilities and the high cost of agricultural materials. • Also, expansion of urbanization and newo constructions eat up farmland; for example: You might have noticed that there is a large gas line that goes through our district. Although we are not sure how we benefit from that gas line, that line ate part of people's farmlands and government indicates that we cannot cultivate close to the gas line as such areas are now classified as protected area and one can get arrested for farming on such land. People whose farms were in what now is called the gas line area lost part of their livelihood when the land was changed from farmland to gas line area
	What is the impact of the expansion of Tripoli on the land around and on the livelihoods of the people living around Tripoli?	Have a negative impact on farmland due to urbanization thus affecting the decline of agricultural production Have a positive impact on improving the level of living individuals to solve their social problems and Provide services to people, whether commercial and service

Appendix C: Coded List of Respondents:

Name of respondent	Male/female	Age	Place of interview	Date of interview	Size of farm
F1	male	50	Farmers' home	12/8/2013	4
F2	male	55	Farmers' home	14/8/2013	5
F3	male	48	Farmers' home	15/8/2013	10
F4	male	71	Farmers' home	16/8/2013	15
F5	male	68	Farmers' home	18/8/2013	2
F6	male	63	Farmers' home	19/8/2013	4
F7	male	50	Farmers' home	21/8/2013	26
F8	male	29	Farmers' home	22/8/2013	15
F9	male	80	Farmers' home	24/8/2013	5
F10	male	62	Farmers' home	25/8/2013	4
F11	male	40	Farmers' home	26/8/2013	5
F12	male	36	Farmers' home	27/8/2013	3
F13	male	47	Farmers' home	28/8/2013	5
F14	male	50	Farmers' home	29/2013	10
F15	male	42	Farmers' home	31/8/2013	5
F16	Male	80	Farmers' home	2/9/2013	3

Appendix D: Arabic version of interview questions

أسئلة المقابلة	الأجابة
المهنة	
عمر الفلاح	
نوع الملكية	
كم عدد الهكتارات؟	
أي نوع من الري التي تستخدمها؟	
كمزارع، أي نوع من المشاكل التي تواجهونها في منطقت؟	
ما هي أسباب وتأثير إزالة الغابات في منطقتك؟	
ما هي الأسباب التي شجعت المزارعين على بيع المزرعة بأكملها أو جزء منه؟	
كانت الأراضي الزراعية التي تم بيعها تنتج المحاصيل؟ هل الانتاجية في تغيير الأرض؟	
ما هو تأثير التوسع في طرابلس على الأراضي المحيطة وعلى سبل عيش الناس الذين يعيشون في جميع أنحاء طرابلس؟ كيفية التعامل مع هذه التغييرات؟	

Appendix E: Raw data of tree branches for problems and solutions.

Agriculture land degradation	
Why	How
Deterioration of water quantity and quality Increased water drain Lack of rainfall Increase of the percentage of sulfur and iron in the water wells	Addressing the problem of water Establishment of desalination plants on the coast (sea) Training and explanation to farmers on How to use water (irrigation distilling) Contribution to increased rainfall, reforestation and attention for forest and maintain of vegetation cover
Soil degradation, farmers are not following the agriculture cycle Lack of natural elements contribute to the poor quality of the soil (due to over cultivation)	The soil should be analysed before grow any crops The agricultural cycle
Financial problems, lack of support from the government Rising prices of seeds, fertilizers, pesticides, agricultural equipment	Support and motivation to the farmers by agricultural bank Provision of agricultural equipment and seed, fertilizers, pesticides to farmers at affordable prices. Support and development the agricultural association to serve the farmers
Sources of energy problems Power outages, lack of electric generators	Establishment of solar power plants especially in the agricultural land
Desertification caused by deforestation, overgrazing	Reforestation

Appendix F: Raw data of solution ranking by respondents using Bean Counter method

Bean counter			
Addressing the problem of water and the establishment of desalination plants on the sea	7	Provision of agricultural equipment and seeds to farmers at affordable prices	5
The establishment of dams on the valleys water	4	Support and incentives to farmers by the agricultural bank	4
Attention for forest and maintain of vegetation cover	5	Establishment of solar power plants	5
Study and analysis of the soil before planting crop	5	Establishment of nurseries	5
Give a respite for soil and work based on agricultural cycle	4	Farmers willing to stop wind	4
Support and develop the agricultural association to serve the farmers	6	Stop power outages	6

Appendix G: Raw data of solution ranking by respondents using Solution Matrix method

Solution matrix						
Farmers/ solution	A	B	C	D	Total	Rank
Address the problem of water/ establishment of desalination plants on the sea	5	5	3	4	17	1
Attention for forest and maintain of vegetation cover	4	4	5	4	17	2
Study and analysis of the soil before planting crop	3	3	2	2	10	6
Support and development the agricultural association to serve the farmers	2	3	4	3	12	3
Support and incentives to farmers by the agricultural bank	2	3	3	4	12	5
Establishment of solar power plants especially in the agricultural land	4	2	3	3	12	4