UNIVERSITY OF EDUCATION, WINNEBA

LIVELIHOOD STRATEGIES AND LAND COVER IN THE GA CENTRAL MUNICIPALITY

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A thesis in the Department of Geography Education, Faculty of Social Sciences, submitted to the School of Graduate Studies in partial fulfilment of the requirements for the award of the degree of Master of Philosophy (Geography Education) in the University of Education, Winneba

May, 2020

DECLARATION

STUDENT'S DECLARATION

I, Daniel Tackie-Yarboi, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature: ……..

Date: ……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of theses as laid down by the University of Education, Winneba.

Dr. Mrs Esther Yeboah Danso-Wiredu (Supervisor)

Signature: ……

Date: ……

DEDICATION

To my entire family

ACKNOWLEDGEMENT

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ABBREVIATIONS

ADAR	Airborne Data Acquisition and Registration
DFID	Department for International Development
FAO	Food and Agriculture Organisation of the United Nations
GCMA	Ga Central Municipal Assembly
GIS	Geographic Information System
GSS	Ghana Statistical Service
HES	Human-Environment System Framework
HDP	Human Dimensions of Global Environmental Change Programme
IGBP	International Geosphere–Biosphere Programme
LC	Land Cover
LUCC	Land-Use and Land-Cover Change
LULC	Land-Use and Land-Cover
SES	Socio-Ecological System
SLA	Sustainable Livelihood Approach
UNFPA	United Nations Population Fund
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

ABSTRACT

The work of human activities and its rapid effects on the land and the environment especially in neighbouring districts like the Ga Central Municipality close to cities like Accra cannot be overlooked. The continuous change in the land cover linked with people's livelihood is worth examining. The sustainable livelihood and human-environment system concepts were combined to study assets and livelihood strategies residents relied on for survival in the communities. The purpose of the study was to assess the livelihood strategies of residents of Ablekuma, Agape and Gonse and land cover in the Ga Central Municipality. The study ascertained the effects of livelihood strategies on the extent of land cover changes and their effects on the natural environment in the three communities. A mixed-method approach to research using the cross-sectional and case study designs was applied in the study. Three hundred and nine respondents answered questionnaires and 40 key informants, interviewed in the communities. The main findings of the study were that the dominant land cover in the three communities had gone through changes over the years; farmlands were the dominant land cover feature in 1991, grassland and shrubs in 2003 and built-up areas in the year 2018. The construction industry is the dominant economic activity or form of livelihood present in all three communities with retail activities as support. Increasing land temperature and water pollution were the major negative effects of livelihood strategies to the land cover while poor sanitation, water, air and noise pollutions were the major reciprocal effects from the natural environment to human beings. The study concluded that, the shift towards the usage of the environment for built-up as an alternative livelihood activity included livelihood strategies of investment, diversification, agricultural intensification and reciprocity. The study recommends policy should be drawn and implemented by the local assemblies to ensure residents plant in their homes a required minimum amount of trees to improve the biodiversity of the environment.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter presents the beginning of the main body of the study under the subsections; background of the study, statement of the problem, purpose of study, objectives of the study, research question, significance of the study, scope, delimitation and the study, and organization of the study.

1.1 Background of the Study

Organisms in every part of the ecosystem in the world are subject to a cycle that inevitably involves survival. Survival, in the sense, refers to organisms meeting their daily needs with regards to food, water, clothing and shelter in their cycle of life. This need to survive undoubtedly is key with regards to the human race. According to Aruma and Hanachor (2017), Abraham Maslow's hierarchy of needs theory which he proposed as five needs and was later modified to show seven levels of human needs shows the importance of survival. These needs posited by Maslow were grouped into two major categories namely, the deficiency needs and growth needs (Aruma & Hanachor, 2017; Huitt, 2007).

The deficiency needs according to Maslow's theory included the physiological needs, safety needs, social needs and ego needs while the growth needs include; self-actualization needs, understanding needs and aesthetic needs (Aruma & Hanachor, 2017; Huitt, 2007). According to Maslow, the physiological needs of individuals include needs such as food, water, shelter, clothing, sleep as well as procreation. These basic needs of the human society essentially cannot be done without which will lead to

the extinction of the human race if non-existent. The basic and most urgent needs of human society are very important for the survival and sustainability of the human race in society (Aruma & Hanachor, 2017). This need to survive pushes an individual to engage in various activities that make them meet these critical needs.

In meeting the basic needs of man, individuals have to make a living or achieve a livelihood. A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living (Department for International Development, 1999; Scoones, 1998). To achieve a livelihood, individuals depend on resources readily available to them like the land, forest, rivers among others. According to Balvanera, et al., (2016), in tropical Africa, forest ecosystems are important repositories for vital livelihood resources and ecosystem services, and at the same time, constitute major wildlife habitats. Kamwi, Chirwa, Manda, Graz and Katsch, (2015) in their study of livelihoods, land use and land cover change in the Zambezi region, Namibia found out that, natural resource uses are vitally important in the rural livelihoods as they depend on them.

Also, Mandere, Ness and Anderberg, (2010) in their study of peri-urban development, livelihood change and household income, in Nyahururu, Kenya, show that individuals depend on the land to engage in agricultural activities as well as infrastructural development to gain higher incomes to make a living. In Ghana, a study conducted by Koku (2002), on the environment, livelihood and natural resource management in the Lower Volta basin of Ghana, specifically the South Tongu district state that residents predominantly subsistence farmers depend on the basin's resources which include the land in meeting their livelihoods. Edusah, (2011) conducted a study on how livelihoods of forest fringe communities have been affected by the constitution of four forest reserves in Brong Ahafo and Ashanti Regions of Ghana and found that

farming was the main livelihood of the people as cocoa and oil palm were the major cash crops grown in the area. Constituting forest reserves meant claiming their farmlands which affects their livelihoods and also community participation in the management of the reserve. This continuous use of natural resources especially the land draws attention to how these resources are utilised, managed and protected.

The land and environmental resources, as we know have undergone different evolutions when it comes to human beings affecting the environment. From the discovery of minerals to the building of skyscrapers; the land cover has seen changes. Land cover is considered to be the biophysical state of the earth's surface and its upper subsurface while land use is the utilization (Yeboah, Awotwi, Forkuo, & Kumi, 2017). Also, land cover can be described as the layer of soil and biomass, including natural vegetation, crops and manmade infrastructures that cover the land surface (Omer, 2005).

Land cover change is one means to describe landscape patterns and characteristics that are critical in understanding aspects of the environment, including the availability of and changes in habitat, the potential for dispersion of chemicals and other pollutants, and potential contributors to climate change, such as reflectivity of the land (United States Environmental Protection Agency, 2015). Human inputs and management levels on the earth's surface, driven by production and consumption dynamics that are closely tied to social, political and economic activities have led to land cover modification. Land cover change, therefore, has a unique signature on the topography and soil distribution, that gives rise to natural resource changes (Yeboah, Awotwi, Forkuo, & Kumi, 2017). Land use and land cover change are regarded as the single most important variable of global change affecting ecological systems (Vitousek 1994; Reis 2008 as cited in Tendaupenyu, Magadza, & Murwira, 2017, pp 797). Land

cover changes do not only have environmental consequences but also serious economic and social impacts on the livelihoods of many in various parts of the world (Kamwi, Chirwa, Manda, Graz, & Katsch, 2015). Land use and land cover (LULC) dynamics are widespread, accelerating, and significant processes driven by human actions but also producing changes that impact humans (Agarwal, Grove, Green, Evans, & Schweik, 2002). The land cover changes are often conceived as simple and irreversible conversions from one cover type to another (Mertens & Lambin, 2000). Inevitably, land use and land cover changes could lead to a decreased availability of various products and services for human, livestock, agricultural production and damage to the environment as well (Ohri & Poonam, 2012).

The transition from original land cover types to other land uses often contributes to permanent deforestation, loss of biodiversity, increased weed pressure, declines in soil fertility and accelerated soil erosion as found out by in their study of trends, drivers and impacts of changes in swidden cultivation in tropical forest-agriculture frontiers: a global assessment (van Vliet, et al., 2012). Further, Chen (2002) studied the impact of land cover change on sustainable development in the west coastal zone of Korea using remote sensing and GIS. The post-classification method was used to detect land cover change from multi-temporal satellite data for the years 1985, 1987, 1990 and 1993. The results obtained showed that land cover change in the west coastal zone of Korea had occurred in the decade under review as a result of both natural forces and human activities, which has in turn impacted on the regional sustainable development.

Furthermore, Islam, Borgqvist and Kumar, (2018) conducted a study on monitoring mangrove forest land cover changes in the coastline of Bangladesh from 1976 to 2015. The study used multi-date Landsat images to quantify mangrove cover changes in the whole of Bangladesh from 1976 to 2015. The results indicated an

increase in the areal extent of mangroves by 3.1% even though some original areas were lost to deforestation, shrimp and salt farmlands, coastal erosion and sedimentation (Islam, Borgqvist, & Kumar, 2018). Also, Forkuor and Cofie (2011) examined dynamics of land-use and land-cover change in Freetown, Sierra Leone (1974 – 2000) and its effects on urban and peri-urban agriculture using a remote sensing approach and discovered built-up areas increased by 140% between 1974 and 2000 with the major conversion of land showing a strong linkage between urbanization, agriculture and deforestation.

In Ghana, Appiah, Forkuo, Bugri and Apreku (2017) also examined geospatial analysis of land use and land cover transitions from 1986-2014 in a peri-urban Ghana and noted a remarkable increment of 380% over a 24 year period (1986 – 2002) in the Bosomtwe district to built-up areas and bare areas mainly from dense forest and agricultural efficient areas close to the central business district.

1.2 Statement of the Problem

Land is one of the most important non-renewable natural resources (Yesmin, Mohiuddin, Uddin, & Shahid, 2014). In Ghana, the availability of natural resources as well as their dynamics and management vary considerably from region to region. According to Frimpong (2015), the Ghana National Land Policy (1999), states Ghana's territory of land and inland water areas to cover a total of 238,539 km². In the past few decades, areas surrounding Accra have experienced a shift of development towards their direction as urbanisation expands rapidly. The Ga Central Municipality is no exception as it shares a border to the south-east with the Accra Metropolitan Area (Ghana Statistical Service, 2014a). The municipality also falls within the north-western corridor of the Greater Accra Metropolitan Area (GAMA) which is seen to experience

rapid development with increasing dense populated areas (Ga Central Municipal Assembly, 2017).

With the rapid increase in urbanisation as well as its spill overs from Accra, grassland areas have shifted from the coast into the hinterlands specifically the northern and north-western parts of GAMA, which the municipality falls and was formerly forest (Addae & Oppelt, 2019). Extensive patches of forest which were located around and beyond the Weija lake as well as the fringe forest around the Densu River had begun to disappear in the early 2000s where the municipality is found (Addae & Oppelt, 2019). This continuous changes to the land cover along with the rate of forest loss in the country which stood at 4.7 million hectares between 2001 and 2015 and a 3.51% annual loss of forest due to human activities such as mining, agricultural activities, infrastructure development among others resulting in deforestation and forest degradation, it is important there is a constant review of the natural resource stock in the Ga Central Municipality (Forestry Commission, 2017). With spatial technologies available like remote sensing and GIS, the spatiotemporal nature of land covers is easily detected and important for future planning and conservation measures (Food and Agriculture Organisation of the United Nations, 2019). The nature, scope, and totality of the natural resources inherent in Ghana's territorial domain constitute the nation's socio-economic backbone, the basis of its wealth, the realm of its physical and political strength and the source of its sustainable livelihood and very survival (Frimpong, 2015).

The linkage between the land cover and human activities for a livelihood in the Ga Central Municipality is clearly visible with the population growth rate of the municipality standing at 3.1% as adopted from the region's rate (Ghana Statistical Service, 2014b). With industry comprising of the services sector, building and construction, mining and quarrying and agriculture being the main economic drivers in

the municipality there is an undeniable effect on the land cover and environment. According to the Ghana Statistical Service (2014a), construction is a major industry in the municipality, especially in its peri-urban and transitional zones. Housing/estate construction is currently the most dominant form of construction which inevitably is changing the land cover of the municipality.

With construction a form of livelihood on the rise, changes in the land cover evident and the need of the world through the Sustainable Development Goals brought into force in 2016 to protect, restore and promote sustainable use of terrestrial ecosystem, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss as well as increasing the capacity of people to pursue sustainable livelihood opportunities, as stated in goal 15, there are most sub-goals needed to be met by 2020 (United Nations Development Programme, 2020). This study, therefore, examined this gap in the literature of what has been achieved with regards to SDG 15 as it looks at livelihood strategies and land cover in the Ga Central Municipality addressing the stifle that exists in the need to ensure the sustainability of the natural environment and sustainable livelihood in the Ga Central Municipality.

1.3 The purpose of study

The purpose of this study is to assess the livelihood strategies of residents and land cover in the Ga Central Municipality.

1.4 Objective of the Study

The main objective of the study is to assess the livelihood strategies and land cover in the Ga Central Municipality. Specifically, the study seeks to:

- Assess the extent of land cover changes of the area for the period (1991 to 2018).

- Ascertain the livelihood strategies adopted by residents in the area
- Assess the effects of livelihood strategies adopted by residents on the land cover of the area

1.5 Research Question

The study was to address the following questions:

- What is the extent of the land cover changes for the period (1991 to 2018) in the area?
- What forms of livelihood strategies are adopted by the residents in the area?
- What are the effects of livelihood strategies adopted by residents on the land cover of the area?

1.6 Significance of the Study

- The results of the study can be adopted by the government and private agencies in drawing policies that would best support a sustainable social and ecological system.
- It will help the nation preserve resources especially forest for the generations unborn.
- It will also help address the various challenges the environment faces due to anthropogenic activities especially in the cities.
- The study will go a long way to help the government identify the livelihood strategies of the people and know which assets to concentrate on developing or needs the most attention.

1.7 Scope of the study

The study focused on livelihood strategies and land cover. The study was limited to the Ga Central Municipality with emphasis on Ablekuma, Agape and Gbawe Gonse.

1.8 Limitation of the study

Females especially the married were reluctant to participate in the study unless with the approval of their husband. This was taken care of by moving to the available person or seeking the consent of husbands when they were available. The researcher spent more time and money on transportation in order to get approval to interview officials of the Ga Central Municipal Assembly even though an authority letter from the university was presented. This challenge was overcome by consistently checking up for the approval and getting help from the Secretary of the Ablekuma Stool who gave out a contact person to help me facilitate the interviews.

1.9 Organization of the Study

The study involves five chapters, with the first chapter providing an introduction involving the background of the study, statement of the problem, objectives and research questions, significance of the study, scope and delimitation of the study and the organization of the study. Chapter Two captures an exhaustive but incisive review of relevant literature on land cover, land cover changes, livelihoods, sustainable livelihood approach, human-environment system and livelihood strategies. Chapter Three describes the methods used including information on respondents and participants, sampling techniques and procedure, research design and research instrument. Chapter Four details and explains the outcome of the research using tables and figures as well as discuss, identify and interpret significant and novel findings to make inferences and lastly, Chapter Five being the summary, conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter captures relevant literature on the concepts of land cover, livelihoods, land cover change, livelihood strategies; global perspectives on the sustainable livelihood approach and human-environment system framework. It also views these concepts in the context of Ghana.

2.1 Land Cover and Land Cover Change

The concept of land cover (LC) has over the years raised eyebrows of many across continents and being an issue of global concern. Land carries the natural resource stock from which flow of resources and services useful for livelihoods are derived (Lyatuu & Urassa, 2015). Land cover and its associated changes or use are seen to be interrelated concepts but seemingly different (Musa & Odera, 2015). Various activities that take place on the land usually effect changes in its cover (Dadson, 2016). Land cover can be defined as the ‘‘observed (bio) physical cover of the earth’s surface’’ and a synthesis of the many processes taking place on the land (Food and Agriculture Organisation of the United Nations, 2016). Land cover is also considered as a geographically explicit feature that can be used in different disciplines (geography, ecology, geology, forestry, land policy and planning) as a geographical reference (FAO, 2016). As a geographical reference, land cover is useful for land use as well as ecological studies. According to Dadson (2016), land cover refers to the physical material found at the surface of the earth. It includes both natural and human made materials such as trees, buildings, grass, water, asphalt and any other objects that cover the surface of the earth. Land cover represents the actual or physical presence of

vegetation (or other materials where vegetation is non-existent) on the land surface (USEPA, 2015). Land cover is also often described as what can be seen on land viewed from above.

According to Lambin, Geist and Lepers (2003), land cover is defined by the attributes of the earth's land surface captured in the distribution of vegetation, water, desert, ice and immediate subsurface, including biota, soil, topography, surface and groundwater and human structures. On the other hand, land use is defined by the purposes for which humans exploit the land cover (Lambin, Geist & Lepers, 2003). Land cover reflects land occupation (and its transformation) by various natural, modified or artificial systems and to some extent how these systems affect the land (FAO, 2016). According to the Food and Agriculture Organisation of the United Nations statistics data, Ghana's land cover distribution in 2016 stood at 9,945,323 hectares of tree-covered areas, 9,460,798 hectares of Grassland, 2,966,379 hectares of Herbaceous crops, 1,704,090 hectares of Woody crops, 660,719.4 hectares of inland water bodies and 278,562.6 hectares of Artificial surfaces including urban and associated areas (FAO, 2019) .

Land cover is one of the most easily detectable indicators of natural and anthropogenic interventions on land because it can change both gradually and quickly over time. Land cover is also a good proxy for dynamics of the earth surface resulting from a variety of drivers and factors. Land cover emphasises has stemmed from the wide range of areas that it covers and its impact on human beings. Land cover data has been attracting the scientific community's attention over the past few decades due to its quick impression it gives to available resources and changes occurring in the various land covers (Chen, 2002; Islam, Borgqvist, & Kumar, 2018). Data on land cover and changes to that land cover have proved important for satisfying the ever increasing

demand for reliable data to support studies and research at local, regional and global scales (FAO, 2016). Land cover data support comprehension and analysis of natural phenomena such as climate change; provide a means to assess carbon stock accountability; and help monitor agriculture development, disaster management, land planning and defence of biodiversity (FAO, 2016).

Planning and implementation of environmental, food security and humanitarian programmes all depend on land cover data that need to be of great quality and reliability. Concerns about loss of biodiversity especially in the tropical regions of the world like the Amazon region, Congo Basin and other parts of the world in recent times have spawned a great deal of research to elucidate the dual effect of these losses, both on man and the environment (Chen, 2002; Lambin, Geist, & Lepers, 2003; Caldas, et al., 2007; FAO, 2016). The realization of the land surface processes influencing the ecosystem and other cycles of the planet earth raises the need to constantly and frequently study the changes that occur to the land cover of areas at the local, regional and global level.

Changes in land covers all over the world are regarded as the single most important variable of global change affecting ecosystems (Tendaupenyu, Magadza, & Murwira, 2017). Land cover changes are mainly associated with human activities and natural factors that compromise many ecological systems (Matano, et al., 2015). Nature and society are claimed not to exist as independent entities but as parts of an interdependent whole, a hybrid socio-nature that includes social, ecological and discursive components (Harvey 1996 as cited in Walker & Solecki, 2004, p. 311). Land cover changes and modifications generate numerous environmental problems at local, regional and global scales (Walker, 2004; Tendaupenyu, Magadza, & Murwira, 2017). The changes and modifications of land cover have led to environmental consequences

such as the release of greenhouse gases, loss of biodiversity, depletion of soil nutrients, reduction in water quality and sedimentation of lakes and streams are but a sampling of the sorts of impacts that arise by virtue of modifications and changes to the land cover (Walker, 2004; Tendaupenyu, Magadza, & Murwira, 2017).

Land cover changes have not always being negative but also positive with the continuous increase in food and fiber production, wealth, well-being and efficient use of resources. Land covers throughout the world shift from one form to another, independent of climate, topography, and level of economic development (Lambin, Geist, & Lepers, 2003). Most early concern of land cover changes focused on tropical deforestation, which typically resulted from activities such as commercial farming, logging, mining, and even the residential use of space encroached on old-growth forest or replace long-fallow shifting cultivation. In recent years, concerns of land cover changes have not only focused on the impacts of these changes on just biodiversity and loss of many important ecosystem goods and services but also on climate and its reciprocal effects on human beings (Lambin, Geist, & Lepers, 2003; Dadson, 2016; Tendaupenyu, Magadza, & Murwira, 2017). Land cover changes do not only have environmental consequences but also serious economical and social impacts on livelihoods of many in various parts of the world (Kamwi, Chirwa, Manda, Graz, & Katsch, 2015).

Land cover change, according to Ellis (2013), is a generic term for the human modification of the earth's terrestrial surface. Land cover change, according to Lambin, Geist and Lepers (2003), is categorised into two forms that is land-cover modifications and land-cover conversions. Land cover conversions refer to the complete replacement of one cover type by another as measured by a shift from one land-cover category to another as in the case of agricultural expansion, deforestation or change in urban extent.

Land cover modifications on the other hand are more subtle changes that affect the character of the land cover without changing its overall classification as in the case of agricultural intensification where higher levels of inputs lead to increased output of cultivated or reared products per unit area and time (Lambin, Geist, & Lepers, 2003).

With the help of remote sensory, monitoring of land cover change especially land cover conversions can be performed by a simple comparison of successive land cover maps developed from remotely sensed imagery. By contrast, the detection of subtle changes within land cover classes requires a representation of the land cover as land surface characters that vary continuously in space and time at seasonal and interannual scales (Lambin, 1999; Lambin, Geist, & Lepers, 2003). Even though land cover change detection is important for identification of conversion and modification of land surfaces towards formulation of policies and planning, it can sometimes be problematic depending on the approach being used (Chen, 2002). Land-cover change is complex to characterize and "noise" sources such as misregistration, differences in scene illumination and atmospheric effects, and anisotropic reflectance effects can cause land-cover change to be missed or falsely detected (Longmire & Stow, 2001).

Consequently, with the complexity of land-cover change as well as the component of geographic territory being identified many resolutions over the world have being developed to curtil the difficulty. For instance, in 1991 the famous Land-Use and Land-Cover Change (LUCC) Science/Research Plan by the joint initiatives of the International Geosphere–Biosphere Programme (IGBP) and Human Dimensions of Global Environmental Change Programme (HDP) Core Project was proposed and approved by IGBP and HDP in 1993 which became truly an international and interdisciplinary cooperative research project or programme with the general aim of improving our basic understanding of the dynamics of global change, with a focus on

improving our ability to model and project such changes (Chen, 2002; Lambin, Geist, & Lepers, 2003).

The LUCC Science/Research Plan and other initiatives over the years by the Food and Agriculture Organisation of the United Nations have improved upon traditional approaches to provide dynamic information through the analyses of real-time remotely sensed data needed for development planning and management decision making (Chen, 2002; FAO, 2016). The need for land cover change data and information is enormous as it is the driver of where the world is heading to currently. In terms of decisions on biodiversity, food production, deforestation, population control, climate change and other international issues concerning regional, social and economic development as well as global environmental changes, land cover change plays a pivotal role.

Land cover change detection through the use of remote sensing technologies by the Global Forest Resources Assessment of the FAO (2000), estimated that the world's natural forests decreased by 16.1 million hectares per year on average during the 1990s; that is a loss of 4.2% of the natural forest that existed in 1990. The net global decrease in forest area was therefore 9.4 million hectares per year from 1990 to 2000. The total net forest change for the temperate regions was positive, but it was negative for the tropical regions. FAO (2000) estimated that tropical regions lost 15.2 million hectares of forests per year during the 1990s. Forest degradation was most extensive in Southeast Asia (0.42% per year), lowest in Latin America (0.13% per year), and intermediate in Africa (0.21% per year). Forest regrowth was more extensive, both in absolute and relative terms, in Southeast Asia than in the other humid tropical regions (0.19% for Southeast Asia, 0.04% for Latin America, and 0.07% for Africa) (Lambin, Geist, & Lepers, 2003).

Land cover changes through analysis in real time monitoring of crop conditions have become important for the early detection of possible adverse climatic conditions affecting production, particularly in food insecure countries to support crisis prevention and response planning (Perez-Hoyos, Rembold, Kerdiles, & Gallego, 2017). Chen (2002), studied the impact of land cover change on sustainable development in the west coastal zone of Korea using remote sensing and GIS. The post-classification method was used to detect land cover change from multi-temporal satellite data for the years 1985, 1987, 1990 and 1993. The results obtained showed that land cover change in the west coastal zone of Korea had occurred in the decade under review as a result of both natural forces and human activities, which has in turn impacted on the regional sustainable development. Based on the findings Chen (2002) recommended the results as very useful information to local government for decision making and policy planning. Also, Longmire and Stow in (2001) assessed the utility of very high spatial resolution, digital remotely sensed imagery for monitoring land-cover changes in habitat preserves within southern California coastal shrublands. Changes were assessed for Los Penasquitos Canyon Preserve, a large open space in San Diego County, over the 1996 to 1999 period using multispectral, digital camera imagery acquired using the Airborne Data Acquisition and Registration (ADAR) digital-camera system. Results showed that most land-cover changes were associated with differences in phenology and precipitation between the years 1996 and 1999 as human impact was also evident in the form of clearing near road and trail sides (Longmire & Stow, 2001).

Similarly, a study conducted by Musa and Odera (2015), on the effects of land use land cover changes on agricultural land in Kiambu County, Kenya and to determine the main drivers of land use land cover change used geospatial technologies. Digital image analysis was carried out through supervised classification on satellite images for

the years 1984, 1993, 2002 and 2013. The study found that, over the period of study, agricultural land decreased from 39.7% to 15.8% with grassland, forest, waterbody and bare areas also decreasing in contrast to an increase in built-areas (Musa & Odera, 2015). Furthermore, Islam, Borgqvist and Kumar, (2018) conducted a study on monitoring mangrove forest landcover changes in the coastline of Bangladesh from 1976 to 2015. The study used multi-date landsat images to quantify mangrove cover changes in the whole of Bangladesh from 1976 to 2015. The results indicated an increase in the areal extent of mangroves by 3.1% eventhough some original areas were lost to deforestation, shrimp and salt farmlands, coastal erosion and sedimentation (Islam, Borgqvist, & Kumar, 2018).

Appiah, Forkuo, Bugri and Apreku (2017) also examined geospatial analysis of land use and land cover transitions from 1986-2014 in a peri-urban Ghana and noted a remarkable increment of 380% over a 24 year period (1986 – 2002) in the Bosomtwe district to built-up areas and bare areas mainly from dense forest and agricultural efficient areas close to the central business district. Forkuor and Cofie (2011), examined dynamics of land-use and land-cover change in Freetown, Sierra Leone (1974 – 2000) and its effects on urban and peri-urban agriculture using a remote sensing approach and discovered built-up areas increased by 140% between 1974 and 2000 with major conversion of land showing a strong linkage between urbanization, agriculture and deforestation. Addae and Oppelt (2019) studied land-use land-cover change analysis and urban growth modelling in the Greater Accra Metropolitan Area, Ghana by estimating the rate and extent of land use land cover changes in the region and the main drivers of these changes. The study used Geographic Information System (GIS) and remote sensing techniques in monitoring land-use land-cover change over space and time between 1991 and 2015 and forecasting changes. The results revealed that built-up

areas increased by 277% over the 24-year study period with forest areas experiencing massive reduction, diminishing from 34% in 1991 to 6.5% in 2015. The 2025 projected land use map revealed that the urban extent will massively increase to cover 70% of the study area, as compared to 44% in 2015 (Addae & Oppelt, 2019).

2.2 Livelihoods

The ability of human beings to sustain life is very important. People engage in various social and economic activities to make a living, to sustain them as well as survive (MacKeigan, 2004; May, Brown, Cooper, & Brill, 2009). A livelihood is basically the means that a household uses to achieve their well-being and sustain it (Messer & Townsley, 2003). The well-being of people is defined by a household's key objective and differs from one society to another. The impacts of people's livelihoods are clearly seen at the household level. A household is a group of people who eat from a common pot, and share a common stake in perpetuating and improving their socio-economic status from one generation to the next (FAO 1992, as cited in Messer & Townsley, 2003, p.7). Livelihoods of households and people also varies larger based on their geographical location whether in the rural or urban setting, factored on population. Eventhough there may exist variations in livelihoods with reference to rural and urban settings, the clear distinction is hazy and unclear in peri urban communities (Farrington, Ramasut, & Walker, 2002). Livelihoods opportunities differ for economies across regions and countries and it is therefore important to avoid making generalisations about livelihood conditions which in turn have linkages between urban and rural areas such as in Sub-Saharan Africa (Meikle, Ramasut, & Walker, 2001; Farrington, Ramasut, & Walker, 2002).

The concept of livelihoods and its sustainability were impressed on by Robert Chambers and Gordon Conway in 1992, Scoones in 1998 and other developmental

institutions and agencies like the DFID, IDS, UNDP among others in the late 20th century and continues to be used by researchers all over the world. A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living including food and income (Chambers & Conway, 1992; Scoones, 1998; Department for International Development, 1999; Ellis, 2000). The definition of livelihoods according to Ellis (2000) has moved past income towards a more holistic consideration of the manner in which a person makes a living. This definition has in practice, resulted in some approaches to livelihoods tilting towards focusing closely on access to the various types of assets drawn upon by individuals and households to make a living (McCusker & Carr, 2006). Livelihood does not only mean income generating activities but self-sustaining activities (Iiyama, Kariuki, & Kristjanson, 2008). A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels, in the long and short term while not undermining the natural resource base (Chambers & Conway, 1992; Scoones, 1998; DFID, 1999; Ellis, 2000; Meikle, Ramasut, & Walker, 2001; Farrington, Ramasut, & Walker, 2002; May, Brown, Cooper, & Brill, 2009).

Livelihood as defined by the various authors centred on individuals or households capabilities, assets and activities. To make a livelihood, individuals and household employ a range of activities or an activity which is convergent around the assets available to the people. Households vary in the kind of livelihood activities and strategies they pursue according to their location and assets. For instance, some households undertake livelihood activities in their homes while others engage in activities outside of their homes all within space and on land which is an asset (Mahama

& Maharjan, 2017). A livelihood activity is defined as any direct income-generating activity (for example production of cash crops) or any activity that might not directly bring in income but increases the consumption and or well-being of an individual or household (Lyatuu & Urassa, 2015). Household socio-economic characteristics such as educational background, size of labour force, geographical location, sex, age and marital status of household heads and members may influence its access to assets and livelihood activities pursuable (Barrett et al., 2001 as cited in Lyatuu & Urassa, 2015, p. 260).

Assets are the resources that individuals and households draw upon to build livelihoods (Oduro, Adamtey, & Ocloo, 2015). Assets are what individuals and households need to cope with stresses and shocks, and to maintain and enhance capabilities now and in the future. Assets are the building blocks of a sustainable livelihood. By building assets, individuals and households develop their capacity to cope with the challenges they encounter and to meet their needs on a sustained basis (DFID, 1999). There are five types of livelihood assets (DFID, 1999). Assets are a vital antidote, and the recognition that everyone has an asset in terms of material or non-material assets which include their health, their labour, their knowledge and skills, their friends and family and the natural resources around them which in this research is land is important in the choice of a livelihood (DFID, 1999; Rakodi, 2002). Members of a household combine their capabilities, skills and knowledge with the different assets at their disposal to create activities that will enable them to achieve the best possible livelihood for themselves and the household as a whole (Messer & Townsley, 2003).

Capabilities as used by Sen (1987) refers to being able to perform certain basic functionings, to what a person is capable of doing and being. Capabilities include for instance, gaining access to and using services and information, competing and

collaborating with others, being adequately nourished, to be comfortably clothed, to lead a life without shame, to keep track of what is going on and what others are talking about, to visit and entertain one's friends, to avoid escapable morbidity and preventable mortality (Sen, 1987; Chambers & Conway, 1992). Livelihood capabilities as a part of the whole emphasized by Sen (1987) should be able to cope with stress and shocks as well as being able to find and make use of livelihood opportunities (Chambers & Conway, 1992).

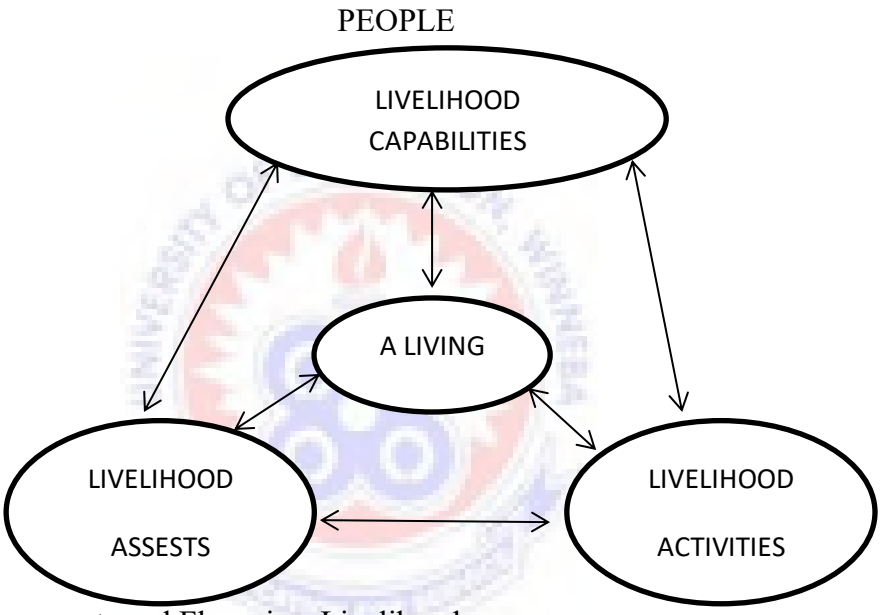


Figure 1: Components and Flows in a Livelihood

Source: Adopted from Chambers and Conway, (1992)

2.3 Livelihood Strategies

Households and individuals engage in various activities combining a portfolio of their tangible and intangible assets to make a living (Scoones, 1998; Rakodi, 2002; Lyatuu & Urassa, 2015). According to Ellis (2000) livelihood strategies are a portfolio of activities pursued to achieve a livelihood goal. Farrington, Ramasut and Walker (2002) defined livelihood strategies as the planned activities that men and women undertake to build their livelihoods. They usually include a range of activities designed to build asset bases and access to goods and services for consumption. The various

actions decided by households and individuals to maintain their well-being or improve upon their well-being or to cope with impoverishment, using livelihood assets available to them is referred to as livelihood strategies (Oduro, Adamtey & Ocloo, 2015). Livelihood strategies open to a family unit depends both on the arrangement of capital held and on the household's capacity to discover and utilize livelihood openings. Households and individuals ability to pursue meaningful diversity of livelihood strategies are reliant on their assets endowment and their socio-economic characteristics that will aid in combining the assets (Lyatuu & Urassa, 2015). For an individual, it might be ideal to seek after a specific blend of livelihood strategies, however these may have either positive or negative effects on other family units, individuals or the more extensive network of the community regarding shared assets like the land and its cover (Scoones, 1998).

Households settle on choices on how resources are utilized as far as procuring, transfer, satisfying kinship commitments and duties or creating mutual support networks. The livelihood approach adopted by persons and family units focus on issues of how to cope with and recuperate from stress and shocks by stinting, storing, protecting, exhausting or diversifying their portfolio of activities; to keep up or improve capability and resources; migrate and to provide sustainable livelihood openings for the generation unborn (Chambers & Conway, 1992; Rakodi, 2002).

Individuals, households and communities at the local or global level develop different kinds of livelihood strategies (Scoones, 1998). At the local level different combinations of strategies may be pursued sequentially depending on changes in dependency ratios, health conditions and other factors (Scoones, 1998). Generally, these entities either develop coping strategies or adaptive strategies to make a livelihood (DFID 1999; Ellis, 2000; Rakodi, 2002). Coping strategies refer to the short term

measures adopted by individuals and households in response to shocks just to survive (Farrington, Ramasut & Walker, 2002). Adaptive strategies are usually long term measures employed by people to change their behaviour pattern as an attempt to build asset bases (Farrington, Ramasut & Walker, 2002). Addressed with shock, stress or risk, family units devise coping strategies to protect their social reproduction and empower recuperation. The coping strategies might be incapable in the long haul, when utilization decreases or potentially resources are forever lost, or progressive approaches specifically drain and deplete the natural, social or financial related assets on which people, family units or communities depend on (Meikle, Ramasut & Walker, 2001; Rakodi, 2002).

In relation to long term strategies, various authors have catergorised various livelihood strategies implemented by individuals, households and the community into different forms (Scoones, 1998; Ellis, 2000; Meikle, Ramasut & Walker, 2001; Rakodi, 2002; Mahama & Maharjan, 2017). Among the different forms of livelihood strategies employed by the various entities, diversification is a running theme across the various authors. Diversification is the process of constructing different portfolios of activities to achieve a set livelihood goal. Diversification is considered a norm as very few people rely on a single source of income and it is triggered by people's assets and willingness to innovate which generates earnings (Mahama & Maharjan, 2017). Livelihood diversification is an essential source of incomes for individuals and households in rural and urban areas in developing countries. Livelihood diversification patterns have shown a decrease in the reliance on agriculture by households in general in most African countries and developing countries (Mahama & Maharjan, 2017). Livelihood diversification, according to Scoones (1998) lies between an active choice to invest in diversification for accumulation and reinvestment and diversification aimed at coping

with temporary adversity or more permanent adaptation of livelihood activities, when other options are failing to provide a livelihood.

Other categories of livelihood strategies identified by Scoones (1998) especially, among rural dwellers were agricultural intensification and/or extensification that focus on between capital-led (supported often by external inputs and policy) and labour-led (based on own labour and social resources and a more autonomous process). Also, migration were individuals decide between different migration causes (voluntary and involuntary movement), effects (for example; reinvestment in agriculture, enterprise or consumption at the home or migration site) and movement patterns (to or from different places). Furthermore, another general characterisation of different livelihood strategies by Rakodi (1999) as cited in Farrington, Ramasut and Walker, (2002) were investment in securing more of an asset which may promote security and also allow for diversification or intensification of activities. **Substitution of one asset for another**, for example, compensating for the declining availability or quality of natural capital by increasing inputs of physical capital.

Disposal, which involves the sale of assets such as livestock, land or jewellery, to compensate for a consumption shortfall or to release funds for investment and

Sacrifice, for instance, not investing time and resources in fostering reciprocal social relations, thereby reducing future ability to draw on social capital; sacrificing children's ability to earn adequate incomes in future by withdrawing them from school because of the inability to pay fees or need for their labour. Finally, a categorisation of livelihood strategies by Farrington, Ramasut and Walker (2002) included income-enhancing, expenditure-reducing, collective support and external representation strategies.

Shah, Khan, Akmal and Sharif (2005) in their study of livelihood assets and livelihood strategies of small farmers in the salt range of Pind Dadan Khan District Jhelum in Pakistan performed a diagnostic analysis using participatory rural appraisal (PRA). The results of the study showed that for sustainable livelihood; improvement of crop production, effective utilization of rainwater with very little application of brackish ground water for irrigation; improved livestock management; and diversification of livelihoods towards non farm activities are of utmost importance (Shah, Khan, Akmal & Sharif, 2005). Also, Lyatuu and Urassa (2015) assessed the relationship between land access and livelihood strategies in the context of land scarcity. The study conducted adopted the cross-sectional research design with data collected both qualitatively and quantitatively. Both multinomial logistic regression and content analysis were applied to data collected. The results indicated, farming as the dominant household livelihood strategy with significant proportion of households coping with land shortage by engaging in survival off-farm livelihood strategies (Lyatuu & Urassa, 2015). Livelihood strategies are more than a response to contextual factors and the assets available but also the result of men and women objectives and choices which are in turn affected by individual and cultural preferences (Farrington, Ramasut & Walker, 2002).

2.4 Effects of livelihood strategies on land cover

Land and human beings do not exist in vacuum. The linkage between humans and land cannot be over emphasized as there exist continuous interactions between humans and land as two unique systems. The interaction of humans as part of the ecosystem is a perspective where social, economic, ecological, cultural, political, technological, and other components are strongly linked (Sommerkorn, et al., 2013; Petrosillo, Aretano, & Zurlini, 2015). Land is a key asset for livelihoods because of its primacy in asset sequencing (DFID, 1999). Everything that we need for our survival

and well-being depends, either directly or indirectly on our natural environment. The relationship or interconnectedness between humans and the environment (land) is co-evolving across spatial and temporal scales, where the ecological component provides essential services to society such as supply of food, fibre, energy, and drinking water (Petrosillo, Aretano, & Zurlini, 2015). As the environment continues to supply essential services to society, there is the challenge of the changing landscapes that have global, regional and local impacts as people continue to expand their livelihoods with populations expanding. There has been much research on the effects of humans on the environment and effects of environmental changes to humans with extensive views while little has been done on the interconnected effects posed by both variables. The continues expansion in livelihoods and population across the globe have led to two schools of thought that either focus on the ecological impacts of the growth as a threat to the sustainability of the natural environment or on the other hand the economic impacts the growth and expansion in populations and livelihoods bring to fore, in terms of derived benefits through sustainable livelihoods. Sustainability, as defined by the USEPA (2016), "creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of future generations".

Researchers and other professionals who belong to the school that holds the economic impacts of livelihoods (human activities) as a positive agent to change to livelihood characteristics found in both cities and periphery communities have contended that, livelihood strategies and resultant outcomes have offered adequate satisfaction of residential choices, better social amenities and lower crime rates (Khosravaninezhad, Zadehbagheri, Nikdel, & Fathi, 2011). Opponents who focus on the ecological impact of livelihoods and strategies employed on the contrary argue that

the choices lead to amplified cases of degradation of the green vegetation cover, alteration in valuable environmental landscapes, air and noise pollution, congestions, conversion of agricultural lands into non-agricultural uses and other manifold undesirable outcomes (Owusu, 2012). The need to strike a balance to ensure the sustainability of both the natural environment and livelihoods leads to the need to recognise the effects on peripheries becoming part of the city in light of environmental, economic, and social effects.

The environmental effects and threat posed by livelihoods of residents on the land cover especially in periphery communities can be seen from the pressures for the demand of resources from these communities in terms of arable lands, water, air and forestry products (Habibi & Asadi, 2011). The rate at which forests and various forms of natural land cover types around cities are disappearing for the past years is very alarming with the trend remaining unusual (Yaro, Okon, Bisong, & Ukpali, 2016). The high demand for timber and other forest products such as wood for fuel or construction and others has resulted in a high level of forest encroachment, land cover conversions and a high rate of deforestation and forest degradation worldwide (Yaro et al, 2016). This huge demand by the populace for these essential resources have led to the demolition of agricultural lands, environmental pollution in the inner and outer areas, changing cultivation patterns, construction in areas exposed to environmental hazards and alteration in valuable environmental landscapes (Khosravaninezhad, Zadehbagheri, Nikdel, & Fathi, 2011). According to Mya (2010), change in forest cover worldwide has been influenced by converting those areas into other land uses due to rapid urban development. The use of peripheries as sinking grounds or dumping sites for urban solid and liquid wastes is also a consequence of the expansion of livelihoods and various strategies meant for survival and a sustainable livelihood from the cities. For

instance, periphery towns like Mallam and Anyaa were huge sites for dumping waste which led to serious environmental degradation in terms of water and air pollution as the built environment expanded (Naa, 2011; Dogbevi, 2017).

The extraction and use of resources such as water, forest products, sand, mineral deposits among others within the environment lead to pollution, degradation of the environment and thus making people vulnerable and susceptible to diseases and contamination. The health and wellbeing of the human population depend on the services provided by the ecosystem and their components within the environment. Therefore, any destruction in the ecosystem makes the services provided very difficult to duplicate as they may non-renewable even though these services provide a multitude of benefits to humanity (Science for Environment Policy, 2015 pp.3). Particularly, in the periphery communities surrounding the city, the problem is more alarming on the people since they lack the needed support services to cope with the new environmental challenges that their livelihood activities pose to them.

In addition, Peskett, Huberman, Bowen-Jones, Edwards and Brown, (2008) stated that the on-going degradation of ecosystem services is increasing the likelihood of serious damage to human well-being. Many human activities disrupt, impair, or re-engineer ecosystems for which land covers exist every day as stated in Ecological Society of America (2000). The following human activities impair, destroy or modify the land cover within the ecosystem; runoff of pesticides, fertilizers, animal waste, pollution of land, water, and air resources, overharvesting fisheries, destruction of wetlands, erosion of soils, deforestation and urban sprawl. The allocation of peripheral lands for citing of industries in the lack of effective regulation gives rise to a host of serious health risks to the peri-urban dwellers especially the poor residents because of the discharge of industrial wastes in the environment (UNFPA, 2007).

Kombo and Ekisa (2015) in their paper, the impacts of land use changes on livelihood of the Maasai community in Kajiado County, Kenya, assessed impacts of land use changes on livelihoods and subsequent environmental degradation in Amboseli ecosystem of Southern Kenya. The paper employed both quantitative and qualitative methods of data collection. The findings revealed that practices such as deforestation, overgrazing and use of fertilizers are increasing environmental degradation and further perpetuating challenges related to environmental conservation that greatly affect their livelihoods (Kombo & Ekisa, 2015). Also, in a study on the effects of land use change on land degradation reflected by soil properties along Mara River, Kenya and Tanzania, Matano, et al., (2015) determined the effect of land use change on the physico-chemical properties of soil along the course of the Mara River. The results indicated that the five land use types affected land degradation differently along the Mara River, while adjacent land degradation affected water physico-chemical properties. These results point to the need to have focused policies on integrated land and water resource management strategies in the Mara River Basin.

Furthermore, much of the livelihood pressures that is inflicted on the land cover especially in periphery communities are seen in the form of land use changes as cities continue to expand outwardly into these areas. This continues expansion and change in land use mostly to built environment from conversion of arable farmlands have affected the livelihoods of residents, mostly indigenes who are dependent on natural resources, causing them to adopt new strategies to livelihood that sometimes leaves them vulnerable (Owusu, 2012; Oduro, Adamtey, & Ocloo, 2015).

The transition from original land cover types to other land uses often contributes to permanent deforestation, loss of biodiversity, increased weed pressure, declines in soil fertility and accelerated soil erosion. Even with these negatives, other authors have

identified that the changes of land cover towards more intensive land uses has mainly translated into an increase in household income, particularly in cases where managed fallows, mixed fruit trees, annual crops or paddy rice have expanded (Rasul & Thapa, 2003; Padoch, et al., 2008; Xu, Lebel, & Sturgeon, 2009). The need for land, as a valuable asset for survival, and achieving a livelihood as cities expands, with increasing populations from rural-urban migration inevitably converts large portions of arable lands into non-agricultural uses, raising land and building values, high cost of food and developing informal settlement and in peripheral areas thereby pricing out the poor dwellers whose livelihoods are dependent on tilling the land (Habibi & Asadi, 2011; Khosravaninezhad, Zadehbagheri, Nikdel, & Fathi, 2011; Oduro, Adamtey, & Ocloo, 2015). In effect, the peripheral areas are adversely influenced by the growing demand for space leading to the displacement or decline in agricultural employment.

With the city virtually interlocking with peripheral communities, it is important to note that the economic effect of the livelihood activities and strategies on the peripheral areas is not entirely negative. Peripheral areas are also influenced positively by urban centres by offering ready markets to their produce, availability of job opportunities to their residents and access to better essential services like hospitals and universities lacking in these areas (Lyatuu & Urassa, 2015). Residents of peripheral communities who have been displaced tend to benefit from the changes in land use, by venturing into petty trading and wage labour or cultivating higher value agricultural produce to supply urban demand (Oduro, Adamtey, & Ocloo, 2015). Therefore, the need to create a shift towards encouraging more of the positive effects on livelihoods while reducing to the barest minimum the negative economic effects is important.

The continuous expansion outward of cities to peripheral communities disposes of the homogenous composition of residents in these areas. Population re-composition

is seen as a key characteristic of peripheral or peri-urban communities with heterogeneous nature of inhabitants who range from urban middle class folks, farmers, informal settlers and local industrial entrepreneurs (Narain & Nischal, 2007). The traditional form of social network serves as a major social capital in the peripheral interface. Central to the social networks is the establishment of relationships - across class, generation, gender, and ethnic cleavages; that rely on patterns of connections and information exchange (Hanson, 2005).

Individuals' livelihoods and decision making strategies are shaped by, and in turn shape, the exchange of information and services. The network experiences, although not exactly analogous, nonetheless reflect elements of a core value system. Similarly, the cultural context formed by these experiences constitute the level at which social capital is experienced, negotiated, and sustained. The dynamism of social entanglements is derived primarily from the depth of trust and shared values among family, kin, and close personal associates. All interactions reflect an ongoing process of social change that shapes and is in turn being shaped by individual actions and attitudes (Hanson, 2005). Conversely, Thuo (2010) stated in his work that the non-recognition for extended family ties often leads to loss of communal cohesion, the negligence of orphans and the aged and also raising the prevalent rate of crime and social vices in the Nairobi rural-urban fringe. These experiences show the different perspectives livelihood activities bring to the fore, both negatively and positively.

2.5 Theoretical Approach

This section dissects the theories underpinning the study which are the sustainable livelihood approach and the human-environment system framework.

2.5.1 Sustainable Livelihoods Approach

The sustainable livelihoods approach as a framework has been modified severally by many NGOs, international institutions and agencies since the concept came into being after the 1987 UN Environment Summit and further advanced by Chambers and Conway, in 1992 (Farrington, Ramasut & Walker, 2002). This study focuses on the sustainable livelihoods approach developed by the Department for International Development, UK. The Sustainable Livelihoods (SL) approach focuses on ways for understanding the practical realities and needs of people in general mainly the poor. It further investigates to understand what they really do to make a living, the resources that they can draw on and the issues that they face in doing this (Farrington, Ramasut & Walker, 2002). The Sustainable Livelihoods (SL) approach is seen to work at three levels that is, as an overall development objective, a set of underlying development principles and an analytical framework.

The development objective of the Sustainable livelihoods approach is to enhance the sustainability of people's livelihoods with a specific focus on the livelihoods of households, poor men and women (Farrington, Chapman & Slaymaker, 2001). The developmental principles guiding the sustainable livelihoods approach is the need for objectives to be people centred, that is focusing on people's own views of their priorities, opportunities and responsiveness through their participation in decisions. Other principles are that developmental activities should be holistic as livelihood strategies are diverse and depend on an array of assets, sustainable, multi-level, conducted in partnership and dynamic (Meikle, Ramasut & Walker, 2001). This study will focus on the third level which is the analytical framework of the sustainable livelihoods approach. The analytical framework focuses on the assets that people use and the strategies that they employ to make a living rather than on their needs (DFID

1999; Farrington, Ramasut, & Walker, 2002). I will therefore elaborate on the various assets or capitals on which livelihoods are made.

2.5.1.1 Human Capital

Human capital represents the skills, knowledge, ability to labour, physical capability and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives (Scoones 1998; DFID, 1999). Human capital according to Oduro, Adamtey and Ocloo (2015) refers to both the quantity and quality of labour available to households to undertake productive and reproductive tasks. The quantitative dimension of labour resources refer to the number of household members and time available to engage in income-earning activities while the qualitative aspects refer to the levels of education and skills and the health status of household members (Rakodi, 2002). At a household level human capital is a factor of the amount and quality of labour available; this varies according to household size, skill levels, leadership potential, health status, among others (DFID, 1999). All other assets strongly depend on adequate human capital to be put into use (Farrington, Ramasut & Walker, 2002; Shah, Khan, Akmal & Sharif, 2005). For example, an individual may utilize his human capital by participating in waged employment or undertaking a business venture. Education can help improve people's capacity to use existing assets better and create new assets and opportunities (Messer & Townsley, 2003).

2.5.1.2 Natural Capital

Natural capital refers to the term used for the natural resource stocks from which resource flows and services (for instance, nutrient cycling, erosion protection) useful for livelihoods are derived (DFID, 1999). According to Oduro, Adamtey and Ocloo (2015) natural capital refers to natural resources such as land, forestry, water and mineral resources that can be consumed directly, sold or converted to consumable or

merchantable products. There are ranges of differences in the resources that make up natural capital, from intangible public goods such as the atmosphere and biodiversity to divisible assets used directly for production (for example, trees, land) (DFID, 1999).

Natural capital is very important for rural communities because they derive all or part of their livelihoods for survival to withstand seasonality and shocks from resource-based activities. In peri-urban areas where traditional rural communities are progressively absorbed into the urban system, natural assets like land is very essential as they are dependent both on agricultural and non-agricultural activities (Farrington, Ramasut & Walker, 2002). Land is a key asset for livelihoods because of its primacy in asset sequencing. Land secured households may be more likely to invest in conservation projects, housing projects, use it as collateral to access financial capital and thereafter use the financial capital to enhance their human capital through investing in their children's education (Lyatuu & Urassa, 2015). Furthermore, through owning land the household's social status is dignified enabling it to benefit from greater social capital (Worku & Mekonnen, 2012 as cited in Lyatuu & Urassa, 2015 p. 261) For all these it is important to consider access and quality and how both are changing (Shah, Khan, Akmal & Sharif, 2005). Natural capital can be a private good, for example, private land or a common pool resource, for example, the fish stock in the sea (Meikle, Ramasut & Walker, 2001; Scoones, 1998).

2.5.1.3 Physical Capital

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods. Infrastructure consists of changes to the physical environment that help people to meet their basic needs and to be more productive while producer goods are the tools and equipment that people use to function more productively (DFID, 1999). Physical capital includes tools and equipment as well as infrastructure such as

roads, ports and landing places and market facilities. Access to these and other forms of infrastructure such as health care facilities and water supply will influence people's ability to earn an adequate livelihood (Messer & Townsley, 2003). Physical capital may also include productive and household assets, housing and household goods, as well as stocks (such as jewellery) that people own, rent or use and public infrastructure that they have access to (Farrington, Ramasut, & Walker, 2002; Rakodi, 2002). The ability to invest in production equipment may directly generate income and enhance labour productivity. Housing is normally one of the most important assets for rural, peri-urban and urban households due to its multifunctionality (Rakodi, 2002). Housing in the form of shelter is used both for shelter and reproductive purposes and for productive or income-generating purposes such as renting out rooms or for a home-based enterprise (Farrington, Ramasut & Walker, 2002; Rakodi, 2002).

2.5.1.4 Social Capital

Social capital means the social resources upon which people draw in pursuit of their livelihood objectives (DFID, 1999). According to Farrington, Ramasut and Walker, (2002) social capital refers to networks of mutual support that exist within and between households, extended family, and communities, which people can mobilise to access, for example, loans, childcare, food, accommodation and information about employment and opportunities. Social capital is also defined as the social resources (networks, social claims, social relations, affiliations, associations) upon which people draw when pursuing different livelihood strategies requiring coordinated actions (Scoones, 1998). Social capital is either developed through networks and connectedness, either vertical (patron/client) or horizontal (between individuals with shared interests) that increase people's trust and ability to work together and expand their access to wider institutions (DFID, 1999). They can also be gained through

persons being members of formalised groups which often entails adherence to mutually-agreed or commonly accepted rules, norms and sanctions. Social capital can be developed through relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor (DFID, 1999). A key asset for both the urban and the rural population is social capital (Meikle, 2002). Social capital is of key importance to the way people work together, both within the household and in the wider community enhancing livelihoods (Messer & Townsley, 2003). Households in many rural, peri-urban and sometimes urban communities are linked together by ties of social obligation, reciprocal exchange, trust and mutual support, all of which play a critical role especially in times of shocks, stress and seasonality (Meikle, Ramasut & Walker, 2001; Messer & Townsley, 2003). Social capital in times of vulnerability is one of the resources on which poor people can turn to for instance, ill health, death, drought, evictions and fire outbreaks (Phillips, 2002). The welfare and access to different resources of people especially the poor expands as they increase their range of social networks (Farrington, Ramasut, & Walker, 2002; Phillips, 2002).

2.5.1.5 Financial Capital

Financial capital denotes the financial resources that people use to achieve their livelihood objectives (DFID, 1999). Financial capital refers also to all financial resources and services used by individuals and households to pursue various livelihood options. For instance, personal savings, loans from relatives, friends or moneylenders, as well as credit and financial services received from formal financial institutions (Rakodi, 2002; Scoones, 1998). Financial capital includes flows as well as stocks which contribute to consumption as well as production. The main sources of financial capital are available stocks and regular inflows of money. Available stocks may include

savings which are the preferred type of financial capital because they do not have liabilities attached and usually do not entail reliance on others. Other forms are cash, bank deposits or liquid assets such as livestock and jewellery (DFID, 1999). Regular inflows of money are mainly through earned income. The most common types of inflows other than earned income are pensions, or other transfers from the state, and remittances (DFID, 1999). Most developing countries have their economies commodified and everything depends on money, making access to income necessary for survival in rural, peri-urban and urban areas (Rakodi, 2002) Financial capital in most developing countries are generated from the sale of labour that is human capital. The communities in this study earn financial capital through other means of retailing and manufacturing.

2.5.2 Human - Environment System Framework (HES)

There are in existence various socioecological system (SES) frameworks employed in diverse research fields based on the problem under study. These frameworks include the Driver-Pressure-State-Impact-Response (DPSIR) framework, the Earth Systems Analysis, the Ecosystem Services (ES) framework, The Human-Environment System (HES) framework and the vulnerability framework (Binder, Hinkel, Bots, & Pahl-Wostl, 2013). These theories are based on concepts as adaptive cycles, resilience, adaptability, transformability, and hierarchy (panarchy), and aim to provide knowledge basis to manage complex adaptive systems and to achieve sustainable development in theory and in practice. These SESs recognize that human dimension shapes and is shaped by environment, so that social and ecological systems are interconnected and coevolving across scales (Zurlini, Petrosillo, & Cataldi, 2008).

Human-environment systems (HES) are defined as the interaction of human systems with corresponding environmental or technological systems (Scholz & Binder,

2004). Human–environment systems are characterized by mutually overlapping transactions wherein humans adjust to (situationally constraining or promotive) influences of the environment on the achievement of social goals, and in turn, attempt to modify the environment in furtherance of these same goals (Stokols, Lejano, & Hipp, 2013). The primary focus of the human–ecological perspective is the continuous exchanges that occur between the social and ecological systems which are interdependent. The exchanges between the systems are referred to as transactions in that they are bidirectional and mutually influencing (Stokols, Lejano, & Hipp, 2013). The complex interactions between development decisions of actors and ecosystems, and how the consequences of these decisions influence human values is an important area of research interest (Scholz, Gallati, Le, & Seidl, 2015). Ecosystems, structure and function are determined primarily by human interactions, perceptions, and behaviours. Therefore it is more appropriate to think of human-environment systems as an approach combining from both environmental and social sciences (Petrosillo, Aretano, & Zurlini, 2015). Human activities affect the ecological system through actions in an intended or unintended way and in the short and long run. Feedback through environmental awareness and environmental changes to human actions is conceptualized in the short and long run (Binder, Hinkel, Bots & Pahl-Wostl, 2013). Moreover, a transactional approach emphasizes the bidirectional nature of exchange between humans and their environments.

The HES was developed as a heuristic tool for structuring the investigation of human-environment interactions (Scholz & Binder, 2003; Scholz & Binder, 2004). The HES approach is considered a framework for the understanding of the mechanisms underlying environmentally sensitive action, for reflecting on interferences among different levels (that is, the individual and societal level), and for reflecting on different

feedback loops or RFC mechanisms that may lead to sustainable action (Scholz & Binder, 2004). The HES framework also provides a methodological guide or template for analysing the structure of social-ecological systems and understanding the processes and dynamics between the social and ecological systems as well as within different scales of the social system (Binder, Hinkel, Bots, & Pahl-Wostl, 2013). The HES approach conceptualizes a mutualism between human and environmental systems. The human and the environmental system are conceived as two different systems that exist in essential dependencies and reciprocal endorsement (Scholz & Binder, 2004). The reciprocity between human and environment systems, or the $H \leftrightarrow E$ impact chains, can be approached from the environmental as well as from the human perspective. The environmental perspective looks at optimizing environmental quality by integrating human models into ecosystem analysis (Naveh & Lieberman, 1994 cited in Scholz & Binder, 2003, 2004). The human perspective investigates the impact of regulatory mechanisms on the state of the environment, taking an anthropogenic perspective (Scholz & Binder, 2004).

Dynamics of the ecological system are not explicitly mentioned with regards to HES, but the understanding of the ecological system stands out front in the framework with feedbacks within the ecological system being analysed in form of stocks or flows (Binder, Hinkel, Bots, & Pahl-Wostl, 2013). The ecological system which in this study is the land cover is conceptualized from an anthropocentric perspective as the coupled system to the social system. An HES analysis is problem oriented and typically departs from the ecological system. HES' framework conceptualizes reciprocity in three ways. First, it explicitly looks at the complementarities between the systems as early as when a study is designed: the scale of the ecological system to be studied is chosen to fit with the problem perception in the social system. Second, the feedback loops considered in

the analysis explicitly include both the short-term and the long-term impact of human actions on the ecological system, and also their links back to the decision making process (primary and secondary feedback loops). Finally, environmental awareness, which is considered in each step of the decision making process, allows for considering the degree to which changes in the ecological system affect goal setting, strategy development, and strategy selection. These various feedbacks drive the dynamic interaction between the social and ecological systems (Binder, Hinkel, Bots, & Pahl-Wostl, 2013).

Scholz and Binder present a HES paradigm through a process structure model (PSM), which is derived from integrative modelling, system theory, basic cybernetic feedback loop modelling, cognitive sciences, and decision research. The PSM allows for investigating regulatory, feedback, and control mechanisms (RFC-mechanisms) in HES. The model focuses on understanding the mechanisms rather than on describing and defining units of operation (Scholz & Binder, 2003; Scholz & Binder, 2004). The HES paradigm includes three main characteristics which are higher ordered feedback loops, interfering regulatory mechanisms and relating and integrating disciplinary knowledge. Scholz and Binder's structure process model of HES is divided into human systems and environmental systems. The interface between both systems is given by the environmental awareness of humans and the environmental impacts (short and long-term reaction) of human action.

The model starts with the developing of intentions or goals, as human behaviour are goal directed and purposeful. This is followed by strategy formation. In this context game theoretic conception of a strategy in extensive games was adopted. Strategy is defined as a complete plan that provides a behavioural directive for each situation in the course of goal attainment and postulate that human systems build a set of strategies. In

order to conceptualize mutualism in HES, the environmental awareness box is introduced in the model (Scholz & Binder, 2003; Scholz & Binder, 2004). The degree of environmental awareness in the human system determines the extent to which environmental concerns are included in goal formation. Strategy selection is tied to evaluation and precedes action. The model assumes that the human system can subjectively evaluate the supposed expected utility or gain of a strategy. An action results from a strategy taken under given environmental circumstances and constraints. The human and the environmental systems physically alter after a human action. Many actions resemble decision making under uncertainty, as the human system does not know, which impact or environmental reaction will result if an action is carried out (Scholz & Binder, 2003; Scholz & Binder, 2004).

Within the human system a post-decisional evaluation takes place in close temporal relation to the environmental reaction and can be conceived of as learning. The human system is supposed to learn based on the planned behaviour (goal formation, strategy evaluation), the shown behaviour (action) and the reaction from the environment (Scholz & Binder, 2003; Scholz & Binder, 2004). We consider the effect of post-decisional evaluation on goal formation to be the primary feedback loop. However, human action can result in side effects, which are unintended dynamics, which alter the environmental system in a favourable or unfavourable manner. Side effects are often delayed or dislocated, as, from the human system perspective, they are not directly related to the perceived environmental reaction. These temporal (or spatial) delays (dislocations) in the environmental system are considered to be second order feedback to the human system as the individual will notice the effects later. Cross-scale or cross-level interactions play a challenging role in complex HES, because reciprocal effects and (first and higher order) feedback loops are frequent and can establish tricky

rebound effects. Thus, coping with multiple impacts and interactions is a special challenge (Scholz, Gallati, Le, & Seidl, 2015). Human action at one level of the human systems, may lead to environmental impacts, which in turn provide feedback to the human systems at a level different to the one of action. That is, feedback loops do not necessarily occur within one scale or level of the human system, but across levels. In addition, the human systems might differ in their goals, and strategies, generating interfering actions and environmental feedbacks (Scholz & Binder, 2003; Scholz & Binder, 2004).

2.6 Conceptual Framework: Attaining Substantiable livelihoods in the Human-environmental system

The Sustainable Livelihood approach is employed as the main concept to address the research questions of this study. The framework starts on the notion that all individuals or households crave the need for survival thus, to meet their unlimited needs and wants, no matter their level of income and economic status. Survival which is the underpinning concept refers to meeting the basic needs of human beings in terms of food, water, shelter and clothing which essentially cannot be done without and may lead to the extinction of the human race if non-existent (Aruma & Hanachor, 2017). In the need for survival, individuals and households are noted to possess different forms of assets which they stand upon to pursue a livelihood. These livelihood pursued by these set of units, first begins with an intended goal which leads to a review of assets available to a person or household towards survival. The intended goal which focuses on the need for survival, motivated to arrive at a livelihood outcome leads to various combinations of resources or assets by individuals who form the human system or capital that interacts with the environment (natural capital). Individuals and households combine their assets of human capital which involves their energy, skills and

capabilities with either their financial capital, natural capital that is land and water bodies within the natural environment, physical capital (shops, machines) or social capital which involves an individual's network of friends and association. The various combinations of assets led to a choice and the implementation of livelihood strategies, an economic or social strategy to livelihoods by the individuals or households in the three selected communities in the Ga Central Municipality.

The economic strategies available for individuals and households were livelihood diversification, agricultural intensification and investment. Livelihood diversification is the process of constructing different portfolios of activities to achieve a set livelihood goal (Mahama & Maharjan, 2017). Investment refers to engaging in activities that provide long term security and can be relied on in times of uncertainties to provide a means of survival in the short, medium and long run (Rakodi 1999 as cited in Rakodi 2002). Agricultural intensification refers to when there is an increase in the total volume of agricultural production that results from agricultural production been maintained while certain inputs such as the land decreases in size for agricultural purposes (FAO, 2004).

Also, the social strategy available for residents in the three communities; Ablekuma, Agape and Gonse is reciprocity. Reciprocity refers to the exchanges that exist between people of close ties and related by a common substance. The results of the implementation of the various livelihood strategies are the livelihood outcomes that can be positive or negative to both man and the environment. The SLA is combined with the Human Environment System framework to address the weaknesses of both models. Additionally it was to bring out the depth of content needed that fits the selected peri-urban areas. The SLA as discussed above puts persons at the centre of development by recognizing them as the drivers of change. It does this by highlighting

the strategies they employ to survive. These strategies are diverse and may differ from community to community, and as this study later explain in the empirical section, residents in each community in the case study employing the different strategies to make a living. The SLA also helps to identify the differences in the assets endowment of the various community, households or individuals.

The HES framework expanded earlier focuses on the interdependence between humans (human capital) and the environment (natural capital). This is highlighted by the bidirectional interaction of reciprocity that involves flows between these two units. These interactions produce feedback effects that are experienced by both sides either in the short or long term. The interaction and feedback also among assets, especially been converted from one form to another is essential point to the study. This study explains the feedback effect on both humans and the environment with special emphasis on how to create a balance from the actions of humans and its outcome on the land cover to ensure sustainability of both the natural environment and livelihoods in the Ga Central Municipality

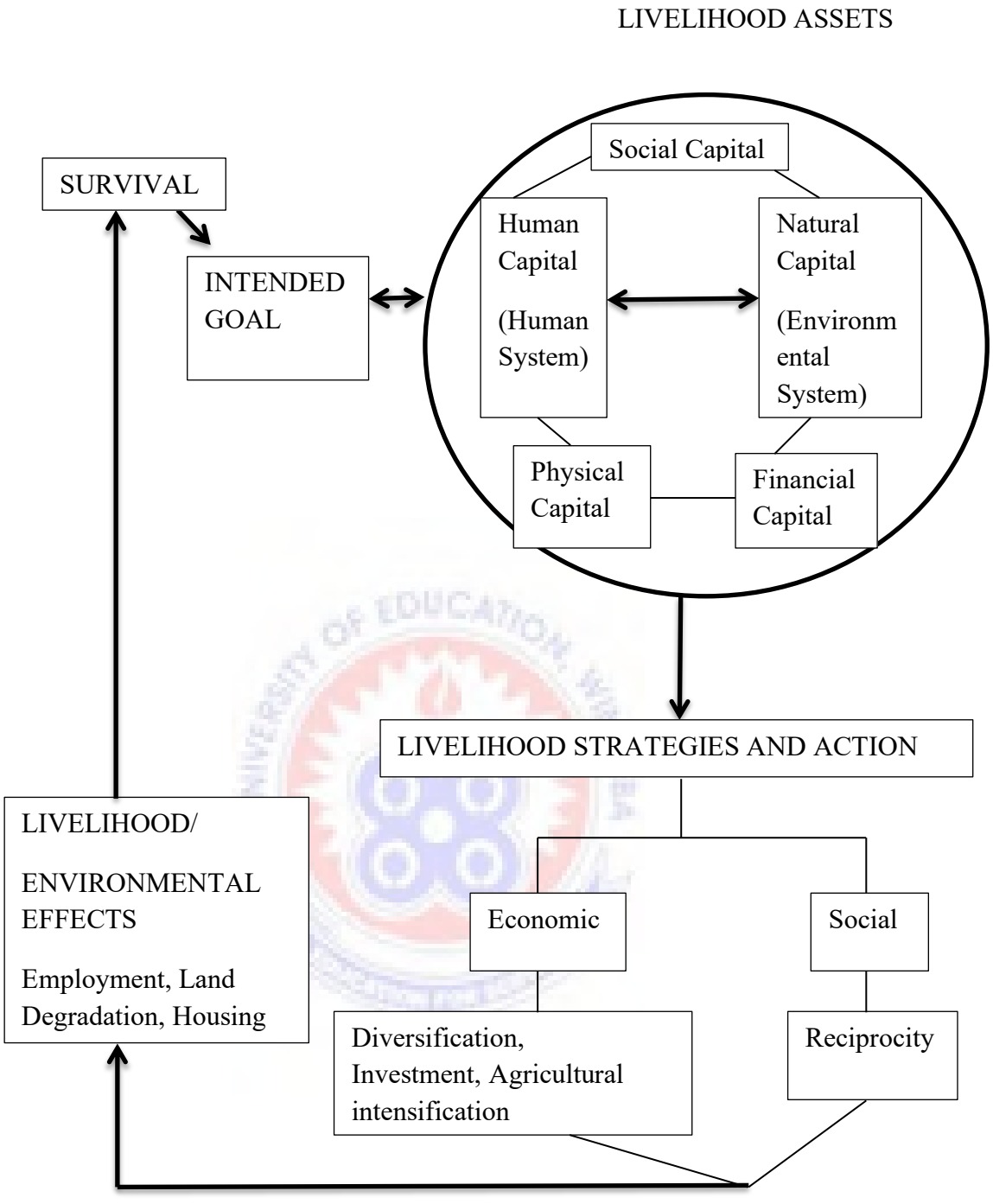


Figure 2: Attaining Substantiable livelihoods in the Human-environmental system

Source: Author's Construct, adopted from DFID (1999) and Scholz and Binder (2004).

2.7 Summary of Literature Review

The first section of the chapter was devoted to the review of related literature for the study. Specifically, the concept of land cover and land cover change as a principal

area of concern. Authors who had studied the shift in the natural environment and resources were covered reviewing past and present literature to gain different perspectives on the subject. Further, the chapter provided an overview of the various livelihood strategies envisaged by various scholars and institutions alike, for instance, DFID. Finally, the various effects and feedback from and on the land cover and humans were addressed.

The rapid transformation of peri-urban land use and livelihoods especially in cities like Accra has seen considerable amount of studies conducted across developmental issues mostly considering these concepts as linked or separate entities. Although these studies highlight significant studies on the linkage between land-cover land-use changes, livelihoods and its related activities, there is still a paucity of literature that assesses the effects of livelihood strategies of residents on the land cover changes and which strategies to adopt to cope with the emerging challenges. With the Sustainable Development Goals in force in 2016, and goal 15 which is protect, restore and promote sustainable use of terrestrial ecosystem, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss including increasing the capacity of people to pursue sustainable livelihood opportunities, have most sub goals needed to be met by 2020. This study therefore examined this gap in literature and provides empirical results addressing the stifle that exist in the need to ensure sustainability of the natural environment and sustainable livelihood in the Ga Central Municipality. Hence, the study employs two concepts, which are the sustainable livelihood approach and human-environment system framework to address this stifle.

CHAPTER THREE

MATERIALS AND METHODS

3.0 Introduction

This chapter provides an overview of the methodology used in this study. The chapter presents the study area, research design, target population, sample and sampling techniques as well as the different approaches used in data collection and analysis.

3.1 Study area

The study was conducted in the Ga Central Municipal Assembly in the Greater Accra region of Ghana, specifically in three communities namely; Agape, Ablekuma and Gbawe Gonse. The Ga Central Municipality lies within the coordinates 5˚ 34' 45" N to 5˚ 39' 20" N and 0˚ 21' 45" W and 0˚ 15' 30" W. The Ga Central Municipal Assembly covers 1.5% of the total land area of the Greater Accra region and is one of the sixteen district assemblies in the region (GSS, 2014a). The Ga Central Municipality is bounded to the North by the Ga West Municipality, to the South-East by the Accra Metropolitan Assembly and to the South by the Ga South Municipality. Specifically, the selected communities for the study lie within the Ablekuma/Anyaa enumeration area as divided by the Ghana Statistical Service during the 2010 Population and Housing census (GSS, 2014). The three communities were selected since they fall within the north-western corridor of the Greater Accra Metropolitan Area (GAMA) which is seen to experience rapid development and form part of the densely populated areas in the municipality (Ga Central Municipal Assembly, 2017).

The Ga Central Municipality comprises 52 communities and falls within the coastal savannah agro-ecological zone. Rainfall within the municipality is bi-modal with an annual temperature ranging between 25.1 ˚C in August and 28.4 ˚C in February

and March which are the hottest months (GSS, 2014a). The Municipality consists of two main vegetation types, namely the shrub lands and grassland with the Coastal Savannah Ochrosols being the main type of soil in the area suitable for coconut and shallots cultivation. The Municipality covers part of the Akwapim range with the soils there, rich in sandstone and limestone that are a good source of material for the construction industry. The land area of the Municipality consists of gentle slopes interspersed with plains in most parts and generally undulating at less than 76 metres above sea level (GSS, 2014a).

The Municipality is dominated by five main land cover types. The land cover types include grassland and shrubs, farmlands, built-up, bare area and waterbodies. These land cover types were used as the basis for the land cover change analysis performed in the municipality.

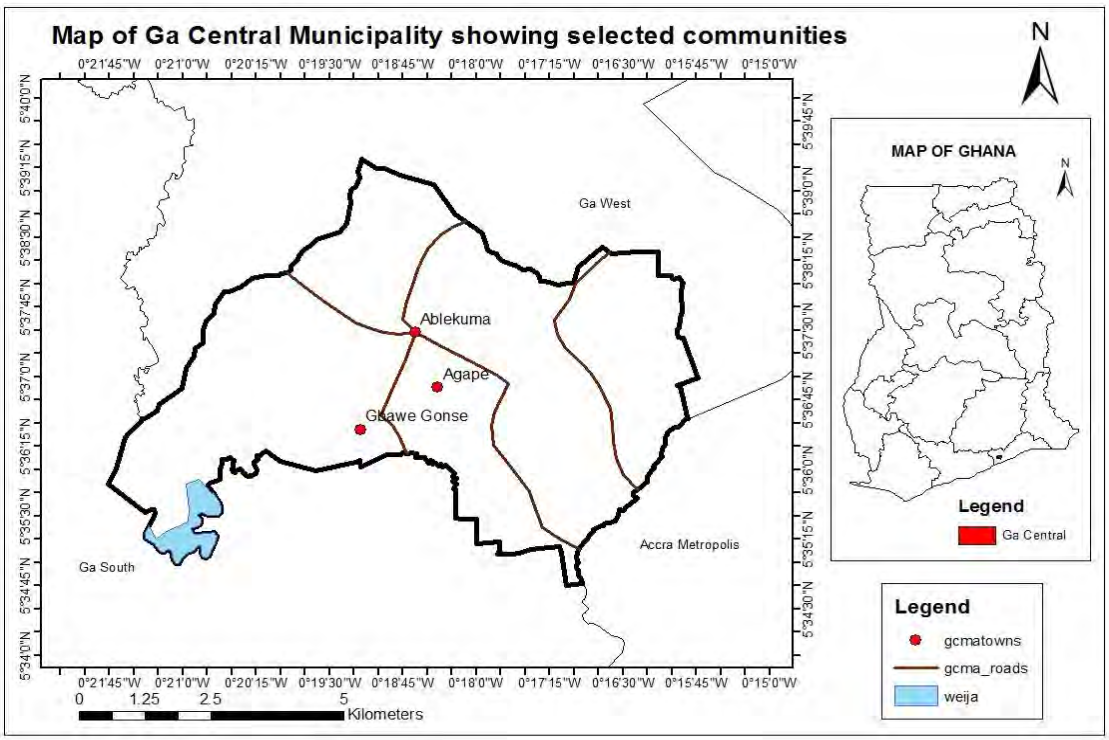


Figure 3: Map of Ga Central Municipal Assembly

Source: Author's Construct

3.2 Research design

The study adopted the cross-sectional and case study designs as it sort to assess the effects of livelihood strategies on the land cover change in the Ga Central Municipality. A cross-sectional design is an observational study design where researchers collect data, measure the outcome to describe and make inferences about a population of interest during a one-time study (de Vaus, 2001). The cross sectional design was employed to analyse the changes to the land cover over the years by comparing images to draw differences during the period under study. The design helped the researcher from a quantitative perspective using Remote Sensing and GIS, to scrutinise the problem, analyse and make inferences about the changing nature of the land cover within the study area.

The case study design is an empirical inquiry that involves an in-depth and detailed investigation of a phenomenon within its real-life context (Gillham, 2000; de Vaus, 2001). The case study design was adopted to assess the various livelihood strategies employed by residents of the three communities of the Ga Central Municipality over the years. The case study design helped to investigate the various livelihood strategies of residents, increase the understanding of the researcher on the subject matter through in-depth information gathered from the field.

The research approach employed in this study was the mixed method approach combining both the quantitative and qualitative approaches in a concurrent manner. The mixed method approach represents research that involves collecting, analyzing and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon (Leech, 2008). The mixed method approach was employed to allow the quantitative and qualitative methods complement each other, get the fullness of experiences of participants as well as explore the

interconnected aspects of the phenomenon. The quantitative aspect of the study covered mainly the extent of land cover changes while the qualitative aspect was based on the various livelihood strategies employed in the study area.

3.3 Target population

The target population under this study were residents of the Ga Central Municipality specifically, residents of Ablekuma, Agape and Gbawe Gonse who were eighteen (18) years and above, leaving within these communities for at least ten (10) years. The age barrier was used to target residents who were old enough to provide historical information necessary for the study. The ten (10) year stay limit enabled the researcher gather information from the residents based on their observation and experiences over the years with regards to the phenomenon been investigated.

Also, the study targeted the traditional authorities, opinion leaders as well as officials of the Works and Physical Planning departments of the Ga Central Municipal Assembly. The traditional authorities of these areas were targeted as they are the custodians and legal owners of lands within the jurisdiction under study and involved in the sale of lands as well as the development of these areas. Opinion leaders were targeted as they were people who had first-hand information due to their own experience and observation as well as were known and influential personalities in their various communities. The officials of the Works and Physical Planning departments of the Ga Central Municipal Assembly were targeted as they serve as the government's representation in the municipality in charge of implementing policies. They are also in charge of planning and engineering duties such as issuing building permits, monitoring the development of building structures and infrastructural development like roads, schools among others which take place on the land, induce changes and affect livelihoods.

3.4 Sampling size

Sampling refers to the process where a portion of the population is selected as a representation of the population. A sample is a set of individuals selected from a population, usually intended to represent the population in a research study (Gravetter & Wallnau, 2007). With regards to the sampling size, a sample size of 370 was arrived at using a 95% confidence level based on the Research Advisor table from a population of 19,541. The Research Advisor table provided a sample size for a range of population values based on the variance in the population and a determination of the maximum desirable error as well as the acceptable Type I error risk functioned on Krejcie and Morgan (1970) formula of determining sample size (The Research Advisors, 2006).

Three hundred and thirty (330) respondents of the total sample size of 370 were sampled residents who had lived within these communities for more than 10 years were. One hundred and ten (110) respondents each from the three communities were sampled based on the population of the Ablekuma/Anyaa enumeration area where these three communities are located determined by Ghana Statistical Service in the 2010 Population and Housing Census (GSS, 2014). The remaining 40 were participants who had in-depth, historical and/or technical knowledge about the problem been studied. The 40 participants were selected to aid the qualitative aspect of the work was justified by Morse (1994) who suggested between 30 – 50 participants for such an approach.

3.5 Sampling technique

The study employed both the probability and non-probability sampling techniques using both the purposive and stratified random sampling techniques. Purposive sampling refers to the selection of units based on personal judgement rather than randomization. The purposive sampling technique was used to select the forty (40) participants for the study who had vast knowledge, experience and/or technical

expertise concerning the problem studied. These participants were selected based on the criteria of been 18 years and above, influential, technical experts, had lived more than ten (10) years in the communities, making them experience the nature of land cover change and having a historical perspective of their communities. The participants included traditional authorities, opinion leaders, business owners, officials of the Works and Physical Planning departments of the Ga Central Municipal Assembly and okada riders.

The purposive sampling technique also was chosen to select the three communities under the study. The three communities purposively selected within the Ga Central Municipal Assembly for the study are; Agape, Gbawe Gonse and Ablekuma rapidly developing areas in the north-western corridor of the Greater Accra Metropolitan Area (GAMA). The three communities; Agape, Ablekuma and Gbawe Gonse were chosen for the study as they are all relatively new areas in Accra that have gone through enormous changes in terms of land cover and their development seized or slowed after the murder of the two policemen over land litigation in 1998 that led to the destruction of life and properties, with people going into hiding from the communities making it a ghost village affecting the sequence of land cover and livelihoods (Mensah, 1998a; Mensah, 1998b; Otoo, 1998; Mensah, 1998c; Mensah, 1998d).

Stratified random sampling also refers to the process of dividing a target population into strata (groups) based on characteristics important for the research study from which a sample is drawn (Elder, 2009). The stratified sampling method was also employed to afford equal representation of respondents from the three selected communities. Stratified random sampling was adopted to select 110 respondents each from the three communities that fell within the Ablekuma/Anyaa enumeration area and responded to the semi-structured questionnaire. The stratified random sampling was

used since it created equality and equal distribution of the sample as other communities together with the three selected formed the Ablekuma/Anyaa enumeration area. Each stratum consists of homogeneous respondents that have lived in each community for ten (10) years or more and were randomly selected based on their availability and consent.

3.6 Data collection instrument

Data for the study was gathered from residents using a semi-structured questionnaire, with closed-ended and open-ended questions. This helped the researcher gather the views and opinions of residents on the livelihood strategies of the residents in the Municipality on the land cover. Key informant interviews were conducted using structured interview guides. The interviews were carried out with the traditional authorities, opinion leaders, business owners and the Works, Survey and Planning departments of the Ga Central Municipality to acquire in-depth and detailed information about the perceptions and opinions of the participants.

Also, remote sensing data of Landsat images from three satellites Landsat 4 TM, Landsat 7 ETM and Landsat 8 OLI for the years 1991, 2003 and 2018 were obtained from the United States Geological Survey (USGS) online data portal to run analysis on the land cover changes within the Municipality.

3.7 Data collection procedures

The study was conducted to achieve an analysis of change from the past to present using multi-temporal and multi-sensor satellite imagery. Landsat images from different satellite sensors for three different years 1991, 2003 and 2018 were used. The satellite images for the three years were chosen as they were the best images available that had no cloud or strip interruptions on the images and gave a close to an equal interval between the years to access the pattern of change. The satellite images chosen

were that of the dry season between November and February as the season was void of cloud interruption and afforded clearer images as compared to that of the rainy season.

On-site questionnaires which were primarily in a paper version were administered and collected on-site alongside an electronic form of data collection through an online survey link which employed the survey tool Google Form and allowed the respondents to respond at a convenient time when agreeing to participate in the study. The researcher sent WhatsApp messages as a reminder to respondents who opted for the online survey and yet to fill. Also, forty (40) key informants which included officials of the Works and Physical Planning departments of the Ga Central Municipal Assembly, traditional authorities which include Asafo members (land guards), opinion leaders of the various communities were interviewed. Face to face interviews were conducted with the officials of the Works and Physical Planning departments of the Ga Central Municipal Assembly for their expert views. In-depth interviews were also held with traditional authorities, opinion leaders and business owners of the various communities. Interviews were also held with Okada riders and Asafo members (land guards) who are field servants and yield authority given to them by the various chiefs in their communities as well as the watchers concerning land in the various communities. The interviews focused on the land cover changes and the various livelihoods they observed thriving in their communities.

3.8 Image Processing

Landsat images of the Ga Central Municipality for the years 1991, 2003 and 2018 were used for the study. The data for the years were obtained between November and early February which corresponds to the dry season in Ghana. Remote sensing software: ERDAS Imagine 2013 and ArcGIS versions 10.1 were used for the processing of the images. The downloaded satellite images were converted from Tag

image file format (Tiff) to img format using ERDAS Imagine 2013 in order to be compatible with other ERDAS Imagine files. Pre-processing operations were carried out to correct for radiometric distortion of the images because of curvature, rotation of the earth, atmospheric and sensor effects. The Haze reduction module and noise reduction module in ERDAS Imagine 2013 was processed on all the three images to give a better and an enhanced image for classification. The individual layers for each year were stacked and subsetted to delineate the study area for classification. The UTM Zone 30N coordinate on the WGS 84 was used to geocode the imported image.

Band combination of red, blue and green was used to display the raw images in standard colour composites. The spectral band combination for displaying images often varies with different applications (Trotter, 1998). This was necessary for the visual interpretation of the images. A band combination of red, blue and green (RGB) is often used to display images in standard colour composites for land use and vegetation mapping (Trotter, 1998). Finally, maps for the various years were composed, using ArcGIS (Version 10.1) programme.

Table 1: Satellite images and characteristics

Satellite	**Date**	**Season**
Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) Landsat-8	12th January 2018	Dry Season
Enhanced Thematic Mapper Plus (ETM1) Landsat-7	12th February 2003	Dry Season
Thematic Mapper (TM) Landsat 4-5	10th January 1991	Dry Season

Source: United States Geological Survey (USGS), 2019

3.9 Image classification

The images for the three years 1991, 2003 and 2018 underwent unsupervised classification using the classification algorithm Iterative Self-Organising Data Analysis Technique (ISODATA) with a maximum iteration of 50, classified into 200 different classes with a signature for detailed classification of phenomenon in the study area. The unsupervised classified data was hence grouped into various categories through field observation of the research and with the help of Google Earth Explorer Pro for ground truthing, where the reflected images where given specific colours. Using the supervised maximum likelihood algorithm, the unsupervised image was re-classification. The utility of the algorithm is that, it takes the variability of the classes into account by using the covariance matrix and allowing land covers to be specified more explicitly by allocating to each image pixel, on basis of the spectral properties of the image, the class with which it has the highest probability of membership (Mulders et al. 1992; Jensen 1996).

The maximum likelihood algorithm was most suitable for minimization of classification error. Training sets were defined of each land-cover class from which spectral signatures were generated for image classification. The training polygons were digitized on screen based on terrain knowledge acquired with the assistance of Google Earth Explorer Pro, were Google Earth Explorer Pro images were backed dated to suit the image being classified and through observation. All classifications done were based on a classification scheme adapted from the FAO Land cover classification system. The land cover was categorised into five classes namely; built-up, farmlands, bare area, Grassland and shurbs and water. Table 2 elaborates on the criteria for each land cover class.

Table 2: Land cover classification scheme for Ga Central Municipal Assembly

Land cover class	**Description**
Built-up	Areas with high intensity of artificial cover like infrastructure resulting from human activities
Grassland and shrubs`	Areas with natural vegetation cover of grasses and trees
Farmlands	Areas under cultivation use
Water bodies	Areas naturally covered by water such as rivers, streams or lakes
Bare Area	Areas with exposed soil surface either from human activities or natural occurrences

Source: Adopted from FAO, Land Cover Classification Scheme 2016.

3.10 Accuracy Assessment

After completion of image classification, the supervised classified images were assessed for accuracy. The accuracies of the resulting land cover maps were assessed using the confusion matrix. The confusion matrix is able to generate several measurements of quality, which includes overall accuracy, producer accuracy, user accuracy, and Kappa coefficient. The accuracies were calculated by comparing the corresponding area of interests (AOI) that was generated by ERDAS Imagine 2013 for the classified land cover maps and linked with the reference data of Google Earth. 100 points of AOI was run by ERDAS Imagine 2013 for ground truthing using Google Earth.

3.11 Data Processing and Analysis

According to Creswell (2005), data analysis is a process which involves drawing conclusions and explanation to findings of a study. The findings of this study were reported and analysed using various approaches and techniques. The overlay analysis

was used to analyse satellite images to extract the changes that have occurred within the year, 1991, 2003 and 2018 using the Erdas Imagine 2013 software. ArcGIS 10.1 was used in the creation of maps for the research. The NVivo software was used to code and group the qualitative responses from interviews of participants summarised according to themes in line with the objectives of the study. The themes analysed using NVivo were land cover change, economic activities before 2005 and those after 2005. The SPSS software was used to perform cross-tabulation analysis which was shown in percentages. Results were presented in tables, graphs and narrations.

3.12 Ethical Consideration

The study put a premium on ethical issues as human subjects were involved. A consent letter was sought from the Department of Geography Education, through the School of Graduate Studies, University of Education, Winneba (UEW). Consent was also sought from the traditional authorities of the various communities as well as family heads to enable the researcher to interact with the residents and family members. Selected respondents and participants were given clear and detailed explanations on the objectives of the study as well as its importance. Willing participation from residents and participants was sought to participate in the study. Respondents were also made aware they were free to pull out from the study at any point in time they felt they did not want to continue.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.0 Introduction

This chapter presents the results of data collected for the study which were analysed. It presents data from both primary and secondary sources on the demographic characteristics of respondents, land cover changes, as well as livelihoods of the respondents.

4.1 Demographic Characteristics of Respondents

The study assessed the demographic information of respondents within the three communities studied. Table 3 presents the demographic information gathered as follows. With respect to the gender of respondents, the study indicated that out of the total respondents, the majority of the respondents (63.4%) were males while the remaining 36.6% respondents were female as displayed in Table 3. This result is attributed to the skewed nature of the study to get more information from heads of households, which in most cultures and religions in Ghana turn out to be males.

In terms of the age distribution, the researcher with the aim of targeting the adult population mostly those above 18 years. This helped the researcher gain access to individuals that had historical experience and older to give information about their communities. Table 3 shows the distribution of respondents according to their ages. Results showed that out of the total of 309 respondents, majority of the respondents (38.2%) were within the ages 41-50 and the least respondents (13.6%) within the ages 18-30.

From Table 3 below, the results from the study showed majority of the respondents (43.7%) have received secondary education and the least number of respondents (4.2%) receiving no formal education at all. The result resonates with that of the Ga Central Municipality which shows a high literacy rate of 92.8% for its population (GSS, 2014).

Table 3: Demographics of respondents

	Frequency	**Percentage (%)**
Gender		
Male	196	63.4
Female	113	36.6
Age		
18-30	42	13.6
31-40	100	32.4
41-50	118	38.2
50+	49	15.9
Literacy		
No schooling	13	4.2
Primary	29	9.4
Secondary	135	43.7
Tertiary	132	42.7
Total	**309**	**100.0**

Source: Field survey, 2020

4.2 Extent of Land Cover Change

The research investigated the extent of land cover change within the Ga Central Municipality. The details of land cover distribution and changes are discussed below.

4.2.1 Land cover distribution

The figure 4 below shows the general distribution of land cover features in the study areas: grassland and shrubs, farmlands, water bodies, bare areas and built up. The

chart below displays the trends of each class according to the years 1991, 2003 and 2018 under review for the study.

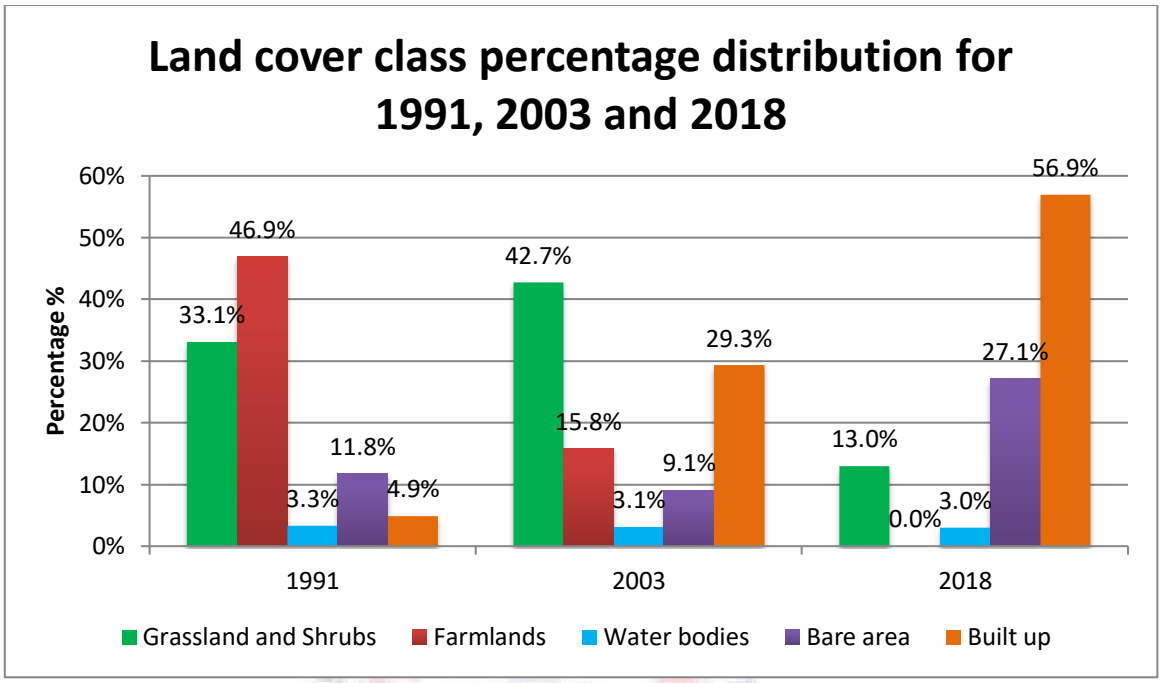


Figure 4: Land cover class percentage distribution for 1991, 2003 and 2018

Source: Author's Construct from Landsat Images 1991, 2003 and 2018

With the exception of bare area and grassland and shrubs, all other land cover types were constant in their direction of change from year to year whether in terms of increasing or decreasing. The study revealed that built up areas in the municipality have been rapidly expanding mainly at the expense of farmlands. Farmlands had the greatest loss, while water bodies showed very little change between 1991 and 2018.

According to the study, in 1991, farmlands were the most dominant land cover type, covering 2,331.45 hectares (46.9%) of the Ga Central Municipality. This was followed closely by grassland and shrubs representing 1,645.2 hectares (33.1%), bare areas covering 587.43 hectares (11.8%), built up also covering 241.02 hectares (4.9%) and water bodies covering 164.88 hectares (3.3%) of the entire study area as shown in Figure 4.

In 2003, grassland and shrubs continued to cover a sizable portion of the municipality specifically 2,120.49 hectares (42.7%) even though marginally increasing by 9% between 1991 and 2003. Between the same time period, farmlands diminished to 786.15 hectares (15.8%), bare areas to 450.27 hectares (9.1%) as well as water bodies diminishing to 156.06 hectares (3.1%). The study also indicated that built up areas significantly increased from 4.9% in 1991 to 29.3% in 2003 within the space of 12 years showing an overall exponential increase of 504.5% in built up areas. This percentage increase means that built up covered an area of 1457.01 hectares of the entire municipality.

As of 2018, built up was the most widespread land cover type covering more than half of the municipality as it continued to rapidly expand. Built up areas covered 2829.44 hectares (56.9%) of the study area in 2018 showing the expanse of urbanisation within the municipality. Also, bare areas hugely increased to 1348.38 hectares (27.1%) while farmlands continued to give way to built-up as it went extinct in the study area in 2018. Within the same time period, grassland and shrubs massively diminished occupying only 643.37 hectares (13%) of the study area in 2018. Waterbodies also experienced a narrow reduction in size to 148.79 hectares (3%) of the study area showing an overall reduction of 9.8%. Figures 4 and 5 show the percentage coverage and spatial distribution of the land cover types for the years 1991, 2003 and 2018.

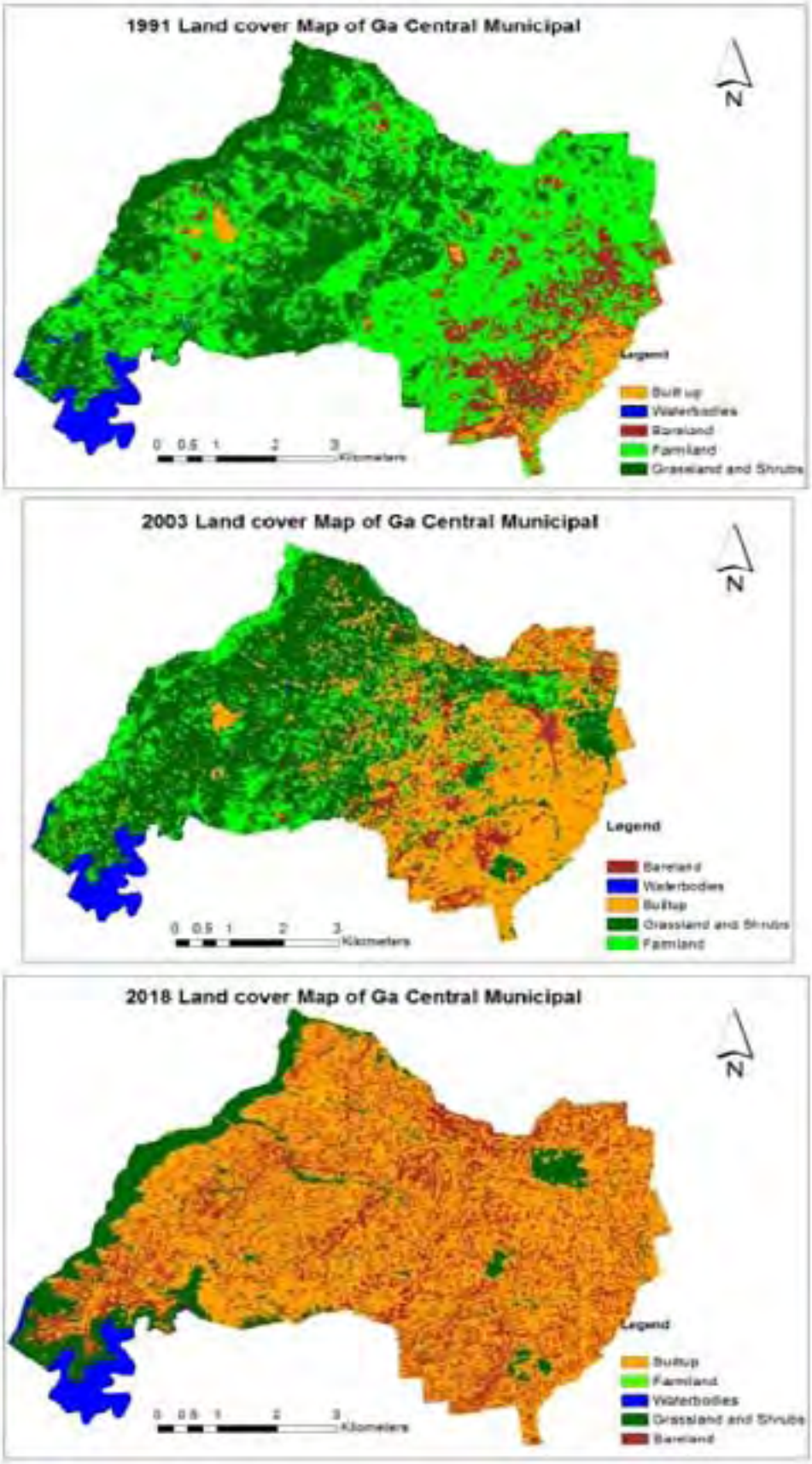


Figure 5: Land cover distribution for the years 1991, 2003 and 2018

Source: Author's Construct from Landsat images 1991, 2003 and 2018

4.2.2 Land cover change and land conversion distribution

Figure 6 below shows the land cover change distribution in hectares of the five land cover classes over the time periods under review showing the net gains and loss to the various land cover classes.

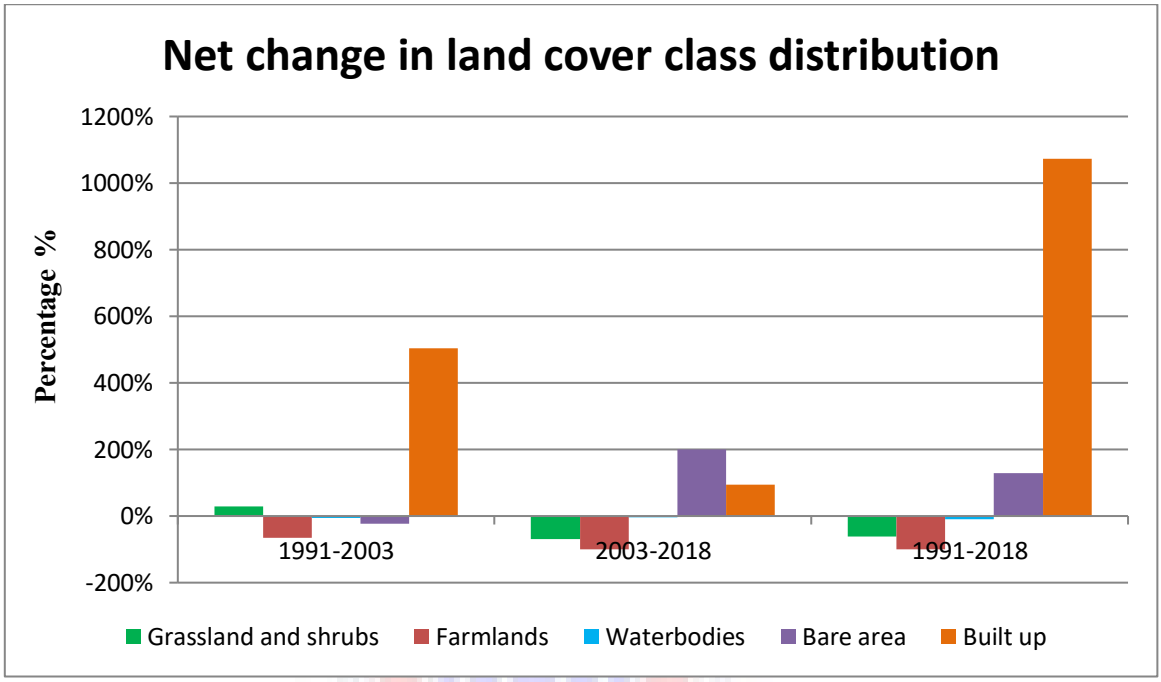


Figure 6: Net change in land cover class distribution

Source: Author's Construct of graph from Landsat Images 1991, 2003 and 2018

With reference to Figure 6, among the five land cover classes analysed, built up experienced the highest expansion rate in the study area while farmlands were the highest diminished feature within the study area. The analysis indicated a great increase in built up gaining 1215.99 hectares (504.5%) with grassland and shrubs also increasing by 475.29 hectares (28.9%) between 1991 and 2003. Farmlands were greatly lost within the same time period with the loss accounted as 1545.3 hectares (-66.3%). Bare areas and water bodies according to the study also experienced decreases by 137.16 hectares (-23.3%) and 8.82 hectares (-5.3%) respectively between 1991 and 2003, a time period of 12 years. Figure 6 shows a great gain in hectares to the land cover class bare area,

having the highest increase of 898.11 hectares (199.5%) between 2003 and 2018. Increases were also accounted for in built-up also enjoying a huge leap of 1372.43 hectares (94.2%). The analysis also revealed a total extinction of farmlands, within the municipality losing all 786.15 hectares (-100%) of remaining farmlands. Grassland and shrubs recorded a massive reduction of 1477.12 hectares (-69.7%) with waterbodies also diminishing by 7.27 hectares (-4.7%) between 2003 and 2018, a time period of 15 years.

Altogether, built-up in the area expanded by 2588.42 hectares (1073.9%) between 1991 and 2018, a time period of 27 years. Within the same time period, all farmlands were lost to other classes totalling 2331.45 hectares (-100%). Bare areas between 1991 and 2018 increased significantly by 760.95 hectares (129.5%) while waterbodies and grassland and shrubs decreased by 16.09 hectares (-9.8%) and 1001.83 hectares (-60.9%) respectively. This complete loss of farmlands, decrease in grassland and shrubs and waterbodies is briefly explained by an opinion leader from Ablekuma who expressed that:

During my youthful years where the population was mostly the natives, who were known farmers, my family used to own large acres of farmlands at the area known as 'Odunshie' presently called Agape. But with spread of development towards Ablekuma, parcels of our farmlands were either sold to individuals for residential purposes or illegally sold by the embattled chief that recently passed on. Our source of drinking water, the stream 'Onufu Bu' (which translates Snake Pit) has also had buildings been put up along its course and hugely polluted.(See Figure 7)

Figure 7: A section of the Onufu Bu stream polluted and its banks encroached

Source: Field survey, 2020

This result of an increase in built-up and bare areas with a corresponding reduction in grassland and shrubs as well as farmlands is consistent with the findings of Appiah et.al, (2017) who examined geospatial analysis of land use and land cover transitions from 1986-2014 in the Bosomtwe district, a peri-urban Ghana. Their results noted a remarkable increment of 380% over a 24 year period (1986 – 2002) in the Bosomtwe district to built-up areas and bare areas mainly from dense forest and agricultural efficient areas close to the central business district. Also the study by Forkuor and Cofie (2011),that examined dynamics of land use and land cover change in Freetown, Sierra Leone (1974 – 2000) and its effects on urban and peri-urban agriculture using a remote sensing approach, discovered built-up areas increased by 140% between 1974 and 2000 with major conversion of land showing a strong linkage between urbanization, agriculture and deforestation.

Table 4: Land conversions in the Ga Central Municipality between 1991 and 2018

Land Cover Class From	**Land Cover Class To**	**1991 – 2003** Area (ha)	**2003 – 2018** Area (ha)	**1991 – 2018** Area (ha)
Grassland and Shrubs	Farmlands	430.83	-	-
	Waterbodies	13.05	3.58	11.03
	Bare area	62.82	508.57	382.64
	Built up	156.6	1260.47	880.85
Farmlands	Grassland and Shrubs	999.72	242.66	203.72
	Waterbodies	4.5	0.09	3.29
	Bare area	252.54	147.67	691.85
	Built up	761.04	395.73	1417.77
Waterbodies	Grassland and Shrubs	18.18	1.82	23.58
	Farmlands	8.73	-	-
	Bare area	-	3.56	2.27
	Built up	-	7.63	0.88
Bare area	Grassland and Shrubs	104.58	5.31	24.77
	Farmlands	28.08	-	-
	Waterbodies	-	-	-
	Built up	340.56	261.74	373.37
Built up	Grassland and Shrubs	16.11	12.24	3.40
	Farmlands	4.86	-	-
	Waterbodies	0.54	0.0225	0.09
	Bare area	20.7	504.11	83.86

Source: Landsat Images 1991, 2003 and 2018

The study revealed major land conversions that have taken place during the study periods as shown in Table 4 and Figure 6. The analysis of changes to the various

land cover classes showed the highest conversion of grassland and shrubs to farmlands of 430.83 hectares was observed between 1991 and 2003. However, it was observed that a substantial area of farmlands in the area was also converted to grassland and shrubs during the same time period, possibly indicating the results of some reforestation efforts in the area or farmers leaving the land to fallow for a period of time. The conversion of farmlands to grassland and shrubs could also point to farmers evacuated from the land by owners to allow lands to be sold for other purposes such as residential use as is the case in most peri-urban and urban areas in Ghana. The highest conversion of farmlands to grassland and shrubs of 999.72 hectares was observed between 1991 and 2003. This was described by an elder of Ablekuma as follows:

Lands in the area were mostly used for farming in the early 1980's till the late 1990's and were given out to farming enterprises like Kittoe farms which operated in Ablekuma for years. Later we had to decide on the development of our town, so we gave the farm enterprises time to leave, then after we sold the lands to individuals and groups to get a fair share of the development that went on in Central Accra and was moving in our direction even though development halted for some years after the murder of the policemen in 1998 which caused fear and panic leading to people abandoning their lands bought in the area.

From the narration, one can conclude that, the murder of the policemen led to the abandonment of farmlands, hence it reverting to the original grassland and shrubs. Other than this, it is not common to see such phenomenon occurring in the country (Mensah, 1998a; 1998b).

The highest conversion of farmlands was to built-up, recording 1417.77 hectares of farmlands converted to built-up between 1991 and 2018. The highest conversion of

bare areas was to built-up areas between 1991 and 2018 covering 373.37 hectares of the study area while waterbodies were highly converted to grassland and shrubs, which could be attributed to swampy vegetation extending in waterbodies or water vegetation like the water lilies growing on top of these waterbodies.

The study revealed major land conversions to built-up areas resulted mainly from farmlands with the highest of 1417.77 hectares observed 1991 and 2018 followed by grassland and shrubs also losing 1260.47 hectares as observed between 2003 and 2018. The expansion of bare areas was at the expense of mainly farmlands, grassland and shrubs and built up respectively. Farmlands, lost the highest of 691.85 hectares between 1991 and 2018, grassland and shrubs converting 508.57 hectares as observed between 2003 and 2018 and built up also losing a total of 504.11 hectares as observed between 2003 and 2018. The complete loss of farmlands and massive reduction in grassland and shrubs areas can be attributed to the expansion of built-up areas in the municipality as more and more people move to towns and cities to make a livelihood. This assertion is supported by the Global Forest Watch (2020), that states the 4.9% tree cover loss in Ghana between 2001 to 2019 can be attributed to areas where the dominant drivers of loss which include urbanization results in deforestation.

The changes recorded in this research with Figure 8, 9 and 10 giving a pictorial description were consistent with a study conducted by Musa and Odera (2015), on the effects of land use land cover changes on agricultural land in Kiambu County, Kenya (1984 – 2013) and to determine the main drivers of land use land cover change, used geospatial technologies. The study found that, over the period of study, agricultural land decreased from 39.7% to 15.8% with grassland, forest, waterbody and bare areas also decreasing in contrast to an increase in built-areas (Musa & Odera, 2015). Similarly, this further goes to assert earlier research by Addae and Oppelt (2019) who studied land

use land cover change analysis and urban growth modelling in the Greater Accra Metropolitan Area, Ghana, by estimating the rate and extent of land use land cover changes in the region and the main drivers of these changes between 1991 and 2015. The results revealed that built-up areas increased by 277% over the 24-year study period with forest areas experiencing massive reduction, diminishing from 34% in 1991 to 6.5% in 2015. The 2025 projected land use map revealed that the urban extent will massively increase to cover 70% of the study area, as compared to 44% in 2015 (Addae & Oppelt, 2019).

Figure 8: A comparison of two different decades 2003 and 2020 of Agape

Source: Agape in 2003, picture received from an Interviewee's and field photo, 2020

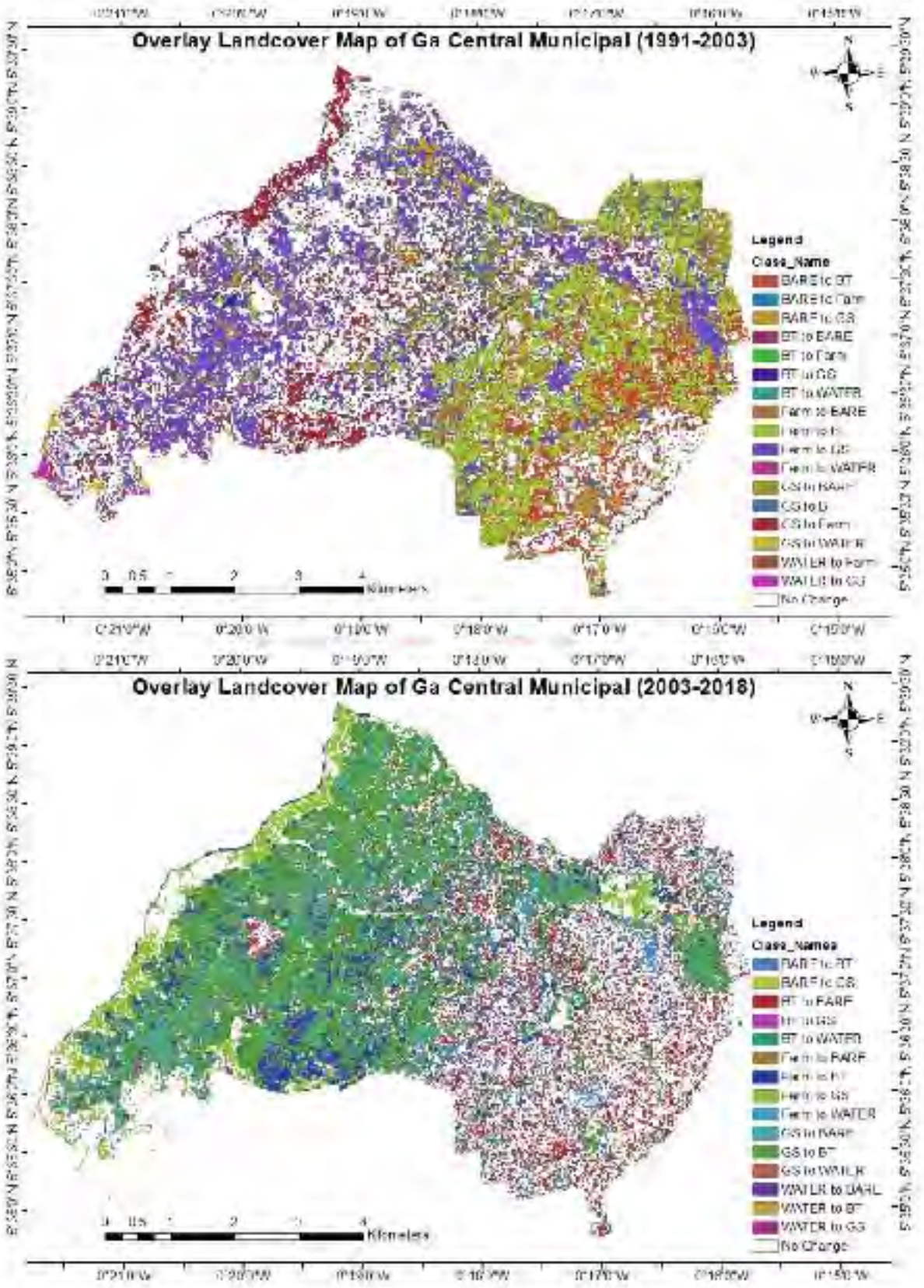


Figure 9: Overlay Land cover maps for 1991, 2003 and 2018

Source: Author's Construct from Landsat images 1991, 2003 and 2018

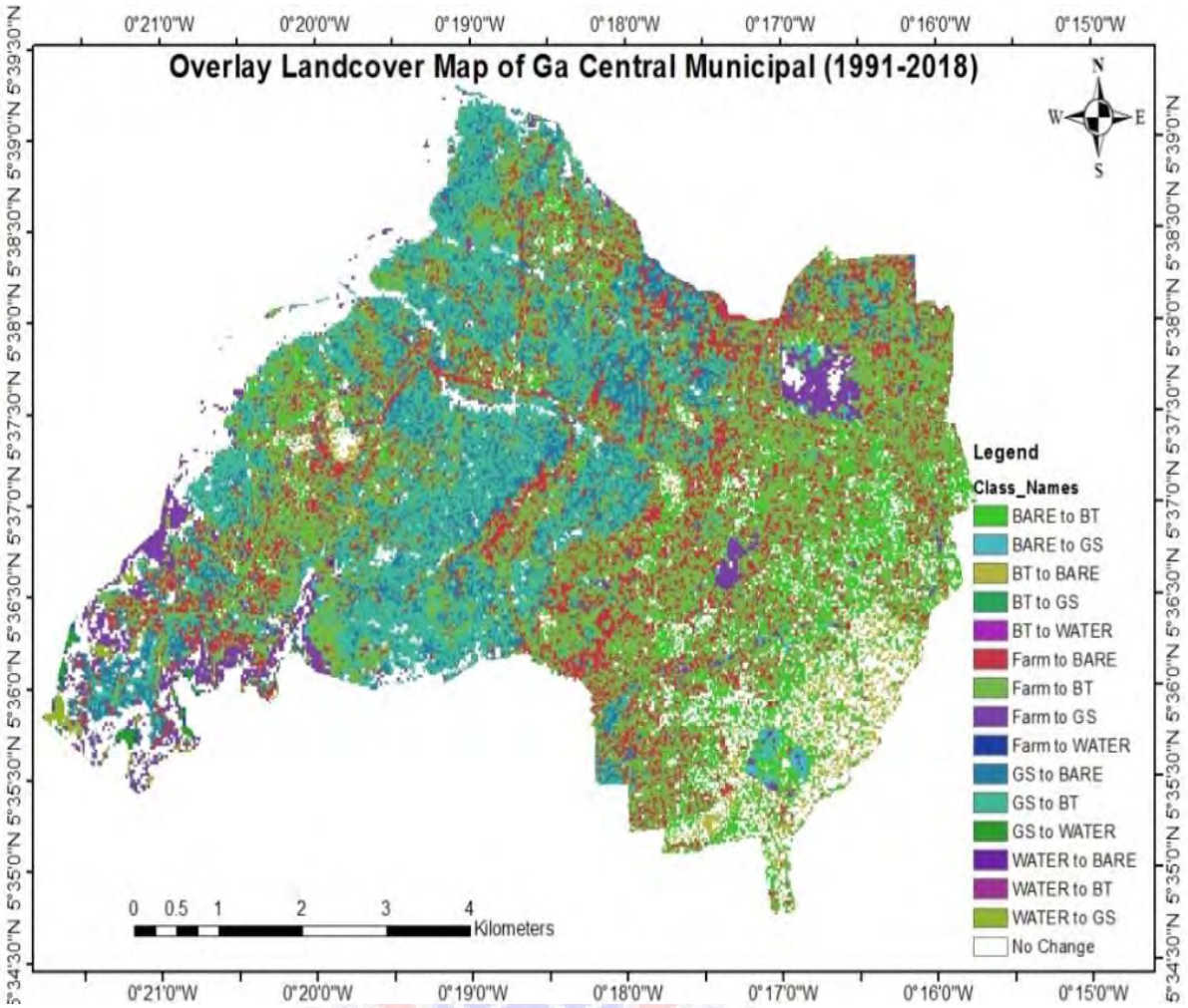


Figure 10: Overlay Land cover map of 1991 and 2018

Source: Author's Construct from Landsat images 1991and 2018

4.2.3 Accuracy Assessment

The study revealed accuracy assessment performed on the resulting land cover maps for the years 1991, 2003 and 2018 which were assessed using the confusion matrix. The confusion matrix is able to generate several measurements of quality, which includes overall accuracy, producer accuracy, user accuracy, and Kappa coefficient. The accuracy assessment was achieved by the use of Google Earth imagery in addition to local knowledge. Stratified random sampling was adopted as ERDAS IMAGINE 2013 was used to produce reference pixel points for the five land cover classes to reduce the possibility of bias. For the 1991 land cover map, a total of 81 reference pixel

points were selected, which were then checked with reference to Google Earth imagery and local knowledge. The results showed an overall accuracy of 84% and a Kappa index of agreement of 0.76. In terms of producer's accuracy, all classes except built up and bare area were over 90% while in terms of user's accuracy, all classes were over 74%, except for the bare area.

The study further revealed from the 2003 land cover map with a total reference pixel points of 101 used, an overall classification accuracy of 89% and an overall Kappa statistics of 0.84 showing an almost perfect agreement between the reference data and producer's data. Google Earth imagery and local knowledge were also applied to check the reference pixel points used. Producer's accuracy for all classes was above 70% except farmlands and user accuracy have all classes scoring 80% and above. Also, the overall classification accuracy for the 2018 land cover map was 88% with overall Kappa statistics recorded as 0.80. Overall, the image processing approach was judged to have been effective in producing compatible land cover data over time, irrespective of the differences in spatial and spectral resolution of the satellite data.

Table 5: Accuracy Assessment of the land cover maps 1991, 2003 and 2018

Class Name 1991	**Reference Totals**	**Classified Totals**	**Number Correct**	**Producers Accuracy**	**Users Accuracy**
Built up	6	4	3	50.00%	75.00%
Waterbodies	5	5	5	100.00%	100.00%
Bare area	11	6	4	36.36%	66.67%
Farmlands	32	40	31	96.88%	77.50%
Grassland and Shrubs	27	26	25	92.59%	96.15%
Overall Classification Accuracy = 83.95%			Overall Kappa Statistics = 0.76		

2003					
Bare area	10	7	7	70.00%	100.00%
Waterbodies	2	2	2	100.00%	100.00%
Built up	31	35	31	100.00%	88.57%
Grassland and Shrubs	44	47	42	95.45%	89.36%
Farmlands	14	10	8	57.14%	80.00%
Overall Classification Accuracy = 89.11% Overall Kappa Statistics = 0.84					
2018					
Built up	45	52	44	97.78%	84.62%
Farmlands	5	0	0	-	-
Waterbodies	5	5	5	100.00%	100.00%
Grassland and Shrubs	6	5	5	83.33%	100.00%
Bare area	15	14	13	86.67%	92.86%
Overall Classification Accuracy = 88.16% Overall Kappa Statistics = 0.80					

Source: Author's Construct from Landsat images 1991, 2003, 2018 and Google Earth, 2020

4.3 Livelihood strategies on land

This section addresses the various livelihoods residents in the study communities have adopted and the livelihood strategies used based on their livelihood activities.

4.3.1. Major economic activities before 2005

The study presents the major economic activities or livelihoods outlined by residents been performed in their communities during the first half of the research period between 1991 to 2018. The major jobs outlined by residents during the early years of settling that is, before the year 2005 using the land and the environment is discussed in Table 6.

Table 6: Major economic activities employed before 2005

Community	**Economic activities**			
	Construction	Quarrying	Agricultural activities	Retail activities
Ablekuma	80	8	16	-
Agape	79	4	17	3
Gonse	19	62	17	4
Total	**178**	**74**	**50**	**7**

Source: Field survey, 2020

The study indicated, out of a total of 309 respondents, 178 respondents (57.6%) saw the construction business of, building, block manufacturing, steel bending, cement sale among others as the major economic activity in the communities, 74 respondents (23.9%) believed that quarrying of stone and sand for construction was the major economic activity in the three communities, 50 respondents (16.2%) saw agricultural activities such as fishing, poultry, livestock rearing and planting of crops as the major economic activity in the communities and 7 respondents (2.3%) believed retail activities such as salons, grocery shops, food joints, selling of pipe-borne water and bars were the major economic activity in the communities.

In all, construction was the major economic activity recorded, both in Ablekuma and Agape with 80 respondents (76.9%) and 79 respondents (76.7%) respectively for data gathered within both communities. Quarrying emerged as the major economic activity for Gonse as 62 respondents (60.8%) consented to that. Agricultural activities were the next major economic activity with 16 respondents (15.4%) in Ablekuma and 17 respondents (16.5%) in Agape while construction, 19 respondents (18.6%) was the next major economic activity after quarrying in Gonse. Quarrying and retail activities were the least major economic activities in Ablekuma and Agape, while agricultural

activities and retail activities were the least major economic activities in Gonse. This result was further articulated by, a businessman in Agape, a resident of Ablekuma and an opinion leader in Gonse as follows;

Living in Agape for more than 20 years, most individuals around then were caretakers who were artisans either masons or carpenters that had moved here because individual landowners were putting up structures on their lands to safeguard their land as the construction business was booming. Cement block factories, iron rod and cement sales were the most lucrative business but now not pulling as first (Businessman, Agape).

Most lands in this community and Agape which we share a boundary with were bought mainly for residential purposes given the plan of these areas. Most landowners decided to put up just a room on their plots to secure their lands but were either unable to complete the structure mainly due to land guard assaults and financial difficulties since these land guards always wanted money when workers were on these lands. Most land owners due to the difficulties left their lands in the care of already established families in the communities who mainly used the extra parcels of land in their care as farmlands to protect these lands (Resident, Ablekuma.)

Gonse is a rocky hill and even digging a foundation for a building will require bringing out huge rocks or boulders. I, for instance, did not buy any stones for my building work as I only employed some women from the quarry nearby at a minimal fee, who broke the boulders into sizable stones for the concrete work. I even had a trip of stone I moved from the digging of my foundation to my plot in Agape even though the quarry business now seems not to be that lucrative and dominant compared to early years within the community (Opinion leader, Gonse).

Figure 11: A section of the quarry site at Gonse and an example of boulders from which stones are got for construction

Source: Field survey, 2020

Agricultural activities been the second major economic activity to construction in Ablekuma and Agape alongside the narration by the resident of Ablekuma, shows the practise of the livelihood strategy of agricultural intensification. The strategy of agricultural intensification is seen as when lands were being built on, the little unoccupied ones were utilized effectively by producing food crops and livestock to feed the communities as described by Scoones, 1998. Agricultural intensification can be technically defined as an increase in agricultural production per unit of inputs that is, labour, land, time, fertilizer, seed, feed or cash (FAO, 2004). In this context agricultural intensification is seen when there is an increase in the total volume of agricultural production that results from agricultural production been maintained while certain inputs such as the land decrease in size for agricultural purposes. This strategy of agricultural intensification in built-up areas links to the garden city concept pioneered

by Ebenezer Howard in 1898 which captured green cities as areas intended to be planned, self-contained communities surrounded by greenbelts containing proportionate areas of residences, industry and agriculture while coping with spatial and population expansion (Gataric, Belij, Dercan, & Filipovic, 2019). The strategy of agricultural intensification is depicted in Figure 12 within the various communities.

Figure 12: Agricultural intensification practised in the three communities

Source: Field survey, 2020

4.3.2. Major economic activities after 2005

The major economic activities or livelihoods outlined by residents been employed in the various study communities after 2005 are presented in this section. The

major economic activities performed using the land currently is shown in Table 7 and discussed below.

Table 7: Major economic activities after 2005

Community	**Economic activities**			
	Construction	Quarrying	Agricultural activities	Retail activities
Ablekuma	92	-	-	12
Agape	87	1	1	14
Gonse	67	-	-	35
Total	**246**	**1**	**1**	**61**

Source: Field survey, 2020

According to the study, 246 respondents (79.6%) out of a total of 309 respondents indicated construction to be the major economic activity in Ablekuma, Agape and Gonse. 61 respondents (19.7%) out of the total of 309 respondents revealed retail activities to be the major economic activity currently booming in the three locations. Quarrying and agricultural activities both had one respondent (0.3%) each that saw them be the major economic activity currently in force within the three communities. These major economic activities of construction, quarrying, agricultural activities and the shift towards retail activities in recent times points to the unpinning need for survival that is, meeting the basic needs of human beings in terms of food, water, shelter and clothing which essentially cannot be done without and may lead to the extinction of the human race if non-existent (Aruma & Hanachor, 2017).

In sum, construction is the major economic activity in the three communities, recording 92 respondents (88.5%) for Ablekuma, 87 respondents (84.5%) within Agape and 67 respondents (65.7%) in Gonse within the counts for each community.

Construction continued to be dominant in Ablekuma and Agape while making gains to be the major economic activity in Gonse currently. This continues dominance of construction as the major economic activity throughout the years under study brings out the livelihood strategy of investment. Investment refers to engaging in activities that provide long term security and can be relied on in times of uncertainties to provide a means of survival in the short, medium and long run (Rakodi 1999 as cited in Rakodi 2002). Investments may include the purchasing of land and building of schools to educate the population, shops, apartments for self-accommodation and renting (physical capital). Residents are seen to invest first in purchasing or renting the land (natural capital) followed by investing in physical capital (building materials) that is putting their financial capital (money) into a building project to have an accommodation and also pay human labour that works on the building as buttressed by Rakodi (1999) as cited in Farrington, Ramasut and Walker, (2002) where investment in an asset is a livelihood strategy.

The next major economic activity after construction is retail activities taking over in recent times from agricultural activities in Ablekuma and Agape and construction in Gonse. The analysis of retail activities showed 12 respondents (11.5%) within Ablekuma, 14 respondents (13.6%) in Agape and 35 respondents (34.3%) at Gonse. The shift from agricultural activities to retail activities, a non-farm based activity as a support to the local economy is consistent with the study by Mandere, Ness and Anderberg, (2010) of peri-urban development, livelihood change and household income, a case study of peri-urban Nyahururu, Kenya which assessed the impact of peri-urban development dynamics to household income, using the case study method. The results showed a decline in full time farming households from 90% in the 1960s to 49%; an indication of the declining economic significance of agriculture while

households adopted diverse non-farm activities whose earnings proved to be of varying importance to the annual household income (Mandere, Ness, & Anderberg, 2010). Also, the changing pattern to retail activities with the construction sector remaining at the forefront can be attributed to these areas which used to be peri-urban in nature are gradually becoming part of the city, hence their shift from agrarian and primary economic activities to tertiary activities (GSS, 2014).

Quarrying and agricultural activities had a total of 2 respondents (0.6%) being the least major economic activity and located in Agape. The dominance of the construction business in the study communities is described by a businessman in Agape as such;

The major economic activity or livelihood continues to be construction but has been modified over the years from mainly the construction of homes to include shops and offices. Also, construction has shifted towards container welding which people rather prefer to buy just for a store which is less expensive than building a concrete single building for a shop.

Figures 13, 14 and 15 below depict pictures of construction still ongoing and a fleet of retail activities along the Agape High Street, Ablekuma and Gonse.


House under construction at Ablekuma

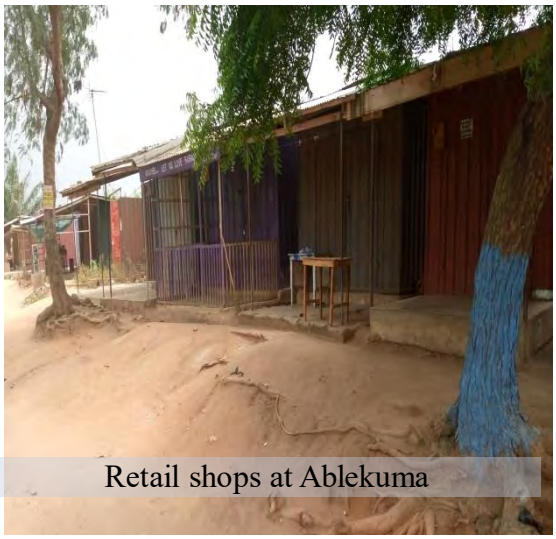
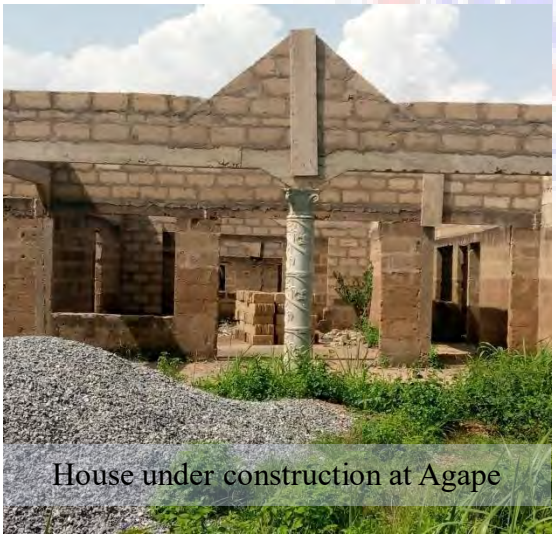

Retail shops at Ablekuma

Figure 13: A section of a house still under construction and retail shops in Ablekuma

Source: Field survey, 2020


House under construction at Agape


Retail shops at Agape

Figure 14: A section of a house under construction and retail shops in Agape

Source: Field survey, 2020

House under construction at Gonse

Retail shops at Gonse

Figure 15: A section of house under construction and retail shops at Gonse

Source: Field survey, 2020

Other economic activities that are also currently booming in the three communities include taxi driving, okada riding, dressmaking, glasswork among others. Among these other economic activities, practitioners of these activities like the drivers, okada riders and dressmakers belong to associations from which they immensely benefit from each other. This point was further articulated by the views of the Okada riders at Agape.

We have enjoyed better help, success and improved our lives as colleague Okada riders. In case, any of us is in financial difficulty, the person can easily consult any of us for help or go for a loan from our local riders association. At other times, we share customers when the one called is busily engaged somewhere else and this improves our livelihood a lot. (Okada riders, Agape).

Figure 16: Some Okada riders at Agape

Source: Field survey, 2020

The potential of having employment, friends and association (social capital) brings forth the livelihood strategy of reciprocity as people of close ties or network exchange and benefit from resources as being part of a group. By reciprocity, networks benefit through the help of the group or a member or members of the group which in this case is based on one's affiliation to a workers association. Also, religious ties to a church or mosque or neighbourhood connection ignite the livelihood strategy of reciprocity. Numerous, by the mere fact of being part of the Landlord or Landlady association in the three communities, have benefitted from security surveillance by the community watchdog, police and the visibility that street lights fixed by the association brings. Members of churches, mosques, companies and workers associations like the GPRTU have also gained access to loans to build business and relief during difficult times.

4.3.3. Reasons for employing various livelihood strategies

The reasons behind residents employing the various combinations of or livelihood activities to make a living are shown and explained in this section. Figure 17

gives a pictorial view of the reasons motivating residents within the three communities to pursue unique livelihood strategies.

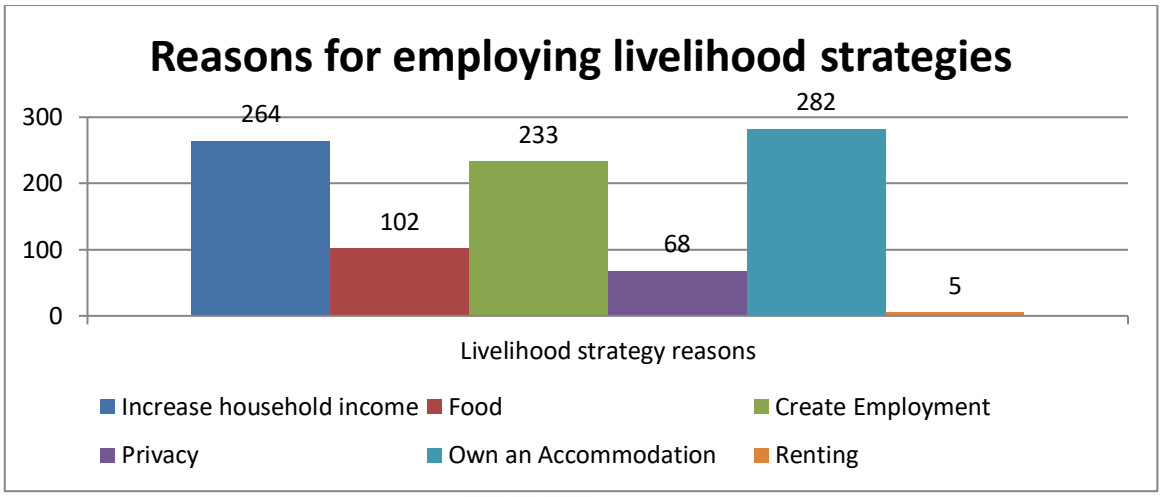


Figure 17: Reasons behind employing livelihood strategies

Source: Field survey, 2020

The study revealed the reasons behind which residents chose to adopt their various livelihood activities and strategies. The main reasons for adopting the various livelihood activities and strategies were to increase household income, create employment, for food, own accommodation and privacy while renting was another reason respondents added. From the analysis it can be seen that respondents' reasons were centred mostly on combining owning an accommodation, increase household income and creating employment with the other reasons being for food, privacy and renting.

In sum, out of the total of 309 respondents, 154 respondents (49.8%) practised their livelihood activities because of the need to increase household income, create employment and own an accommodation. 28 respondents (9.1%) reasons were to increase household income, create employment, food, privacy and own an accommodation. Also, 25 respondents (8.1%) had reasons for increasing household

income, food and own an accommodation, 15 respondents (4.9%) with reasons of increasing household income, create employment, privacy and own an accommodation. Another set of 10 respondents (3.2%) had the reasons of food and owning an accommodation only, 10 respondents (3.2%) also had reasons of increasing household income, food, create employment and own an accommodation, 8 respondents (2.6%) with food, create employment and own an accommodation as their reasons while 6 respondents (1.9%) stated increasing household income and own an accommodation only as their reasons.

A group of 5 respondents (1.6%) had the reason of food only, 5 respondents (1.6%) with reasons of creating employment, privacy and own an accommodation, another 5 respondents (1.6%) with increasing household income only as the reason for the choice of livelihood activities and a last set of 5 respondents (1.6%) with the reasons of increasing household income, food, privacy and own an accommodation. Furthermore, another set of 4 respondents (1.3%) had the reason of owning an accommodation only, 4 respondents (1.3%) with the reasons of increasing household income, create employment and privacy with other combination of reasons having 3 respondents and below as chosen by the residence of the three communities; Ablekuma, Agape and Gonse.

The various reasons given by residents for employing the different combinations of livelihood activities points to the practice or strategy of livelihood diversification. The various combinations of livelihood activities and reasons for the various livelihood strategies are further explained by a businesswoman in Ablekuma and an opinion leader at Gonse as follows:

When we settled in Ablekuma, 20 years ago, it was difficult to get access to goods and services quite easily in the community especially safe drinking water so we decided to buy water from tankers to sell and later drilling the borehole. Also, with land still available we raised a storey building with stores and two apartments on top of the stores over the years for rent and sell groceries, creating employment as well as increasing household income. (Businesswoman, Ablekuma).

I have lived in Gonse for 20 years and experienced almost all the development in this area. Currently, more landowners are developing apartments for rental and almost every house has a shop in front of it to take care of the needs of the growing population. (Opinion leader, Agape)

Building with apartment and shops at Agape

Apartment with shops at Gonse

Building with shops at Ablekuma

Figure 18: Various combinations of livelihood activities in the study communities

Source: Field survey, 2020

The choices made by majority of the residents in the three communities with reasons of the need to increase household income, create employment, own an accommodation food, privacy and renting point to the fact of the practise of livelihood diversification as a livelihood strategy. Diversification is the process of constructing different portfolios of activities to achieve a set livelihood goal and it is triggered by people's assets and willingness to innovate which generates earnings (Mahama & Maharjan, 2017). This is further explained by the work of Scoones (1998), where livelihood diversification, lies between an active choice to invest in diversification for accumulation and reinvestment and diversification aimed at coping with temporary adversity or more permanent adaptation of livelihood activities, when other options are failing to provide a livelihood. This is seen when residents being employed also give out their apartments or shops for rent or employ people to run retail activities on their behalf which they also survive on. Residents within the communities consequently practise backyard gardening to supplement income generated from their mainstream employment.

The reasons given that support the livelihood strategy of diversification is articulated by Mahama and Maharjan (2017), in their study of the determinants of livelihood diversification in Ghana from the national livelihood strategies and spatial perspective. The study used the national survey data to analyse livelihoods and the determinants of livelihood diversification in Ghana by introducing spatial factors in the asset framework. The results observed that livelihoods and diversification are determined by socio-economic factors, characteristics of the main livelihood activity as well as spatial factors (Mahama & Maharjan, 2017). Also, Shah, Khan, Akmal and

Sharif, (2005) in their study of livelihood assets and livelihood strategies of small farmers in the salt range of Pind Dadan Khan District Jhelum in Pakistan performed a diagnostic analysis using participatory rural appraisal (PRA). The results of the study showed that for sustainable livelihood, improvement of crop production, effective utilization of rainwater with very little application of brackish groundwater for irrigation, improved livestock management and diversification of livelihoods towards non-farm activities are of utmost importance (Shah, Khan, Akmal, & Sharif, 2005). These studies go to assert the dominance of livelihood diversification as a strategy whether as a permanent strategy or temporary strategy.

4.4 Effects of Livelihood Strategies on Land Cover

This section presents the effects of the various livelihood activities and strategies of residents in the three communities on the land cover and on residents themselves.

4.4.1. Negative effects of livelihood strategies on land

The various negative effects of livelihood strategies on the land cover as seen by residents are shown and addressed in this section. Figure 19 gives a pictorial view of the various negative effects of livelihood strategies on the land as suggested by the residents of the three communities.

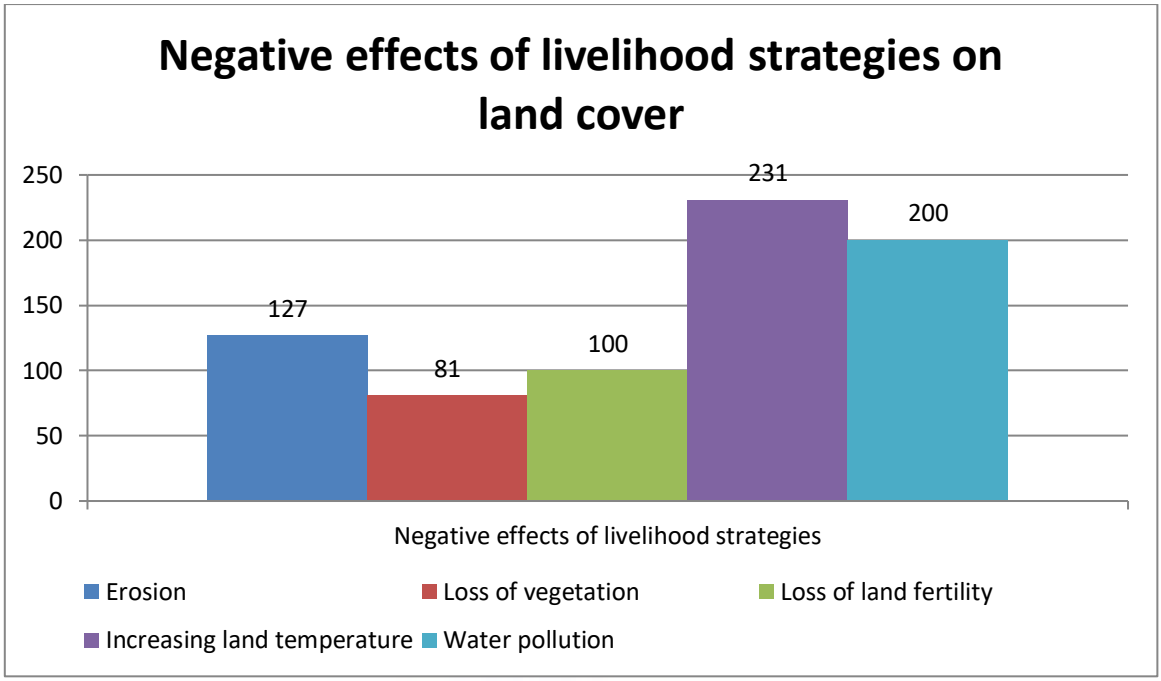


Figure 19: Negative effects of livelihood strategies on land cover

Source: Field survey, 2020

The study indicated respondents selected more than one option of negative effects of their livelihood strategies on the land cover. Respondents selected mostly a combination of increased land temperature and water pollution with the other negative effect options of erosion, loss of land fertility and loss of vegetation. The analysis revealed that, out of the total of 309 respondents, 118 respondents (38.2%) selected increasing temperature and water pollution only as the negative effects of their livelihood strategies on the land cover. Further, 36 respondents (11.7%) selected erosion, increasing land temperature and water pollution only as the negative effects of their livelihood strategies, 18 respondents (5.8%) selected erosion, loss of vegetation and loss of land fertility only and another 18 respondents (5.8%) selected loss of land fertility, increasing land temperature and water pollution only as the negative effects of their livelihood strategies on the land.

Moreover, 13 respondents (4.2%) selected erosion only, 12 respondents (3.9%) selected erosion, loss of land fertility, increasing land temperature and water pollution, 12 respondents (3.9%) selected loss of vegetation only and 11 respondents (3.6%) selecting erosion and loss of vegetation only as the negative effects of livelihood strategies on the land. Also, 11 respondents (3.6%) selected loss of vegetation, loss of land fertility and increasing land temperature as their negative effect of livelihood strategies on land, 10 respondents (3.2%) selected erosion and loss of land fertility only, 7 respondents (2.3%) selected erosion, loss of vegetation and increasing land temperature only as the negative effect to the land.

Furthermore, 6 respondents (1.9%) believed erosion, loss of land fertility and increasing land temperature only were the effects of their livelihood strategies on the land, 6 respondents (1.9%) also indicated erosion, loss of vegetation, loss of land fertility and increasing land temperature only as the effects on land while 5 respondents (1.6%) selected loss of vegetation and increasing land temperature only as the effects of their livelihood strategies on the land.

In addition, 4 respondents (1.3%) selected loss of land fertility and water pollution only as the effects of their livelihood strategies on the land and another 4 respondents (1.3%) selected erosion, loss of land fertility and water pollution as the effects on the land. Additionally, 3 respondents (1%) selected loss of vegetation and loss of land fertility only, 3 respondents (1%) selected loss of vegetation, increasing land temperature and water pollution only, while 3 respondents (1%) selected loss of land fertility and increasing land temperature only and the remaining selecting a mixed or only one option as the negative effect of their livelihood strategies on the land cover.

These results were consistent with similar studies by Khosravaninezhad, Zadehbagheri, Nikdel and Fathi, (2011) that studied Metropolises spatial expansion management with special reference to systems related to environmental values a case study of Tehran metropolis in Iran. The study indicated that a huge demand by the populace for essential resources like land has led to the demolition of agricultural lands, environmental pollution in the inner and outer areas, changing cultivation patterns, construction in areas exposed to environmental hazards and alteration in valuable environmental landscapes. Similarly, Islam, Borgqvist and Kumar, (2018) conducted a study on monitoring mangrove forest landcover changes in the coastline of Bangladesh from 1976 to 2015. The study used multi-date Landsat images to quantify mangrove cover changes in the whole of Bangladesh from 1976 to 2015. The results indicated an increase in the areal extent of mangroves by 3.1% even though some original areas were lost to deforestation, shrimp and salt farmlands, coastal erosion and sedimentation (Islam, Borgqvist, & Kumar, 2018).

The results of the negative effects of livelihood strategies on the land were further articulated by an opinion leader in Agape and a municipal officer as follows;

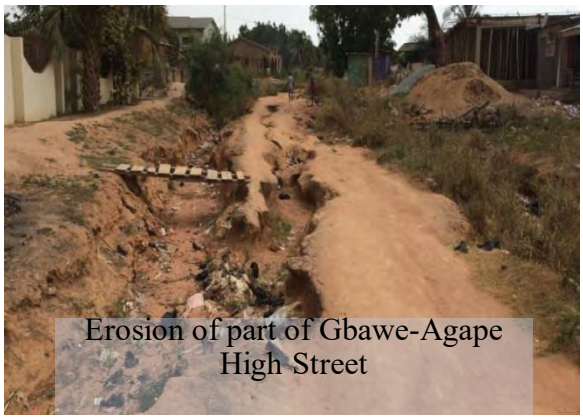
When I first came to Agape in 2000, you could not sleep without a blanket and fully closing your windows and doors because the environment was very windy and cool. By 5pm it was not advisable to sit outside since you could contract a cold or cough. Currently, because buildings have sprung up at every corner, there are very few trees to give fresh air and now one has to sleep with the fan or can even sleep outside if not for mosquitoes (Opinion leader, Agape).

Most buildings in the various communities in Ga Central either do not have a permit or have violated the permit given by the assembly. With the help of land guards and chiefs,

people even build close to waterbodies or on waterways polluting the existing waterbodies that were a source of water to the people or causing it to dry up. Erosion has also resulted from this indiscriminate building and for about a year and a half, part of the Gbawe-Agape High Street was cut off due to erosion unless one uses an alternate link road. Majority of cultivatable areas in the municipality have also been turned into residential dwellings (Municipal official, GCMA).

Apart from the above stated negative effects of residents' livelihood strategies on the land cover, some residents also complained of flooding anytime it rained heavily as another negative effect of livelihood strategies on the land cover especially in parts of Ablekuma and Agape. Figure 20 below shows a section of the Agape-Gbawe High Street and a flooded area in Ablekuma.

Flooding in Ablekuma



Erosion of part of Gbawe-Agape High Street

Figure 20: Flooding in Ablekuma and the eroded part of Gbawe-Agape High Street

Source: Field survey, 2020

4.4.2 Reciprocal effect on human beings from negative effect to land cover

This section looks at the effect of man's livelihood strategies on himself as a result of feedback from the land and environment.

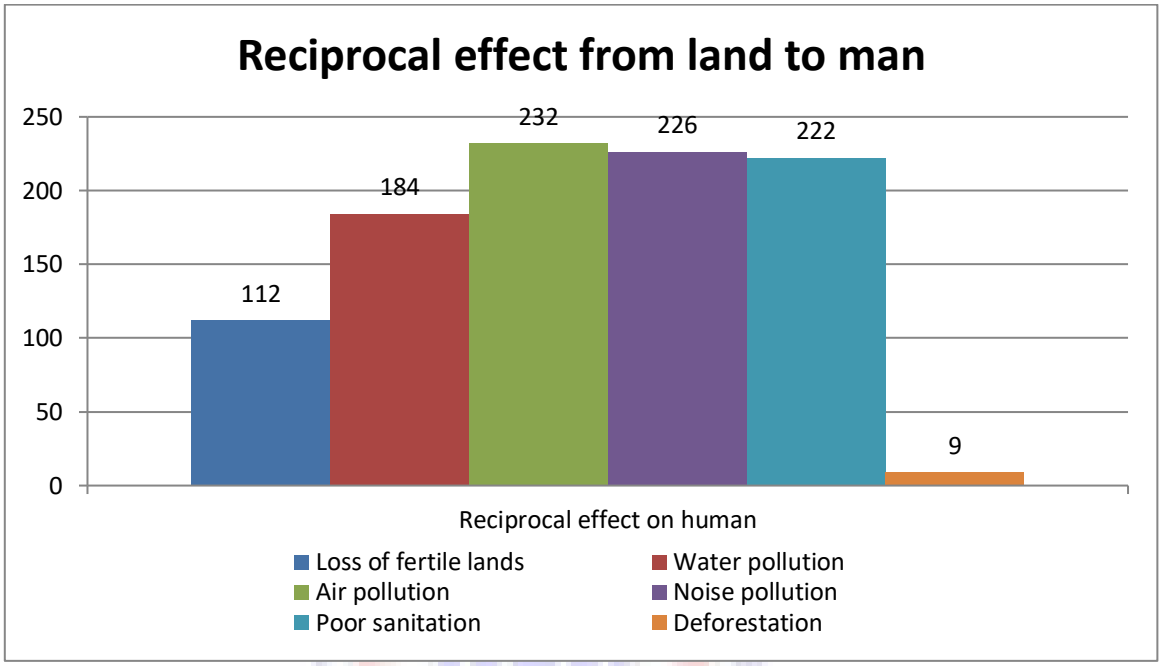


Figure 21: Reciprocal effect from land to man

Source: Field survey, 2020

The study showed the various reciprocal effects of the land and environment on residents in the three communities from their livelihood activities. Respondents selected a range of negative feedback they believed they faced from the environment due to the livelihood activities adopted by them. Respondents selected mainly a combination of noise pollution, poor sanitation and air pollution with other effects such as water pollution, loss of fertile lands and deforestation.

In sum, from a total of 309 respondents from the three communities, 140 respondents (45.3%) believed water pollution, air pollution, noise pollution and poor sanitation were the feedback from the environment based on the livelihood strategies of residents while 32 respondents (10.4%) saw the loss of fertile lands only as feedback experienced. Further, 29 respondents (9.4%) admitted to air pollution, noise pollution

and poor sanitation only to be feedbacks as 14 respondents (4.5%) also saw the loss of fertile lands, air pollution and noise pollution only as feedbacks experienced from the environment.

In addition, 9 respondents (2.9%) believed the loss of fertile lands, water pollution and air pollution only were feedbacks experienced from the environment with 7 other respondents (2.3%) indicating noise pollution and poor sanitation only as feedbacks from the environment. Besides, 7 respondents (2.3%) indicated the loss of fertile lands, air pollution and poor sanitation only as feedbacks while 6 respondents (1.9%) saw the loss of fertile lands and air pollution only as feedbacks experienced from the environment. 6 respondents (1.9%) identified loss of fertile lands, noise pollution and poor sanitation only as feedbacks while 6 respondents also (1.9%) indicating loss of fertile lands, water pollution, air pollution, noise pollution and poor sanitation as feedbacks experienced from the environment.

Additionally, 6 respondents (1.9%) revealed poor sanitation only as feedbacks experienced from the environment, 5 respondents (1.6%) loss of fertile lands, water pollution and noise pollution only and other 5 respondents (1.6%) identifying water pollution, noise pollution and poor sanitation only as feedbacks. Also, 4 respondents (1.3%) believed loss of fertile lands, water pollution, noise pollution and poor sanitation were the feedback they experienced, 4 respondents (1.3%) loss of fertile lands, air pollution and deforestation only while another set of 3 respondents (1.0%) identified loss of fertile lands, water pollution, air pollution and poor sanitation only as feedbacks experienced from the environment. Further, 3 respondents (1.0%) revealed the loss of fertile lands and poor sanitation only as feedbacks, 3 respondents (1.0%) loss of fertile lands and water pollution only and the rest of 20 respondents (6.4%) recorded 2 or

fewer respondents selecting either a single or mixed combination of noise pollution, poor sanitation, air pollution, water pollution, loss of fertile lands and deforestation.

These negative feedbacks indicated mostly impact on the health of residents, productivity and assess to food which was earlier grown, cheap and in abundance in these three areas. The impact on the health of residents is further articulated by the Ga Central Municipal Assembly in its composite budget for the 2015 fiscal year as it indicated that the top diseases recorded affecting the municipality were malaria (48.2%) skin diagnosis (12.9%), Acute respiratory infections (ARI) 6.3%, diarrhoea (4.3%), HPT (3.5%) Typhoid fever (2.2%), Acute upper tract infections (1.4%) among other diseases (Ga Central Municipal Assembly, 2015). Similarly, a study by Huang and Johnson, (2014) on epidemiology and management of Buruli ulcer stated the emergence of the disease was due to local environmental events like deforestation, flooding and building of dams or agricultural activities such as irrigation in areas around rivers, swamps and wetlands. All these negative feedbacks hugely expressed by the residents are consistent with the aftermath on health as stated by the municipality and the study by Huang and Johnson, (2014).

The reciprocal effect from the natural environment to human beings and effect from livelihood activities to the natural environment is a justification of the two-way direction and exchange between the human system (human capital) and environmental system (natural capital) as expressed and seen from Newton's third law of motion that states for every action, there is an equal and opposite reaction (National Aeronautics and Space Administration, 2015).

Both negative effects to the land and environment by livelihood strategies and the reciprocal effects on human beings as discussed is further asserted by Kombo and

Ekisa (2015) in their paper, *the impacts of land use changes on livelihood of the Maasai community in Kajiado County, Kenya*, assessed impacts of land use changes on livelihoods and subsequent environmental degradation in Amboseli ecosystem of Southern Kenya. The paper employed both quantitative and qualitative methods of data collection. The findings revealed that practices such as deforestation, overgrazing and use of fertilizers are increasing environmental degradation and further perpetuating challenges related to environmental conservation that greatly affect their livelihoods (Kombo & Ekisa, 2015). Also, in a study on the effects of land use change on land degradation reflected by soil properties along Mara River, Kenya and Tanzania, Matano, et al., (2015) determined the effect of land use change on the physico-chemical properties of soil along the course of the Mara River. The results indicated that the five land use types affected land degradation differently along the Mara River, while adjacent land degradation affected water physico-chemical properties. All these studies go to assert the experiences of the residents in the three communities.

4.4.3. Residents' projection of change to land cover

This section focuses on the views of residents of the three communities on their expectations of change to the land cover in the next decade. The figure below depicts the nature of change expected by residents.

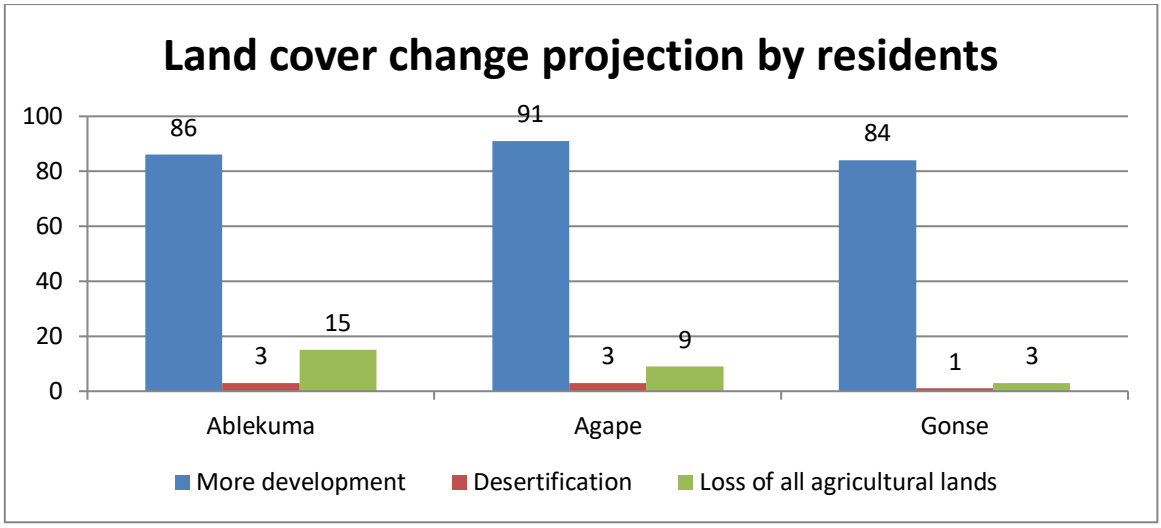


Figure 22: Land cover change projection by residents of Ablekuma, Agape and Gonse

Source: Field survey, 2020

The study indicated, from a total of 309 respondents, 261 respondents (84.5%) projected more development in their respective areas from the provision of pipe-borne water, tarred roads and other social amenities, 7 respondents (2.3%) projected the areas to go into desertification as most fertile lands to them are now been left bare to climatic conditions and 41 respondents (13.3%) projected the total loss of agricultural lands, especially to residence.

In all, 86 respondents (82.7%) within Ablekuma, 91 respondents (88.3%) in Agape and 84 respondents (82.4%) forming the majority have all projected more development in their respective areas. The least number of respondents, 3 (2.9%) in Ablekuma, 3 (2.9%) in Agape and 1 (1%) at Gonse projected desertification of their respective areas.

With survival as the priority of every human being, individuals develop goals hugely based on their available assets. The intended goal of individuals stems from the need to survive and use their assets in various combinations through laid down strategies to achieve an outcome whether desirable or not. Individuals combine their

assets of human capital which involves their energy, skills and capabilities with either their financial capital (money from jobs, rent, retail activities or okada services), natural capital that is, land and water bodies within the natural environment, physical capital (building materials, seeds, apartment, schools, shops) or social capital which involves an individual's network of friends and association. The number of assets available to individuals determine the line of livelihood activities and strategies employed. Livelihood strategies usually include a range of activities designed to build asset bases and access to goods and services for consumption. The need for these planned activities tilts individuals and households towards a range of strategies which include; livelihood diversification, investment, agricultural intensification and reciprocity.

Livelihood diversification, investment and agricultural intensification are more of economic strategies to livelihood while reciprocity is seen in line with social strategies to achieve a livelihood. Livelihood diversification is clearly seen in the communities Ablekuma, Agape and Gonse as people combine the economic activity of construction or their buildings with mostly retail activities such as salon and grocery shops which is evident with almost all buildings having a shop attached to it. Investments may include the purchasing of land and building of schools and apartments for rent. Agricultural intensification is seen in the practice of backyard gardening and poultry on a small and same piece of land. Reciprocity is hugely seen with the exchanges of help among okada riders and drivers belonging to the Ghana Private Road and Transport Union (GPRTU) and residents who are members of the Area Landlord/Landlady Association. The various strategies when implemented leads to a livelihood and environmental effect either positive or negative. Positive when investment yield income from the rental of shops and apartment but negative when it results in increased land temperature, poor sanitation, erosion and pollution. The

livelihood and environmental effects generated leads us back to survival as the needs of human beings evolve with time. . In all, even though the strategies employed affect negatively the natural landscape and environment, it is supports the people to survive both socially and economically in the urban space.

Summary of the empirical evidence in relation to the conceptual framework

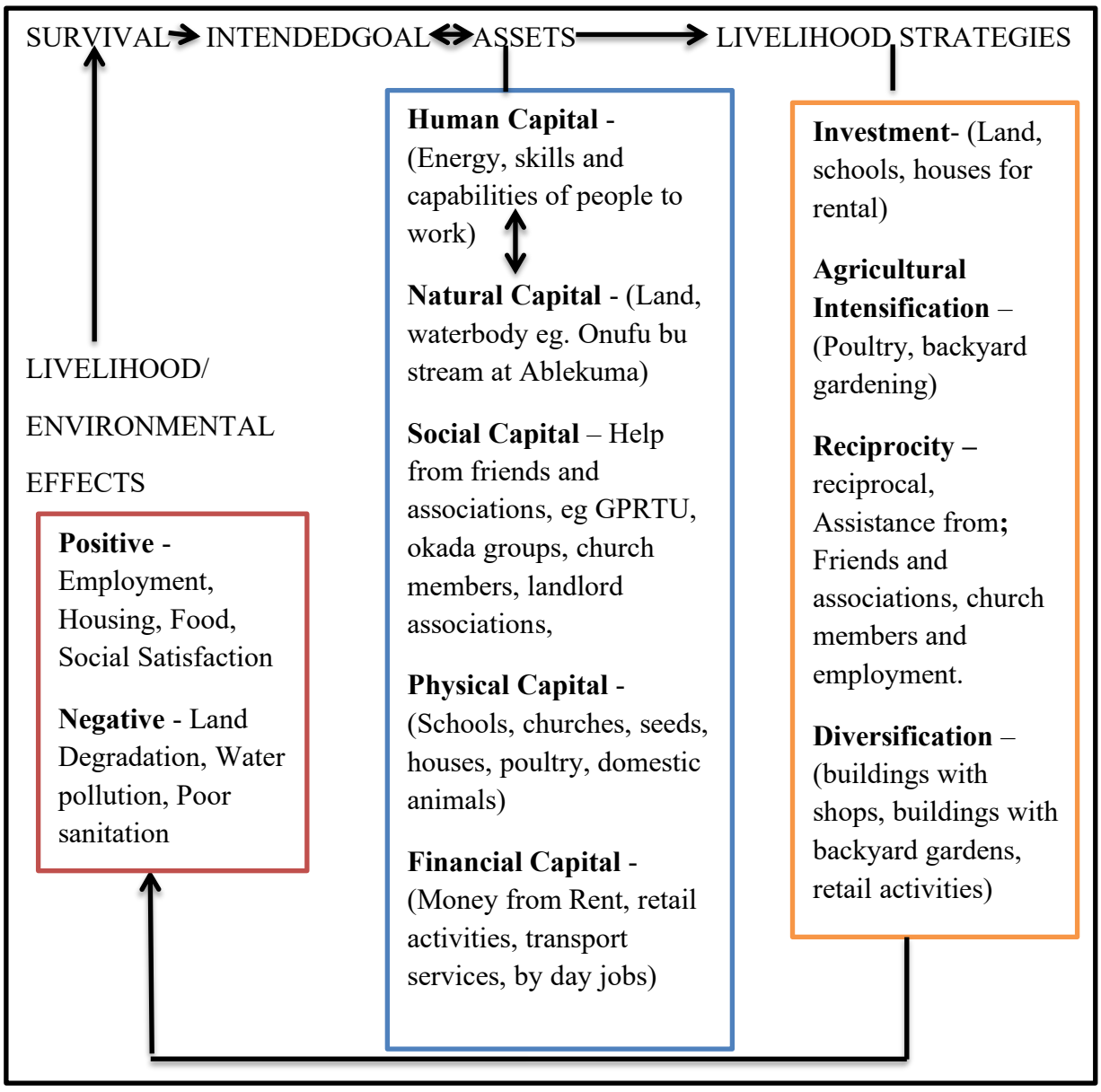


Figure 23: Framework on Land Cover and Livelihood Strategies in Ga Central Municipal

Source: Author's Adaption of DFID (1999) and Scholz and Binder (2004) to reflect the research finding

Conclusion drawn on the three communities

The communities of Ablekuma, Agape and Gonse are linked in many ways from the findings generated. Ablekuma, Agape and Gonse fall within the coastal savannah agro-ecological zone and a viable farmland area suitable for coconut and shallots cultivation (GSS, 2014). In all three communities, the dominant major trend of economic activity now is that of construction business of steel bending, block manufacturing, cement sale, building in terms of residential accommodation, schools, churches, hospitals among others. Also, within the three communities, residents combined various livelihood activities to make life comfortable. Majority of residents within the communities engaged hugely in retail activities as a support to their main economic activity, a sign of the practice of the strategy of livelihood diversification and investment.

Furthermore, the study revealed that the main reasons behind residents of the communities adopting various livelihood activities and strategies were to increase household income, own accommodation and create employment. This is visibly seen with most houses in the vicinities having a shop in front or attached to it. Increasing land temperature and water pollution are the dominant negative effects of livelihood strategies on land that cut across all communities. Water pollution, air pollution, noise pollution and poor sanitation are the dominating reciprocal effects on human beings from the negative effect to the land cover while more development is the main projection expected in the next decade by most residents in the three communities.

Nevertheless, there are few differences between the three communities; Ablekuma, Agape and Gonse from the findings. The respondents' representative of the communities differs in terms of their number. In the past, the major economic activity

in the communities also differs. Quarrying had been the major economic activity in Gonse whiles the construction business of, foundation digging, steel bending, building, block manufacturing, cement sale among others dominated both in Ablekuma and Agape.

In conclusion, it can be seen that there exist more similarities between the three communities in terms of current major economic activity or livelihood, negative effect of human activities on the land among others as few differences were recorded.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This study examined the livelihood strategies of residents and land cover change in the Ga Central Municipality. The study particularly discussed land cover distribution and change, various livelihood activities and strategies of residents in Ablekuma, Agape and Gonse between the years 1991 to 2018, the effects of livelihood strategies on the land cover and the reciprocal effects on human beings. This chapter presents a summary of the study, conclusions drawn and policy recommendations.

5.1 Summary of Study

In order to achieve the objective of the study, measurements were taken on the demographic characteristics of the study area, land cover distribution and change, livelihood activities and strategies and their effects within the periods 1991 to 2018. The following are the summary of the entire study;

The study begins with chapter one, the introductory section to the study. The chapter presents the beginning of the main body of the study under subsections. The background of the study reflects on land cover and its changes, livelihoods and strategies to survival. The statement of the problem, purpose of study, objectives of the study and research questions were all geared to address the livelihood strategies of residents and land cover changes in the Ga Central Municipality. The significance of the study viewed the importance of the study, scope, delimitation and the study covered the extent and boundary of the study within the Ga Central Municipality while the organization of the study looked at the break down of how each of the five chapters were to shape up.

The chapter two of this study was the literature review. The first section of the chapter was devoted to the review of related literature for the study. Specifically, the concept of land cover and land cover change was a principal area of concern alongside livelihoods and their effects. Authors who had studied the shift in the natural environment and resources, as well as livelihoods were covered reviewing past and present literature to gain different perspectives on the subject. Further, the chapter provided an overview of the various livelihood strategies envisaged by various scholars and institutions alike, for instance, DFID. Finally, the various effects and feedback from and on the land cover and humans were addressed as this helped to point out to the need to address the stifle that exists in the need to ensure the sustainability of the natural environment while enjoying a sustainable livelihood, the contribution this study offers to literature.

The study continued with chapter three which was materials and methods for the study. The chapter gives an overview of the methodology used in the study. The chapter presents the study area, research design, target population, sample and sampling techniques as well as the different approaches used in data collection and analysis. The study area was the Ga Central Municipality specifically, Ablekuma, Agape and Gonse. The quantitative and qualitative approaches were combined while the case study and cross-sectional designs were also employed in the study. Data was gathered from residents using both interviews and questionnaires. Also, GIS and remote sensing applications were used to analyse data alongside the use of IBM SPSS version 21.

Chapter four is the data analysis and discussion of the study. The chapter presents the results of data collected for the study which were analysed and discussed. The chapter also discusses and interprets the significant and novel findings of the study for each objective in relation to previous studies. The chapter also discusses the findings

of the study in relation to the conceptual framework which was focused on attaining substantial livelihoods in the human-environmental system while ensuring a balance within the system. Conclusion was drawn on the three communities which had much in common and very little differences.

The following were the major findings of the study. The study indicated that males (63.4%) formed the majority of the total respondents with females (36.6%) in the minority. Results of the study revealed respondents within the 41 – 50 age bracket (38.2%) formed the majority of respondents while those between the ages of 21 – 30 (13.6%) were in the minority. The study pointed out that, majority of respondents (43.7%) had attained secondary education and the minority (4.2%) having no form of formal education. The study revealed five land cover classes in the study area which were grassland and shrubs, farmlands, bare areas, built-up areas and waterbodies. The study pointed out that, farmlands (46.9%) were the dominant land cover feature in 1991, grassland and shrubs (42.7%) in 2003 and built-up areas (56.9%) in the year 2018. The study indicated that, built-up areas over the 27 year period expanded by 1073.9% while farmlands were totally lost. The study pointed out that, the highest conversion of farmlands, bare areas and grassland and shrubs was to built-up areas within the 27 year time period. The study found that the kappa index of agreement for all images was above 0.75 and an overall accuracy of over 83% for all the images.

The study revealed that construction was the dominant major economic or livelihood activity in Ablekuma and Agape and quarrying, in Gonse while retail activities were the least major livelihood activity during the past. Results indicated that construction is the dominant major economic or livelihood activity present in all the three communities with the least being quarrying and agricultural activities. The study revealed that the need to increase household income, own accommodation and create

employment were the major reasons behind the livelihood strategies adopted by residents in the communities. The study indicated that increasing land temperature and water pollution were the major negative effects of livelihood strategies on the land cover. The study found that water pollution, air pollution, noise pollution and poor sanitation were the major reciprocal effects from the natural environment to human beings.

Finally, the concluding chapter was chapter five, which is the summary of findings, conclusions and recommendations. The chapter discusses a summary on land cover distribution and change, land use, various livelihood activities and strategies of residents in Ablekuma, Agape and Gonse between the years 1991 to 2018, the effects of livelihood strategies on the land cover and the reciprocal effects on human beings. It also draws a general conclusion on the findings in relation to the framework and provides policy recommendations.

5.2 Conclusion

Land cover changes are hugely inevitable with the need for human beings to survive. There is undoubtedly a relationship between land cover changes and the activities of man. The rapid spread of land cover changes in the Ga Central Municipality is unbalanced therefore, the need to preserve and protect the environment while creating a balance for man to satisfy his or her needs. A large chunk of people rarely live on one source of income and vary their ways of making or increasing their income. There is a huge reliance on non-farm based activities to survive. Most disasters, illness and negative things that happen in the environment to man is as a result of their actions and inactions. There exists the absence of political will and traditional administration to secure and enforce the preservation of sensitive resources of the natural environment such as water bodies and arable lands. Urgent steps need to be

taken to strike a balance between the need for sustainable livelihoods and the need for the sustainability of the natural environment as we thrive to meet Sustainable Development Goal 15.

5.3 Policy Recommendations

In view of the findings of this study, the following recommendations are made for consideration.

- It is recommended from the study that, traditional authorities together with the local assembly enforce the laws that protect reserved or protected zones of the area by applying the needed sanctions to offenders.
- Also, a policy should be drawn and implemented by the local assemblies to ensure residents plant a required minimum amount of trees to have a balance in the ecosystem.
- To ensure a sustainable livelihood and environment, areas should be properly demarcated with the needed functions, buffer zones created for the preservation of natural resources and opportunity for people to make good use of the environment for a livelihood.

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APPENDICES

APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF GEOGRAPHY EDUCATION

IMPACT OF LIVELIHOOD STRATEGIES ON LAND COVER CHANGE IN THE GA CENTRAL MUNICIPALITY

HOUSEHOLD QUESTIONNAIRE SURVEY FOR RESIDENTS OF SELECTED COMMUNITIES IN GA CENTRAL MUNICIPALITY

Ethical issues: *This survey is mainly for academic purposes and respondents are assured of confidentiality and anonymity. The purpose of this research is to assess the effects of livelihood strategies of residents on land cover change in the Ga Central Municipality. Thank you.*

Instructions: Please, provide answers to any required open questions and tick [√] where necessary

SECTION A: DEMOGRAPHIC INFORMATION OF THE RESPONDENT.

Name of Community ……..

1. Sex

   a. Male [ ] b. Female [ ]

2. Age of respondent

   a.21 – 30 [ ] b. 31 – 40 [ ] c. 41 – 50 [ ] d. 50 + [ ]

3. Literacy

   a. No schooling [ ] b. Primary [ ] c. Secondary [ ] d. Tertiary [ ]

4. Marital status

   a. Single [ ] b. Married [ ] c. Divorced [ ] d. Separated [ ]

5. What is your position in your household?

   a. Head [ ] b. Husband [ ] c. Wife [ ] d. Child [ ]

6. What is your household size?

   a. 0 – 5 [ ] b. 6 – 10 [ ] c. 11 – 15 [ ]

SECTION B: EXTENT OF LAND COVER CHANGE

7. Did you migrate from elsewhere to your current community?

a. Yes [ ] b. No [ ]

8. Where did you migrate from to your current community?

……..

9. Why did you move to your current community?

a. Permanent Accommodation [ ] b.Renting cheaper accommodation [ ]

c. Marriage [ ] d. Farming [ ] e. Other: …….....

10. When did you first arrive in your community?

a.1971 – 1980 [ ] b. 1981 – 1990 [ ]

c. 1991 – 2000 [ ] d. 2001 – 2010 [ ]

11. How long have you stayed in your community?

a.10 – 15 years [ ] b. 16 – 20 years [ ]

c. 21 – 25 years [ ] d. 26+ years [ ]

12. Do you own or have access to land in the community?

a. Yes [ ] b. No [ ]

13. If Yes, what is the size of land?

a.1 – 2 plots [ ] b. 3 – 4 plots [ ]

c. 5 – 6 plots [ ] d. 7 + plots [ ]

14. What was the nature of the land in the community when you first arrived?

a. Grassland and Shrubs b. Bare areas c. Built up d. Farmlands

15. Have there been major changes to the land surface in the community over the years?

a. Yes [ ] b. No [ ]

16. What have been the major changes to land in your community over the years?

a. More Grassland and Shrubs [ ] b. More Bare areas [ ]

c. More Built up [ ] d. Farmlands [ ]

17. What feature currently dominates the land in your community?

a. Grassland and Shrubs [ ] b. Bare areas [ ]
c. Buildings [ ] d. Farmlands [ ]

18. What caused the changes to the land?

a. Human activities [ ] b. Natural occurrences [ ]

SECTION C: LIVELIHOOD STRATEGIES OF RESIDENTS

19. What do you do for a living or occupation?

…….

20. What was your main use of your land when you first arrived in the community?

a. Building [ ] b. Agriculture [ ] c. Retail activities [ ] d. Other: ……..

21. Did you have access to other lands in the community when you arrived?

a. Yes b. No

22. If Yes, what was the land used for?

a. Building [ ] b. Agriculture [ ] c. Retail activities [ ] d. Other: ……..

23. What other activities was your land used for over the years? Tick all that apply

a. Building of apartments [ ] b. Agricultural activities [ ] c. Building of shops [ ]
d. Borehole [ ] e. School [ ] f. Retail activities [ ]

24. What are the reasons behind employing the various activities to the land? Tick all that apply

a. Increase household income [ ] b. Food [ ] c. Create employment [ ]
d. Own an accommodation [ ] e. Privacy [ ] f. Other: ……...

25. Has there been an increase in household income, employing the various activities to the land?

a. Yes b. No

26. What was the main use of land by residents when you first arrived?

a. Building [ ] b. Agriculture [ ] c. Retail activities [ ] d. Other: …….

27. What is the main use of land by residents in the community now?

a. Building [ ] b. Agriculture [ ] c. Retail activities [ ] d. Other: ……..

28. What was the major economic activity the land in your community was been used for when you first arrived?

a. Construction [ ] b. Agricultural activities [ ] c. Retail activities [ ]
d. Quarrying [ ] e. Other: ……

29. What is the major economic activity the land in your community was being used for currently?

a. Construction [ ] b. Agricultural activities [ ] c. Retail activities [ ]
d. Quarrying [ ] e. Other: ……

30. What other activities or things have made life comfortable in your community?

a. Serene environment [ ] b. Friends and association [ ] c. Employment [ ]
d. Available Amenities [ ] e. Other: ……

SECTION D: LIVELIHOOD STRATEGIES ON LAND COVER

31. Do human activities on the land affect the land?

a. Yes b. No

32. What are negative effects of your activities to the land cover? Tick all that apply.

a. Erosion [ ] b. Loss of vegetation [ ] c. Loss of land fertility [ ]
d. Increasing land temperature [ ] e. Water pollution [ ]

33. Has the land gained from the activities you have carried out?
a. Yes b. No

34. What are the benefits of human activities to the land cover? Tick all that apply

a. Planned Layout [ ] b. Landscape Beautification [ ]
c. Accessibility to resources [ ] d. Other: ……

35. Do these effects of human activities on the land affect humans?

a. Yes b. No

36. What ways do humans benefit from their activities? Tick all that apply

a. Accommodation [ ] b. Food [ ] c. Employment [ ]
d. Accessibility to resources e. Other: ……

37. What are the negative effects of humans activities on themselves in your community? Tick all that apply

a. Air pollution [ ] b. Noise pollution [ ] c. Loss of fertile lands [ ]
d. Poor sanitation [ ] e. Water pollution [ ] f. Other: ……..

38. What do you think will be the effect of human activities in your community on the land in the next decade?

a. More development [ ] b. Desertification [ ] c. Loss of all agriculture lands [ ]
d. Other: ……

APPENDIX B

INTERVIEW GUIDE FOR KEY INFORMANTS

1. How long have you stayed in the community? ……

2. Do you own or have access to land in the community?

   b. Yes b. No

3. If Yes, what is the size of land in plots? ……

4. What was the nature of the land in the community when you first arrived?

   b. Grassland and Shrubs b. Bare land c. Built up d. Farmlands

5. What have been the major changes to land in the community over the years?

…….

6. What caused the change?

……

7. What is the current state of land in the community?

……..

8. What was your main use of your land when you first arrived in the community?

   a. Building b. Agriculture c. Retail activities d. Other (specify)

   ……

9. Did you have access to other lands in the community when you arrived?

   b. Yes b. No

10. If Yes, what was the land used for?

……

11. What was the main use of land by residents when you first arrived?

……

12. What is the major use of land currently in the community?

…….

13. What are the different activities you have used your land for till now?

……
……

14. What was the major economic activity the land in your community was been used for?

a. Construction b. Farming c. Retail activities d. Other (specify)
……

15. What is the major economic activity the land in your community is been used for currently?

a. Construction b. Farming c. Retail activities d. Other (specify)
……

16. What are the reasons behind employing the various activities to the land?

……
……

17. What other activities or things have made living in the community comfortable for you?

……
……

18. What are the benefits, the land has gained from the activities you have carried out?

……
……

19. What are the negative effects of your activities to the land cover?

……
……
……

20. Do these effects on the land by our activities affect humans?

a. Yes b. No

21. How do the activities on the land by humans affect us?

……
……

22. What do you think will be the effect on land in the next 10 years?

……
……
……