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Ecosystem Services and Livelihoods of Farming Communities around Eleyele Wetland in Ibadan, Nigeria

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Presented by: **Peter Boluwaji OYEDELE** [B.Agric (OAU, Ile-Ife)]

Supervisor: **Dr. Felix OLORUNFEMI**
Associate Professor,
Nigerian Institute of Social and Economic Research (NISER), Ibadan, Nigeria

Approved on 29th January, 2018 by:

Chair of the Committee: **Prof. Jean SOGBEDJI** (Université de Lomé, Togo)
Committee Members: **Dr. Komi AGBOKA** (Université de Lomé, Togo)
Dr. Mawuli AZIADEKEY (Université de Lomé, Togo)
Dr. Felix OLORUNFEMI, Associate Professor,
Nigerian Institute of Social and Economic Research (NISER), Ibadan, Nigeria

Director of the Program: **Prof. Kouami KOKOU**

DEDICATION

This master thesis is dedicated to God Almighty, the all Sufficient, the glorious, how wonderful and amiable you are. All glory is to your name.

I also want to dedicate it to my wonderful daughter, **Princes**s Hephzibah Boluwatife born to this world while I was away for my Master's Programme study, and to my dear wife, **Queen** Esther Bolanle for her supports.

Finally, I dedicate it to All Mothers and New Born Babies all over the World.

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LIST OF ABBREVIATIONS

DFID: Department for International Development

FAO: Food and Agricultural Organization

FGD: Focus Group Discussion

GPS: Global Positioning System

ICIMOD: International Centre for Integrated Mountain Development

IPCC: Intergovernmental Panel on Climate Change

ICT: Information and Communication Technology

IUCN: International Union for Conservation of Nature

LGA: Local Government Area

MEA: Millennium Ecosystem Assessment

NGO: Non Governmental Organizations

NPC: National Population Commission

RCB: Ramsar Convention Bureau

SL: Sustainable Livelihood

SPSS: Statistical Package for Social Sciences

UNDP: United Nations Development Programme

UNEP: United Nations Environmental Programme

WASCAL: West African Science Service Centre on Climate Change and Adapted Land Use

WWF: World Wide Fund for Nature

ABSTRACT

Wetlands in Nigeria are being rapidly degraded through over exploitation and poor management. This study assesses ecosystem services, drivers of change in wetlands ecosystem, and impacts of those changes on people's livelihoods through a case study of farming communities around Eleyele wetland in Ibadan, Nigeria. The survey was conducted in three major communities located around the wetland. Data collected through household surveys, focus group discussions, and key informant interviews were subjected to descriptive and inferential statistical analysis. Findings indicate that respondents derive a total of 12 ecosystem services from the wetland: crop farming; irrigation water; fish farming; drinking water; religious activities among others. Results also revealed both direct and indirect drivers of the change. Direct drivers include siltation, aquatic weeds invasion, erosion, encroachment, changing weather conditions among others while poor management plan were regards as indirect drivers. These were negatively impacting the wetland resulting in reduction of food availability and economic opportunities for the people. Drastic decreases in availability of meat and water availability (drinking), fish stock are outcome of these changes. Respondents' level education significantly influenced their perception of benefits derived from the wetland. The study recommends more education on wetlands importance, provision of alternative livelihoods, strengthening of existing laws and policies. This will ensure wetlands conservation, sustain provisioning and guarantee food security.

Key words: Wetland, Ecosystem, Ecosystem services, Drivers of change, Livelihoods, Food security.

RÉSUMÉ

Les zones humides au Nigeria sont rapidement dégradées par la surexploitation et la mauvaise gestion. Cette étude évalue les services écosystémiques, facteurs de changement dans les zones humides, les écosystèmes et les impacts de ces changements sur les moyens de subsistance des gens à travers une étude de cas de communautés agricoles autour des zones humides Eleyele à Ibadan, au Nigeria. L'enquête a été menée dans trois principales communautés situées autour de la zone humide. Les données recueillies au moyen d'enquêtes auprès des ménages, des discussions de groupe, et des entrevues avec des informateurs clés ont été soumises à une analyse statistique descriptive et inférentielle. Les résultats indiquent que les répondants proviennent d'un total de 12 services des écosystèmes des zones humides: l'agriculture, l'eau d'irrigation, l'élevage de poissons, eau potable, activités religieuses entre autres. Les résultats ont également révélé des facteurs directs et indirects, y compris l'envasement, l'érosion, l'invasion des mauvaises herbes aquatiques, des empiètements, des conditions météorologiques changeantes, la surexploitation et la mauvaise gestion des terres humides, l'impact négatif du régime résultant de la réduction de la disponibilité de la nourriture et des possibilités économiques pour la population. Des réductions radicales de la disponibilité d'eau potable, viande, gibier, poisson stock sont issues de ces changements. L'éducation des répondants a fortement influencé leur perception sur les avantages tirés de la zone humide. L'étude recommande qu'il ait plus d'éducation sur l'importance des zones humides, d'offre d'autres moyens de subsistance, renforcement des lois et politiques existantes. Cela permettra d'assurer la conservation des terres humides, maintenir l'approvisionnement et de garantir la sécurité alimentaire.

Mots clés: Zones humides, Écosystèmes, Services écosystémiques, Facteurs de changement, Moyens de subsistance, Sécurité alimentaire.

CHAPTER ONE

INTRODUCTION

1.1 Problem Statement

A wetland is a piece of land that is seasonally or permanently covered by shallow water, as well as land where the water table is close to or at the surface (Mitsch et al., 2009). Ramsar Convention (1971) defined wetlands as areas of marsh, fen, peatland or water whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh brackish or salt, including areas of marine water the depth of which at low tide does not exceed six (6) meters. Wetlands, as part of natural ecosystem, where they occur in the landscape are valued for their contribution to ecological balance and biodiversity (Obiefuna et al., 2012). Studies on the value of wetlands indicated that wetlands provide water, food and shelter for fish, shellfish, birds, and mammals, and they serve as a breeding ground and nursery for numerous species (Bardecki, 1998). Wetlands provide numerous goods and services to society, supporting millions of people around the world (Barbier et al., *1*997). Rural households often harvest natural products for food, medicines, cosmetics or materials for shelter (Adaya *et al.*, *1*997, Barbier et al., *1*997). As Adeoye and Dami (2012) asserted, wetlands are among the most productive habitats in the world.

However, in spite of the benefits wetlands offer to people, limited knowledge on the benefits of resources and their associated functions and values resulted in their conversion to other uses in many countries, and the impact of their loss is being realized in different forms. Millennium Ecosystem Assessment (MEA, 2005) reported that the increasing population and development in Africa are putting more demands on the natural resources. Studies revealed that wetlands are among the world's most threatened ecosystems, due to urbanization, pollution, continued drainage, overexploitation or other unsustainable uses of their resources (Adeoye and Dami, 2012). UNEP (2007) alerts that, globally, wetlands have been reduced by 50%. How to balance the use of land to ensure ecosystems protection and long-term ecosystems services on one hand and the accelerated short-term provisioning objectives on the other is a challenge for ecosystems management and climate mitigation (UNDP-UNEP, 2009).

Tijani et al. (2011) opined that Nigeria is richly endowed with both coastal and inland wetlands and these wetlands are of economic, ecological, socio-cultural, recreational and scientific significance. However, with urban populations increase in Nigeria, food production from the inlands cannot meet increasing population food demand; thus, wetlands may be the most logical environments in which this gap can be bridged. Study done by Olanrewaju et al. (2011) on perceived benefits of selected wetlands in south-west Nigeria concludes that wetland benefits are lowly perceived by the people, especially their roles in ecosystem balancing and ensuring food security. In Nigeria, human activities continue to adversely affect wetland ecosystems (Orimoogunje, 2008). The alarming rate at which the country's wetlands are disappearing obviously portends some direct consequences. In particular, wetlands destruction is affecting water supply and water resources management in various parts of the country (Orimoogunje, 2008). There is no gainsaying, therefore, that the degradation of wetland ecosystems in Nigeria increases the task of food and water resources management in the country.

To protect and conserve wetlands from further damage, wetland conservation planning and management is needed. Knowledge on wetland ecosystem services, drivers of change and subsequent impacts specific to regions or areas of concern is essential for ensuring wise use, conservation and sustainable development (Mmopelwa, 2006; Ostrom et al., 2007; Adekola and Mitchell, 2011). This can be achieved through making available information on the importance of wetlands. Gopal (2013) opined that Information on individual wetlands and their exploitation at the local level is very limited. Lack of readily available data and information about the values of wetlands was identified as a major reason why their conversion and development have been viewed as a generally more attractive option, most especially in developing countries (Balmford et al., 2002; Mmopelwa, 2006). For conservation planning and management, there is a clear need for a more detailed understanding of the ecosystem services provided by wetlands, how they affect people’s livelihoods and the threats these wetlands are exposed to (Bhatta et al., 2016; MEA 2005).

It is recognized that the use and state of wetlands areas are relative for different location. Therefore, knowledge on wetlands importance, management and its degradation will help to formulate policies that can improve its conservation and sustainability. The study therefore aims at identifying and examining ecosystem services, the drivers of change of wetlands ecosystem, and the impacts of these changes on people’s livelihoods.

1.2 Research Questions

This study seeks to find empirical and scientifically deduced answers to the following questions:

i. what are the various ways in which members of the community have access to the use of wetland in the area?
ii. what are the ecosystem services present in the wetland, as well as their use and ranking?
iii. what are the drivers of change in the wetland?
iv. what are the coping mechanisms with the observed changes in ecosystem services from the wetland by members of the community?

1.3 Objectives

This study examines ecosystem services and livelihoods of farming communities around Eleyele wetland in Ibadan, Nigeria.

Specifically, the study seeks to examine;

i. the accessibility to the use of the wetland by members of the communities;
ii. the ecosystem services derived from the wetland, their use and ranking in the area;
iii. the various drivers of change in the wetland ; and
iv. the coping mechanisms with the observed changes in the wetland by members of the community in the study area.

1.4 Research Hypothesis

H_o1: There is no significant relationship between access to wetland and the socio-economic characteristics of respondents.

H_o2: There is no significant relationship between the respondents' perception on the benefits of the wetland and their socio-economic characteristics.

H_o3: There is no significant relationship between the respondents' perception on changes in the wetland and their socio-economic characteristics.

1.5 Announcing the Plan of the Thesis

The first chapter includes problem statement, justification of the study, research objectives, research questions and hypotheses. Chapter two provides the conceptual basis for the research and a review of relevant literature. Chapter three deal with materials and methods including the study area, population and economic characteristics of the study area, climate and vegetation and finally methods. The fourth chapter presents the results of analysis and a discussion of the findings while the fifth chapter concludes the report.

CHAPTER TWO

LITERATURE REVIEW

2.1 Concept of Ecosystem

According to Millennium Ecosystem Assessment (2005), an ecosystem is defined as a dynamic complex of plant, animal, and microorganism communities and the non-living environment interacting as a functional unit. Humans are an integral part of ecosystems. Ecosystems vary enormously in size; a temporary pond in a tree hollow and an ocean basin can both be ecosystems. Ecosystems provide various benefits to all people, including the benefits of provisioning, regulating, cultural, and supporting services (MEA, 2005).

The services and functions of ecosystems are crucial for the support of life on earth, and they contribute to human welfare both directly and indirectly (Richardson, 2010). Ecosystem varies greatly in size from a small pond to a large forest or a sea. Many ecologists regard the entire biosphere as a global ecosystem, as a composite of all local ecosystems on earth. Since this system is too much big and complex to be studied at one time, it is convenient to divide it into two basic categories, namely the terrestrial and the aquatic. Forest, grassland and desert are some examples of terrestrial ecosystems; pond, lake, wetland, river and estuary are some examples of aquatic ecosystems. Crop fields and an aquarium may also be considered as man-made ecosystems. Wetlands, as part of natural ecosystem, where they occur in the landscape are valued for their contribution to ecological balance and biodiversity (Obiefuna et al., 2012).

2.2 The concept of Wetlands

Literarily, wetland is a wet land (i.e. land which is wet)! But not all wet land results in a wetland. Characteristically, a wetland can best be found where the land is wet enough (i.e. saturated or flooded) for long enough to be unfavourable to most plants but are favourable to plants that can easily adapt to anaerobic soil conditions. As soil becomes increasingly wet, the water starts to fill the space between the soil particles. In same the vein, Bakare et al. (2011) define wetlands as land where excess water dominates, area of land whose soil is saturated with moisture, either permanently or seasonally with heavy growth of aquatic or semi-aquatic plants and relatively thick organic deposits. When all the spaces are filled with water the soil is said to be saturated. In areas which are not wetlands, water drains away quickly and the soil does not remain saturated.

However, in wetlands the water persists or drains away very slowly and the soil remains saturated or flooded for long periods. Soil in these conditions is said to be waterlogged.

According to Barbier et al. (1997), wetlands provide numerous goods and services to society, supporting millions of people around the world. For instance, Costanza et al. (1997) opined that the global value of wetlands and their associated ecosystem services has been estimated at US$14 trillion annually. Wetlands constitute an ecosystem that is self sustaining and highly irreplaceable. The land is highly susceptible to biodiversity alteration if caution is not taken about its use (Alamu, 2007). As Adeoye and Dami (2012) asserted, wetlands are among the most productive habitats in the world. Wetlands provide rich wetland soils for agriculture, fish for sustenance, trees for timber and firewood, reeds for mats and thatching, as well as recreational opportunities. Similarly, rural households often harvest natural products for food, medicines, cosmetics or materials for shelter (Adaya et al., *1*997, Barbier et al., *1*997). The water itself is a valuable commodity. The plants provide services such as flood attenuation and water purification which benefit people far beyond the wetlands themselves.

In addition, Turpie et al. (2006) asserted that wetlands also have less tangible values which may be linked to cultural heritage or religious values associated with them. These and many more are values that can be derived in a wetland for improvement of human well-being and development in general. Hence, maintenance of wetlands as functioning ecosystems will often ensure that important contributions to development are maintained. Contrarily, Bakare et al., (2011) opined that the use of wetland for cultivation, settlement and infrastructural development, solid waste disposal as well as fishing have had ecological consequences on the sustainable functioning of wetland.

2.3 Wetlands Degradation

Since the very beginning of human life on earth, wetlands have been providing valuable resources and refuge for human populations and many other life forms (Ramsar Convention Bureau, 2002). In spite of their importance in sustaining human well-being, many wetlands remain threatened. Wetlands are highly sensitive ecosystems which make them vulnerable to degradation (Turner et al., *2*000). Despite their importance, wetlands are highly endangered ecosystems which are increasingly becoming threatened (Barbier et al., 1997, Turner et al.,

*2*000). Indeed, wetlands are frequently lost to development and other land uses which offer limited benefits or even end up being costly to the surrounding communities (Bowers, 1983; Turner et al., *2*000).

In Nigeria, Adeoye and Dami (2012) revealed that wetlands are among the country's most threatened ecosystems, due to urbanization, pollution, continued drainage, overexploitation or other unsustainable uses of their resources. There are varieties of wetlands in Nigeria (Tijani et al., 2011); and most of these are being threatened as a result of the quest for urban development. Wetlands are fast being depleted largely from development often unsustainable; wetlands are threatened by anthropogenic factors such as uncontrolled land use activities/development, increased agricultural activities most especially commercialized farming. In this, Orimoogunje, et al. (2009) opined that anthropogenic and bio-geophysical factors that threatened further include population pressure, rapid urbanization, mining, pollution, uncontrolled tilling for crop production, over-grazing, logging, unprecedented land reclamation, construction of dams, transportation routes and other physical infrastructure, marine and coastal erosion, subsidence, ocean water intrusion, invasion by alien floral and faunal species, sand storm, desertification, and droughts. All these factors are associated with urban development processes.

In addition, the livelihood-generating actions of the poor communities that reside near wetlands and their dependency on the wetland resources have degraded wetlands. Thus, a wide range of human activities have altered wetlands around the world and caused their degradation (O'Connell, 2003). Tijani et al. (2011) highlighted the negative impacts of the human-induced influence on the wetland ecosystem through land-use and waste effluent discharges with attendant degradation / loss. It is obvious that the wetland areas are disappearing due to increase in human population and the urbanization process is adversely affecting the size of wetland areas in the cities. Odine (2011) opined that poor understanding of economic values of wetlands is one of the contributory factors that make people see wetlands as wasteland, culminating in massive destruction of this highly productive resource. Over-exploitation of wetland resources and siltation were reported as the major direct drivers of change with impacts on both ecosystem services and people's livelihoods (Bhatta et al., 2016). Based on Orimoogunje et al. (2009) the alarming rate at which Nigeria's wetlands are vanishing obviously portends some dire

consequences, the authors were of the opinion that greater consequences of wetlands destruction is the impact on water supply and water resources management in various parts of the country.

2.4 Ecosystem Services

MEA (2005) defined ecosystem services as the benefits people obtain from ecosystems. These include provisioning (products obtained from ecosystems), regulating (benefits obtained from the regulation of ecosystem processes), cultural (nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences), and supporting (those that are necessary for the production of all other ecosystem services). Ecosystem services are the functions of an ecosystem that generate benefits or value to humans; they are the conditions and processes through which natural ecosystems sustain and fulfil human life (Daly and Farley, 2004; Richardson, 2010). Ecosystem services are generated as "emergent phenomena by the interacting elements of ecosystem structure". Emergent phenomena are those properties of a system that are not recognizable by an understanding of individual parts. Agro-ecosystems do not only provide agricultural commodities such as food and fibre, but also help protect biodiversity, water, carbon storage, and landscape amenity. However, recent environmental change coupled with other stressors is affecting the ability of agro-ecosystems to continue to provide the quality and quantity of ecosystem services required for sustainable rural livelihoods (Gentle and Maraseni, 2012; Shrestha et al., 2012; Baral, 2013).

The Millennium Ecosystem Assessment (2005) categorized the services obtained from ecosystems as follows:

- **Provisioning services** such as food and water;
- **Regulating services** such as flood and disease control;
- **Cultural services** such as spiritual, recreational, and cultural benefits; and
- **Supporting services**, such as nutrient cycling that maintains life conditions on Earth.

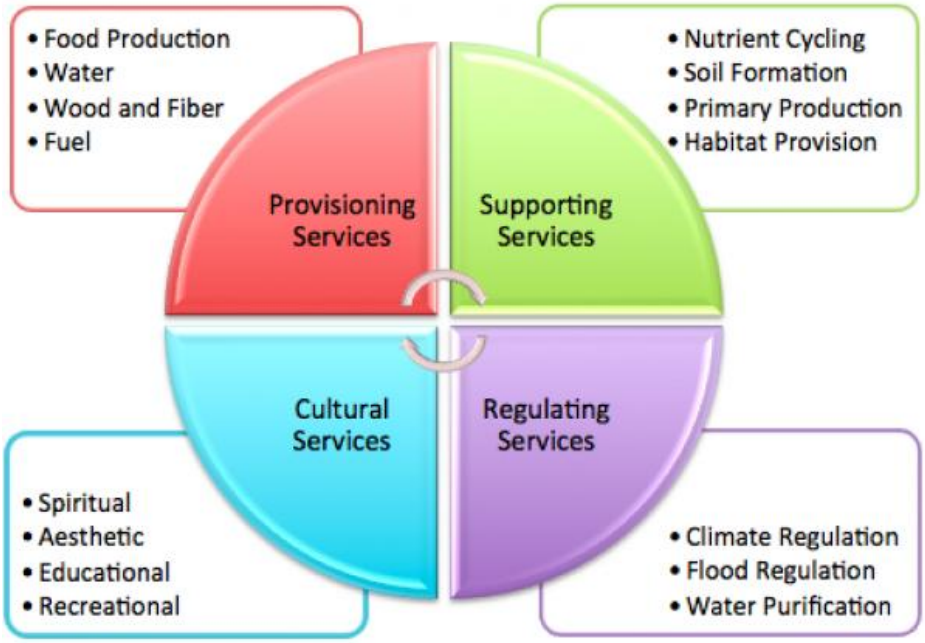

Figure 2.1: Ecosystem Services

Source: Millennium Ecosystem Assessment (MEA), 2005.

2.5 Concepts of Ecosystem Services and Livelihoods

The concept of livelihoods had been defined differently by many authors. Literarily, it connotes means of securing the necessities of life. Chambers and Conway (1992) define livelihoods as a system comprising of assets, capabilities, and activities for a means of living. Ellis (2000) opined that different combinations of capacities and activities form different household livelihoods strategies, which do not only generate income but include many other elements, including social assets. The livelihood approach, as further discussed by Hahn et al. (2009), combined the IPCC vulnerability framework with livelihoods approach. Livelihoods are considered sustainable when they can cope with and recover from such stresses and shocks and maintain or enhance their capabilities and assets both now and in the future, although not undermining the natural resource base (Carney, 1998). This definition strongly argues for and supports enhancement of the adaptive and coping capacity of farming communities to ensure sustainability of their livelihoods to achieving a better well-being.

According to Ellis (2000), different feasible coping strategies will be taken by rural people to overcome the encompassing situation. Farming communities are mostly dependent on ecosystem services such as water, forest products, grass, and fodder for livestock, fisheries, for their

livelihoods, although the priority ecosystem services may vary depending on different interest groups (Paudyal et al., 2015). Paudyal et al. (2015) found that rural women's main concern is forests as a source for firewood, while men are more concerned about timber production. Recent changes in local and regional climate, however, coupled with other drivers are affecting the continuous or sufficient supply of many ecosystem services.

Figure 2.2 depicts the strength of linkages between categories of ecosystem services and components of human well-being that are commonly encountered and includes indications of the extent to which it is possible for socioeconomic factors to mediate the linkage. (For example, if it is possible to purchase a substitute for a degraded ecosystem service, then there is a high potential for mediation.) The strength of the linkages and the potential for mediation differ in different ecosystems and regions. In addition to the influence of ecosystem services on human well-being depicted here, other factors—including other environmental factors as well as economic, social, technological, and cultural factors—influence human well-being, and ecosystems are in turn affected by changes in human well-being. (Millennium Ecosystem Assessment, 2003).

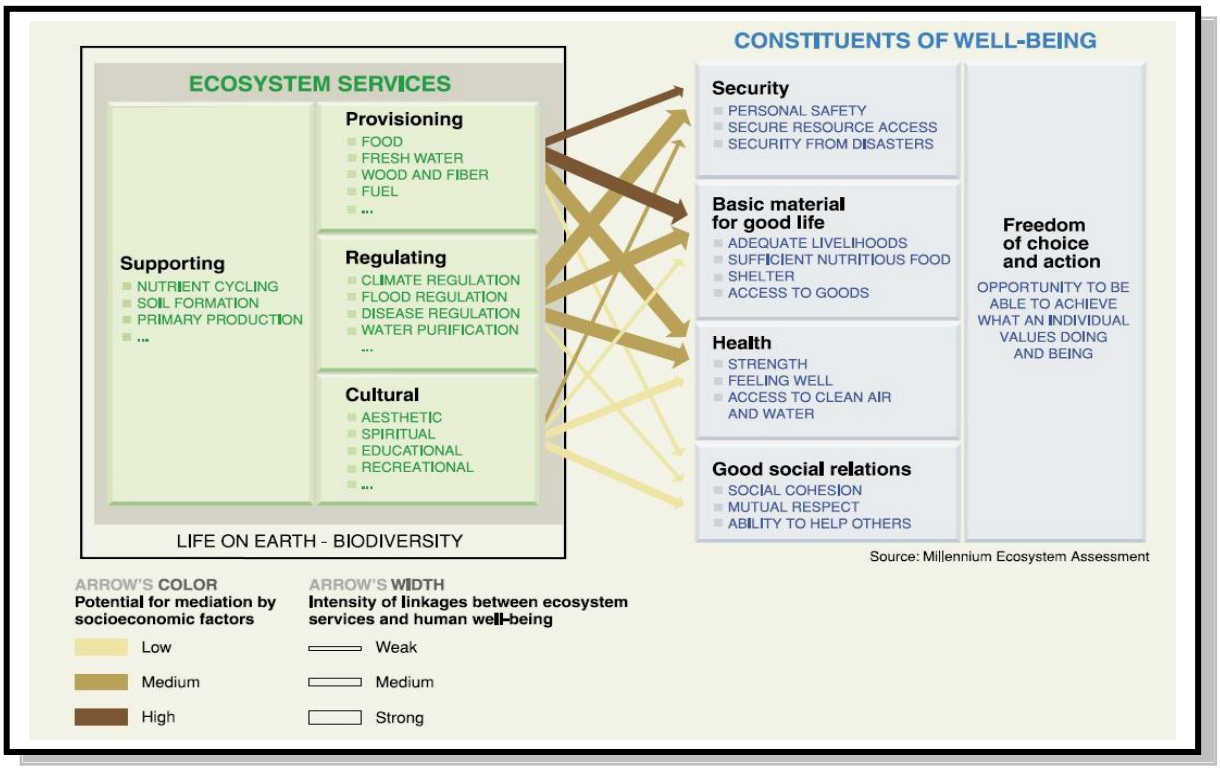

Figure 2.2: Linkages between Ecosystem Services and Human Well-being
Source: Millennium Ecosystem Assessment (MEA), 2003.

2.6 Climate Change and Ecosystem Services

The Millennium Ecosystem Assessment (2005) recognises climate change as one of the major drivers of ecosystem change and argues that "ecosystem degradation tends to harm rural populations more directly and has its more direct and severe impact on poor people". The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2007) projected a severe impact of climate change on ecosystems, particularly because of their sensitivity to warming. Global climate change scenarios suggest that there will be considerable impacts on ecosystems and their associated ecosystem services with serious consequences for the livelihoods of communities, particularly in the most economically challenged parts of the world (IPCC, 2001; Agrawal and Perrin, 2009; ICIMOD, 2010; Van de Sand, 2012).

The nexus between energy, food security, rural livelihoods and climate change is becoming stronger as the demand for ecosystems services continues to increase. Climate change has the capacity to accelerate the ecosystems degradation processes and diminish the capability of ecosystems to provide these services. In poor rural agrarian societies, over-reliance on the natural resource systems induces multiple stressors that are exacerbated by climate change impacts. These stressors increase the vulnerability of populations and stretch the traditional resilience to the limit (MEA, 2005). A negative impact on the ecosystems exposes people to composite externalities including poor resilience, environmental shocks, poor health and economic under-development which deepen the dynamic and context specific poverty-environment linkages at local levels (UNDP-UNEP, 2009).

2.7 Wetlands and Agricultural Practices

As Adeoye and Dami (2012) asserted, wetlands are among the most productive habitats in the world. But in spite of the benefits wetlands offer to waterfowl, wildlife and people, limited knowledge on the benefits of resources and their associated functions and values resulted in their reclamation in many countries, and the impact of their loss is being realized in different forms. Studies revealed that wetlands are among the world's most threatened ecosystems mainly due to continued drainage, urbanization, pollution, over-exploitation or other unsustainable uses of their resources (Adeoye and Dami, 2012). Report also shows that in Canada, in settled areas, up to 70 per cent of wetlands are lost or degraded and every day up to 80 acres of wetlands are lost (Ducks Unlimited Canada, 2015). In Nigeria's wetland ecosystem, the case is no different.

Many types of wetland are highly suitable for agriculture, and have been used for agriculture for thousands of years, especially riverine wetlands in floodplains (Ramsar, 2013). They provide a ready supply of water, are usually found in flat areas, and the regular input of sediment and plant material means that many are naturally fertile. Wetlands are playing an increasingly significant role in the agricultural output of many developing countries; 48% and 66% of Ramsar-designated wetlands in Asia and Africa respectively are used for agriculture (McCartney et al., 2010). Some argued that in Africa wetlands represent a new – possibly the last – "agricultural frontier" (Dixon and Wood, 2003). Many different types of agriculture take place in wetlands: wetlands can be used for growing staple subsistence crops, as well as more lucrative crops, such as vegetables. Many pastoralists and livestock keepers depend on them as a source of water for their animals; reeds and other plants are a source of fodder. Wetlands are contributing to the development of the dairy industry in Uganda (Nakangu and Bagyenda, 2013).

2.8 Concepts of Adaptation

The changing climate is no longer an abstract issue, and the realities of its impacts are being felt across the globe. Climate change is affecting millions of people, and thwarting their efforts to escape poverty. Adaptation to climate change, as defined by the IPCC, constitutes an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2001, 2007). The term "adaptation", in the context of climate change impact, is now mostly considered to be synonymous with the "capacity to cope with changes, reduce vulnerability, and improve livelihoods" (Agrawal, 2009). Adaptive capacity is contextual and varies among various segments of communities, countries, societies, and individuals; it equally changes over both time and scale. When ecosystems are healthy, they can better adjust or better still cope with the effects of climate change and related disasters. Sustainably-managed ecosystems reduce the vulnerability of people to climate change impacts and hazards, hence improve their livelihoods.

Climate change adaptation in context of development and rural livelihoods in Nepal have been much discussed in recent years, with the discourse focusing primarily on whether adaptation as part and parcel of the development process in developing countries (IPCC, 2001; Holmelin and Aase, 2013). Evidence shows that communities that have been practicing adaptation to various changes in these resources for a long time have developed management decisions to cope with these (Berrang-Ford et al., 2011; van Oort et al., 2014).

CHAPTER THREE

MATERIALS AND METHODS

3.1 The Study Area

3.1.1 Study Location

This study was carried out in Eleyele Wetland located in north-eastern part of Ibadan, South-western Nigeria (Figure 3.1). The wetland is located within longitude N07^{0}25'00" and N07^{0}26'47" and Latitude E03^{0}52'50" and E03^{0}50'25". Its boundary is between Ido and Ibadan Northwest Local Government Areas (LGAs) of the state. The study site is surrounded by Eleyele community in the south, Apete in the east and Awotan in the north. Eleyele wetland is a modified natural riverine wetland type with area of about 100 km^2 including the catchment area. The elevation is relatively low ranging between 100-150m above sea level and surrounded by quartz-ridge hills toward the downstream section where the Eleyele dam barrage is located. A number of stream channels serve as feeding/ recharge streams to the Eleyele wetland basin. In 1942, the quest to create a modern water supply system to meet the challenge of water scarcity for the emerging Ibadan metropolis led to the construction of Eleyele Dam on the main River Ona with a reservoir storage capacity of 29.5 million litres.

3.1.2 Climate and Vegetation

The study area falls under Tropical Hinterland Climate Zone (about 150–240km northwards from the coast) with 1000 to 1500mm annual rainfall, temperature range of 21–25°C and relative humidity range of 50–80%. The dry season range from 4–5 months between November to March, with December-January characterized by NE-SW dry, cold and dusty harmattan trade wind, from the Sahara Desert. For the study Eleyele Wetland, the adjoining hilly quartzite ridges are covered by forests, while the wetland lowland areas are dominated by light forest, riparian wetland forest most of which had been impacted by human activities (Tijani, et al., 2011).

3.1.3 Population and Economic Activities

The land area of Ibadan is 986 km² and a population of 5,580,894 (NPC, 2006). On account of extensive fertile soil which is suitable for agriculture, the basic occupation of the people is farming. There are pockets of grassland which are suitable for animal rearing, vast forest

reserves and rivers. The people in the area grow varieties of crops such as cocoa, kolanut, mango, maize, rice and vegetables such as tomatoes, okra, and *ewedu*, among others. Ido Local Government Area is called the fruit and vegetable bowl of the state. Apart from farming, the local government area has also gained tremendously from the services of medium and small scale industries for processing agricultural products like cassava and cashew nuts.

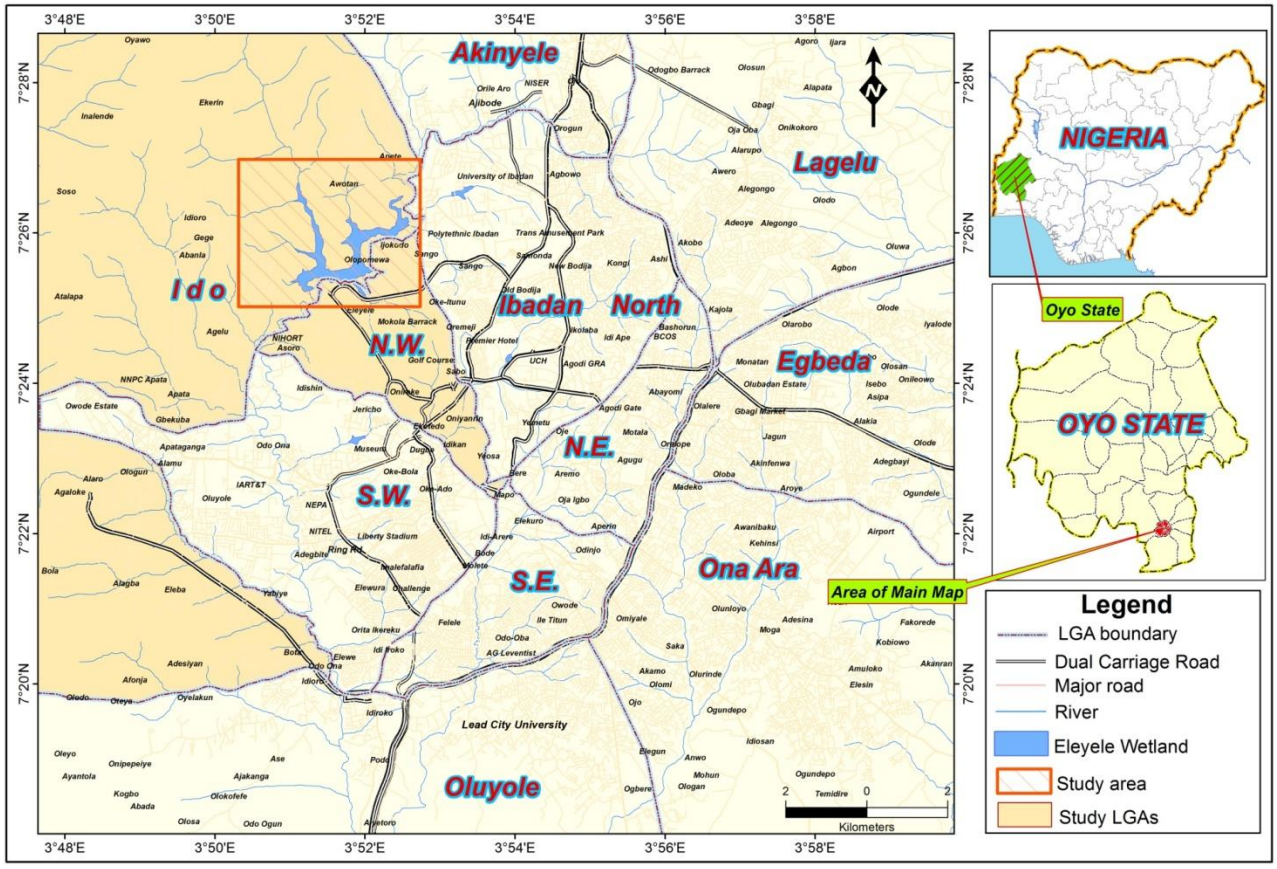

Figure 3.1: Map showing the location of study area

Source: Oyo State Ministry of Urban and Regional Development, Agodi, Ibadan

3.2 Methods

3.2.1 Conceptual Framework:

3.2.1.1 The Millennium Ecosystem Assessment Framework

The conceptual framework for the Millennium Assessment places human well-being as the central focus for assessment, while recognizing that biodiversity and ecosystems also have intrinsic value and that people take decisions concerning ecosystems based on considerations of well-being as well as intrinsic value (figure 3.2). The MA conceptual framework assumes that a dynamic interaction exists between people and ecosystems, with the changing human condition serving to both directly and indirectly drive change in ecosystems and with changes in ecosystems causing changes in human well-being. At the same time, many other factors independent of environment change human condition, and many natural forces are influencing ecosystems.

Changes in factors that indirectly affect ecosystems, such as population, technology, and lifestyle (upper right corner of Figure 3.2), can lead to changes in factors directly affecting ecosystems, such as the catch of fisheries or the application of fertilizers to increase food production (lower right corner). The resulting changes in the ecosystem (lower left corner) cause the ecosystem services to change and thereby affect human well-being. These interactions can take place at more than one scale and can cross scales. For example, a global market may lead to regional loss of forest cover, which increases flood magnitude along a local stretch of a river. Similarly, the interactions can take place across different time scales. Actions can be taken either to respond to negative changes or to enhance positive changes at almost all points in this framework (black cross bars).

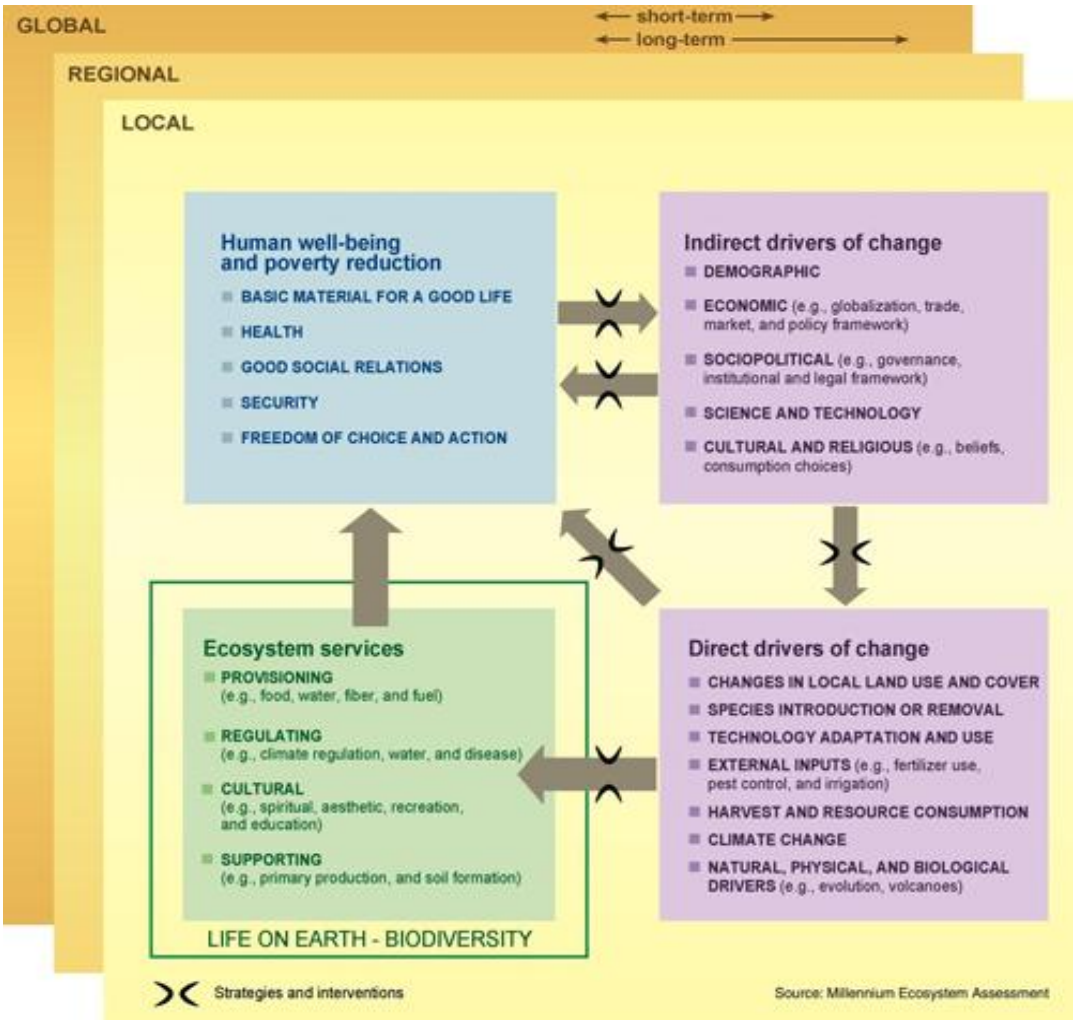

Figure 3.2: The Millennium Ecosystem Assessment Conceptual Framework

Source: MEA, 2003

3.2.1.2 The Sustainable Livelihood Framework

This framework as shown in Figure 3.3 can be seen as a model of livelihoods assessment. It refers to how a system such as the wetland ecosystem can experience shocks, trends and seasonality, which influence livelihood assets of the people. The livelihood assets refer to the human, natural, financial, social and physical capital of the people. According to the framework, the livelihood assets interact with the structures and processes, which encompass level of government, private sector, laws, policies culture and institutions. Interactions between the system, livelihood assets and transforming structures and processes which explain their coping capacities, through livelihood strategies, produce livelihood outcomes. The livelihood outcomes include more incomes, improved well-being, reduced vulnerability, improved food security and

more sustainable use of natural resources from the wetland ecosystem as a result of the ecosystem services derived from there. The framework emphasises that the transforming structures in the governmental system or private sector and respective processes (laws, culture) influence the ecosystem (the wetland) in this context, and determine both the access to and major influences on livelihood assets of people.

The approach underlines the necessity of empowering local marginalised groups in order to reduce ecosystem vulnerability effectively. A central objective of the approach was to provide a method that views people and communities on the basis of their daily needs, instead of implementing ready-made, general interventions and solutions, without acknowledging the various capabilities poor people offer. The approach views ecosystem vulnerability as a broad concept, encompassing livelihood assets and their access, and vulnerable context elements such as shocks, seasonality and trends, as well as institutional structures and processes (DFID, 1999).

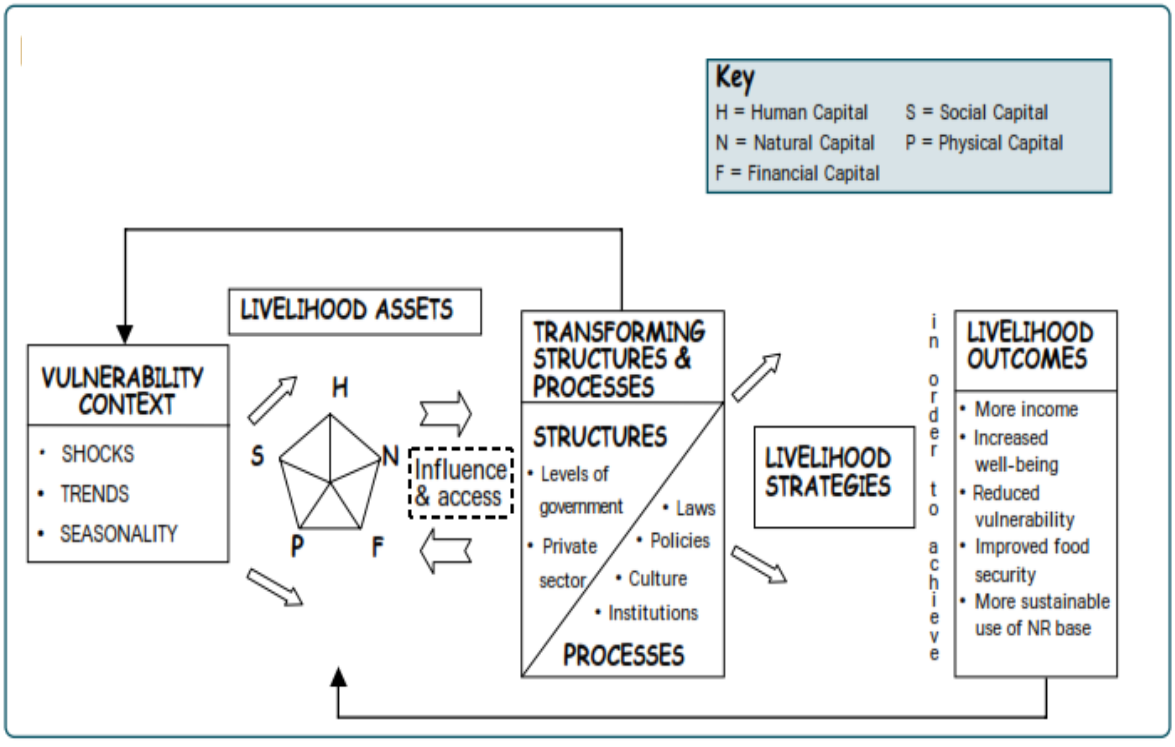

Figure 3.3: The Sustainable Livelihoods (SL) Framework

Source: DFID, 1999

3.2.2 Sampling Procedure, Data Requirement and Data Source

3.2.2.1 Sampling Procedure

The survey was conducted in three major communities located around Eleyele wetland in Ibadan. A multistage purposive sampling procedure was employed in the selection of the survey population. The main sampling unit of the survey was the household. The opinion of the local leadership was relied upon to truly select representative but feasible samples, given the limited time frame and coverage of the exercise. Purposive sampling of the study areas was used (from major communities, various farming communities and up to household level). The purposive sampling method employed was based on the understanding that communities are not homogenous particularly in terms of levels of wetland utilization, conservation challenges, socio-economic values attached and development concerns and threats. Summarily, a total of three (3) major communities, twelve (12) farming communities, and twenty (20) households in each farming communities were considered representative enough for the survey in the study area. This amounted to two hundred and forty (240) households. Figure 3.4 shows a summary of the sampling procedure.

Figure 3.5 shows communities visited and surveyed around Eleyele Wetland are Eleyele (Obokun, Mechanic Village, Orioke and Waterwork/EleyeDam), Ijokodo (Cele, Agbaje, Oluseyi and Babalegba), Apete (Lakoto, Papa Laogun, Morubo and Corner Elefo). Table 3.1 shows the distribution of the questionnaires respondents in the twelve farming communities.

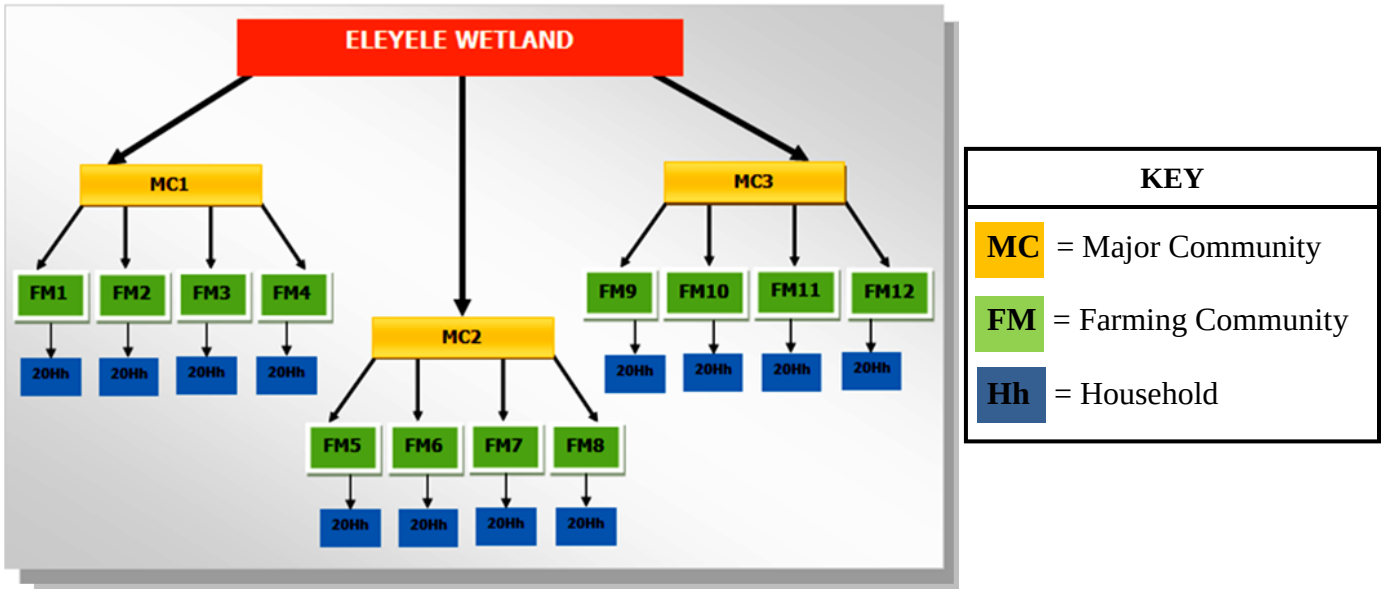

Figure 3.4: Sampling Procedure
Source: Field Survey, 2017

Table 3.1: Questionnaires responded to per farming communities surveyed

Communities Surveyed		No of Respondents	Percent
Eleyele	Mechanic Village	20	8.3
	Orioke	20	8.3
	Waterwork/EleyeDam	20	8.3
	Obokun	20	8.3
Ijokodo	Agbaje	20	8.3
	Oluseyi	20	8.3
	Babalegba	20	8.3
	Cele	20	8.3
Apete	Papa	20	8.3
	Lakoto	20	8.3
	Morubo	20	8.3
	Corner Elefo	20	8.3
	Total	**240**	**100.0**

Source: Field Survey, 2017

3.2.2.2 Data Requirement and Data Source

Both primary and secondary data were used for this research work. Secondary data used include Satellite Imagery collected from the Oyo State Ministry of Urban and Regional Development and base map of the Local Government Area (showing road networks as well as location of villages and major rivers.

Primary data included field observations and measurements collected with portable GPS, key informant interviews, FGDs and data collected through the use of questionnaire. Farmers' socio-economic characteristics include age, gender, farm enterprises/crop grown, other occupation than farming, household size, years of education, income level, and land ownership, among others.

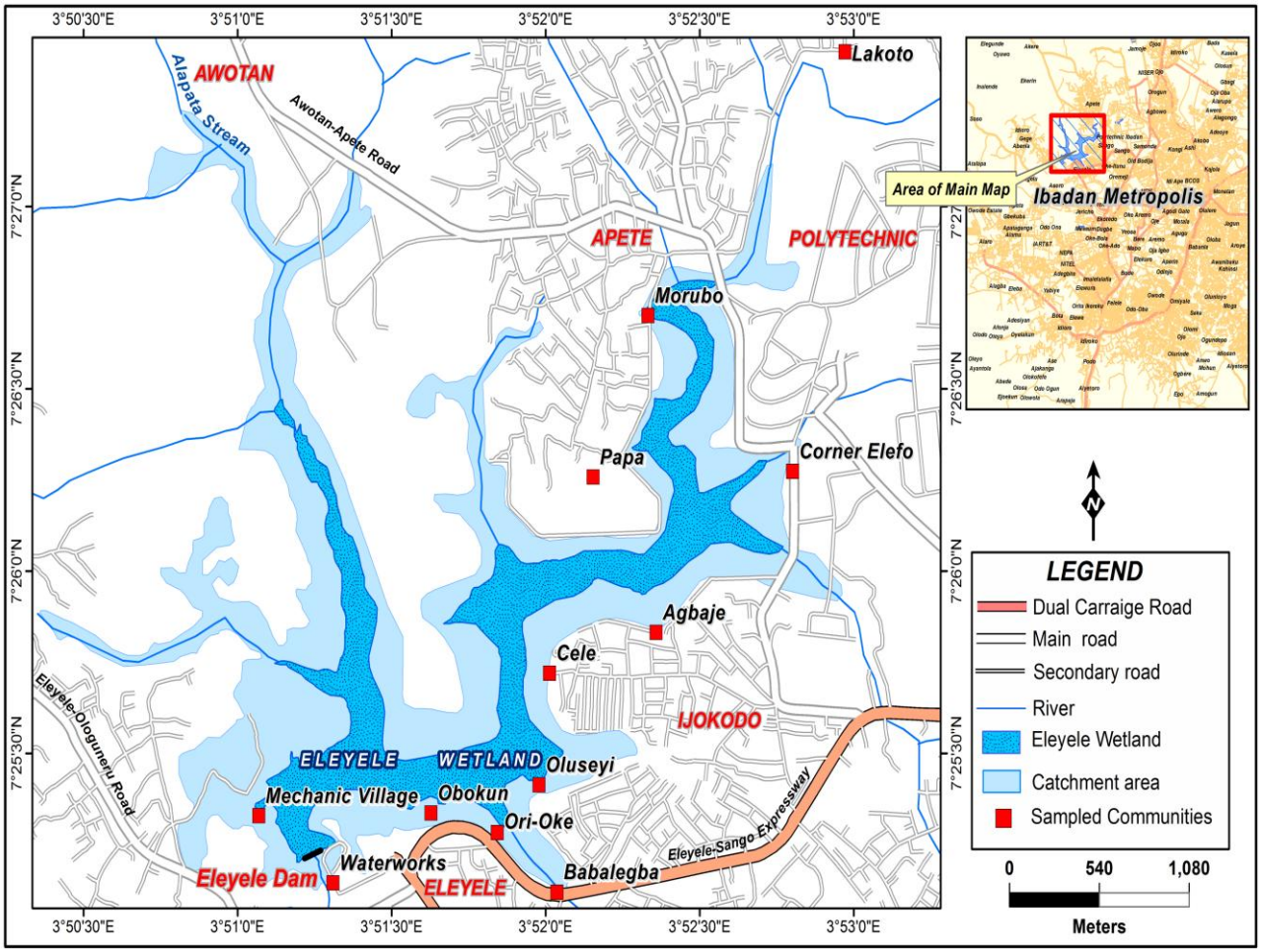

Figure 3.5: Map showing Sampled Communities in the study area

Source: Ikonosi image 2012 and Landsat 2013

3. 3 Data Collection and Analysis

3.3.1 Data Collection procedure

a. Questionnaires

The basic method used in this survey was qualitative/key informant interviews. Several interviews were held with various stakeholders in the use and management of the wetland. Some pictures of activities during the fieldwork.

b. Focus Group Discussions (FGDs)

Focus group discussions were conducted at the community level mainly with people who depend largely on the wetland. This helped the researcher to identify, enumerate and analyze occurrences and developments in the wetland. The FGDs were conducted in three different locations based on the three major communities under consideration.

3.3.2 Data Analysis

Data collected were subjected to appropriate statistical analyses. A data code sheet was developed and used to uniformly code the data for entry purposes by using EpiData 3.1 software. The data was then entered and analyzed using the Statistical Package for Social Sciences (SPSS) IBM 23 software. The descriptive analysis used includes frequency count, percentages, mean, standard deviation, pie chart and bar chart, while the inferential statistics used were correlation analysis, cross-tabulations and its accompanying chi square tests.

3.3.2.1 Pearson Correlation Analysis

The Pearson correlation coefficient is a very helpful statistical formula that measures the strength between variables and relationships. Therefore, Pearson correlation coefficient was used to measure the strength and joint relationship between farmers' access to the wetland, perception on benefits and changes in the wetland over the last 10 years and the independent variables (Socioeconomic characteristics) in the study. Two important properties can immediately be noted: (i) the relationship (r) depends only on the data values and spread, not on any hypothesized relationship; between them (r) does not depend on errors on the measured quantities. One assumption of the Pearson statistic is that the relationship to be tested is a linear one. In this case the outcome is easy to derive. If

$$r = \frac{C_{xy}}{\sqrt{C_{xx}C_{yy}}} = \frac{A}{|A|} = \pm 1$$

In other words, if y and x are exactly linearly related, r = ± 1, depending on whether the slope is positive or negative (correlation or anti correlation). More likely, with real data of any kind, there will be a spread in the values of x and y, in which case the correlation will be less than maximal, i.e. [r] < 1 (Hall 2015).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio-Demographic Characteristics of Respondents

Results of the analysis presented in Table 4.1 shows that majority of the respondents are males (59.2%) while females constitute the remaining 48.8%. This was also the situation during the focus group discussions where there were more males than females. With respect to age, analysis of the respondents' age structure shows that more than half of them are within the active working age of 20-60 years. Specifically, majority of the respondents (81.3 %) are between the age of 31 to 60 years while only 6.7 percent were above 60 years. However, the average age of the respondents was 52 years. This implies that most of the farmers are ageing.

Furthermore, results in Table 4.1 indicate that most of the respondents (75.4%) were married while only five percent were single. Also, more than half of the total number of respondents (67.9%) has between 6-10 numbers of people in their household. The maximum household size is 15 and the minimum is 1 with an average of 7 people in the household. From Table 4.3, the correlation between marital status and household size was (0.17**). This shows positive relationship between marital status and the household size of the respondents. It means that most of the respondents that are married have more people in their households.

With respect to their ethnicity, majority of the respondents are Yorubas (74.6%), followed by Igbo (11.7%), Hausa (1.3%) and other minor tribes like Igedes, Tapas, Ibaribas, Tivs, Egedes and Fulanis who constitute the remaining 12.5%. The dominance of Yorubas among the respondents is not surprising considering the fact that Ibadan in which the study was conducted is in Yoruba Southwest region of Nigeria (Table 4.1).

Furthermore, the level of education of the farmers is an indication of how informed they are likely to be. It also depicts the relative ease of adaptation by adopting new farming techniques and new livelihood patterns. As shown in Table 4.1, 30.8 percent of the respondents have secondary education, close to one-fourth (20.4%) of the respondents have primary education and 8.8 percent had vocational training. It is evident from the correlation matrix (Table 4.3) that both respondents' age (0.18*) and marital status (0.24**) have positive correlation with their level of

education and the relationships are significant. This implies that older and married respondents are likely to be more knowledgeable. However, the low level of education of many of the respondents may likely impair their knowledge on wise use and conservation of the wetland (Mmopelwa, 2006; Ostrom et al., 2007; Adekola and Mitchell, 2011).

Table 4.1: Distribution of respondents by their socio-demographic characteristics

Variables	Frequency	Percentage
Gender		
Male	142	59.2
Female	98	40.8
Age		
Below 31	1	0.4
31-60	195	81.3
Above 61	44.0	18.3
Marital status		
Married	181	75.4
Widow/Widower	27	11.3
Divorced	20	8.3
Single	12	5.0
Ethnicity		
Yoruba	179	74.6
Igbo	28	11.7
Hausa	3	1.3
Others	30	12.5
Household size		
1-5	64	26.7
6-10	163	67.9
Above 10	10	4.2
No response	3	1.2
Level of education		
Secondary	74	30.8
Tertiary	49	20.4
Primary	47	19.6
No formal education	49	20.4
Vocational training	21	8.8
No of years household have lived in the community		
<5 years	31	12.9
5-10 years	95	39.6
11-15 years	31	12.9
16-20 years	28	11.7
above 20 years ago	53	22.1
No response	2	0.8
Total	**240**	**100**

Source: Field survey, 2017

Data in Table 4.1 also reveals that close to half of the respondents (46.7%) have lived in the community for more than 10 years. More than one-third (39.6%) have lived between 5-10 years. In addition, it is also evident from the correlation matrix (Table 4.3) that respondents' age (0.52**), ethnicity (0.14*) and household size (0.52*) all have positive correlation with the number of years they have lived in the community. It implies that the high number of years respondents lived in the community may likely increase their chances of having access to more land due to large household size and the predominance of their ethnic group and their knowledge on changes in the conditions of the wetland. It may also imply that most of the farmers must have acquired enough experience, relevant skills and other resources for the use of the wetland especially the vegetable growers and the fishermen. This is in line with Atagher et al. (2014) that as the farmer get older and more experienced the more resources he commands to generate more income.

Additionally, Table 4.2 shows that most of the farmers (82.1%) were fully engaged in farming and 17.9 percent get their income from other sources besides farming, including trading, craftsmanship and salaried jobs. The predominance of farming as major occupation for the provision and maintenance of the livelihood prompts polygamy and large family size to provide cheap labour on farm. This conforms to Idowu (2006) that most urban dwellers take to urban agriculture to meet their food security and income needs. Moreover, the table also show that almost one-third of the respondents (32.5%) have the average monthly income between ₦20,000 – ₦40,000, 25 percent have income below ₦20,000, while only 1.7 percent have income above ₦100,000 per month. Within the context of the Nigerian economy, many of the respondents are poor. With respect to the sources of food for the household, the result of the survey shown in Table 4.2 reveals that more than half of the respondents (81.7%) partly produce and partly buy their food, while only 12.5 percent buy all food consumed by the household. This may be that most farmers due to their low level of income to acquire more land use only a small piece of land thus producing less than the food needed for household.

In terms of ownership of household assets, data in Table 4.2 reveals that one-third of the respondents (33.3%) have television/video, mobile phone (19.4%), radio (19.1%), while only 1.4 percent of the respondents have canoe. This analysis reveals that most of the households are poor as reflected in the items they possess in their households. On the reasons for settling around

the wetland, the result in Table 4.2 shows that more than one-third (41.1%) of the respondents regarded the community as having favourable climatic conditions for farming as well as the availability of water for irrigation. 30.4 percent settled there because of availability of fertile land for farming, while only 3.8 percent said they were born there. This implies that the various benefits people get from the wetland may be a pull factor that makes them settle there.

Table 4.2: Distribution of respondents by their socio-demographic characteristics (2)

Variables	Frequency	Percentage
Main sources of income		
Farming	197	82.1
Fishing	14	5.8
Trading	13	5.4
Salary	9	3.7
Craftsman	4	1.7
Farm Labour	3	1.3
Income of respondents		
Less than N20,000	60	25.0
N20,000–N40,000	78	32.5
N41,000–N60,000	59	24.6
N61,000-N80,000	23	9.6
N81,000–N100,000	12	5.0
N100,000 & above	4	1.7
No response	4	1.7
Main source of food for the household		
Partly produced and partly bought by household	196	81.7
All food is bought by household	30	12.5
All food is produced on farm by household	14	5.8
Household items		
Television/Videos	80	33.3
Mobile phone	47	19.4
Radio	46	19.1
Motorbike/Bicycle	17	6.9
Motor vehicle	14	5.7
Canoe/Boat	4	1.5
Others	34	14.1
Reason for settlement		
Dry season alternative/ Good climate	99	41.4
Availability of land for cultivation/grazing	73	30.4
Availability of Fish	19	7.9
More productive compared to upland	11	4.6
I was born here	9	3.8
Others	28	12
Total	**240**	**100.0**

Source: Field survey, 2017

Table 4.3: Correlation coefficient among respondents' socio-economic characteristics and other variables

	Gender	Age	Marital status	Ethnicity	Household size	Education level	Number of years lived	Income	Estimated size of the land	Method of land acquisition	Source of land	Perception of wetland benefits	Perception of change in wetland	Coping capacity	Access
Gender	-														
Age	-0.06	-													
Marital status	0.23**	0.31**	-												
Ethnicity	0.05	0.22**	.057	-											
Household size	-0.18**	0.312*	0.17**	0-.05	-										
Education level	-0.06	0.18**	0.24**	0.08	0.10	-									
No of yrs lived	-0.02	0.52**	0.08	0.14*	0.15*	0.13	-								
Income	-0.30**	-0.16*	-0.09	-0.11	0.08	0.092	-0.06	-							
Estimated size of the land	-0.14*	0.22**	-0.05	-0.02	0.03	-0.01	0.39**	0.246**	-						
Method of land acquisition	0.21**	0.15*	-0.16*	0.28**	-0.18**	-0.08	0.06	-0.11	0.05	-					
Source of land	0.06	0.19**	-0.08	0.04	-0.13	-0.12	0.20**	-0.07	0.25**	0.15*	-				
Perception of wetland	0.08	-0.01	-0.02	-0.03	0.04	0.06**	0.05	-0.08	-0.04	-0.03	-0.09	-			
Perception of change in wetland	0.07	-0.19**	-0.03	-0.11	0.06	-0.16*	-0.10	0.01	-0.10	-0.08	-0.01	-0.02	-		
Coping capacity	0.14*	0.26**	0.10	0.23**	-0.01	0.12	0.19**	-0.20**	-0.13	0.31**	0.06	0.07	-0.07	-	
Access	0.18**	-0.14*	0.05	0.11	-0.24**	0.01	-0.11	0.48**	.c	.c	-0.02	0.02	-0.03	0.18**	-

**, Correlation is significant at the 0.01 level (2-tailed); *, Correlation is significant at the 0.05 level (2-tailed); c. Can't be computed

4.2 Accessibility to the wetland

According to FAO (2010), land ownership insecurity is a feature of many farmers in developing countries like Nigeria. Data in Table 4.4a shows that majority of the respondents (92%) own piece of land for the purpose of farming thereby benefiting from services provided by the wetland. In addition, results in Table 4.4 shows that respondents acquired the land either through rent/lease (40%), purchased (39.6%) and 12.1% by inheritance. This implies that access to land is not free. With regards to where and from whom they obtain the land (i.e. source of the land), the result shows that more than one-third of the respondents (44.2%) obtain their land from government agency, another 28.3 percent obtained theirs from other individuals and 19.6 percent from local authority within the study area. Summarily, the analysis shows that respondents have different ways by which they become land owner around the wetland.

Furthermore, close to two-thirds (62.5%) of the respondents own estimated land size that is less than 0.5 acre, 22.1% owned between 0.5 to 1 acre, 7.5% own more than 1 acre. On average, the sizes of land owned by majority of the respondents can said to be very small. This smaller acreage land may be due to their low level of income. It is evident from the correlation matrix (Table 4.3) that respondents' level of income and their estimated size of land are positively correlated and significant (0.24*). In other words, the higher the income, the more likely the size of land owned by the respondents and vice versa. This can also be used to further reiterate the reason for variability of food sources for the household (Table 4.1). Large-scale farming activities and production are difficult without sufficient land (Eze et al., 2011).

During FGDs session, the respondents further stressed that ownership of land depends on the income capacity of an individual. Without access to land, people cannot sustain themselves (Apata et. al., 2016). Land ownership in terms of access has the potential to increase or decrease agricultural production thus improving or diminishing farmers' livelihoods (FAO, 2010). Land ownership, individually managed is widely believed to encourage sustainable livelihoods and the adoption of technologies linked to land such as irrigation equipment or drainage structures, hence enhancing food security (Maponya and Mpandeli, 2013 *in* Shultz et al., 1997).

On the account of gender access to land, the result shows that majority of the respondents (80.8%) confirmed that there is no barrier to the entering into the wetland between men and

women for carrying out their activities but it was reiterated that it solely depend on their individual income capacity. This result was evident from the correlation matrix (Table 4.3). This implies there is no barrier between both male and female to use the wetland hence, this can increase the production of food for household consumption and an improvement in their livelihood conditions**.** Gender involvement in agriculture will lead to increase in farm family's income, availability of food for human consumption, increase in food production and assurance of food security (Ajani and Igbokwe, 2011)

Table 4.4a: Accessibility of respondents to the wetland

Variables	Frequency	Percentage
Own parcel of land		
Yes	221	92
No	19	8
Total	**240**	**100**
Source of land		
Government Agency	106	44.2
Individual	68	28.3
Local Authority	47	19.6
No response	19	7.9
Total	**240**	**100**
Method of land acquisition		
Rented/Leased	96	40.0
Purchase	95	39.6
Inherited	29	12.1
Others	2	0.8
No response	18	7.5
Total	**240**	**100**
Easy to acquire land		
Yes	212	88.3
No	28	11.7
Total	**240**	**100**
Gender accessibility to the wetland		
Yes	194	80.8
No	33	13.8
No response	13	5.4
Total	**240**	**100**

Source: Field Survey, 2017

A cross tabulation analysis was used to further understand the relationships between the respondents' gender and their access to the wetland in terms of number of acreage of land owned between both male and female gender. Analysis reveals that both sexes have access to the

wetland in terms of land ownership. The result in Table 4.4b shows that more males have a higher access the wetland (62%). However, more males (6.3%) have access to higher acreage of land than females (1.8%). A hypothesis was stated to test the significance of the relationship between access to the wetland and sex of respondents. From the result of the analysis, Chi-square value = 0.097. This value shows that they are correlated however not significant at 0.05 level of significance. This implies that sex is a not a significant determinant of access to the wetland. This implies that although the male sex seems to have more access to higher acreage of land as shown in the cross tabulation table, but the analysis further stressed that both sexes have no barrier access to the wetland.

Table 4.4b: Relationship between estimated size of the wetland and gender

Estimated size of the land (acres)	**Gender**		**Total (%)**
	Male (%)	**Female (%)**	
Less than 0.5	38.9	29.0	67.9
0.5 – 1	16.7	7.2	24.0
Greater than 1	6.3	1.8	8.1
Total	62.0	38.0	100.0

Source: Field Survey, 2017

4.2.1 Relationship between socio-economic characteristics of respondents and access to the wetland

The Pearson correlation analysis was used to understand the strength of relationships between the respondents' socio-economic characteristics and their access to the wetland. Socio-economic characteristics variables used were respondents' gender, household size and income. From the result of the analysis in Table 4.5, it is evident that both respondents' gender (0.18**) and level of income (0.48**) have positive correlation with their access to the wetland and are significant.

On the basis of gender, it means that both male and female have equal access to use and benefit from the services provided by the wetland. This result was used to support the respondents' opinions during the FGD session. Also, on the account of the level of income, it shows that income is a significant determinant of their access to the wetland. This implies that respondents with more income are more likely to have access to larger parcels of the wetland.

Also from the findings, the correlation between household size and access to the wetland was (-0.24**). The result shows that both household size and access to wetland are negatively correlated but significant. This implies that household size have negative effects on accessing the wetland. It means that households with more persons are likely to have smaller size of the wetland per head and would possibly exert more pressure on the wetland. More land, water, food and so on will be needed and as such lead to over exploitation and unsustainable use of the wetland resources (Adeoye and Dami, 2012).

Table 4.5: Correlation coefficient among selected respondents' socio-economic characteristics and their access to the wetland

	Sex	Household size	Income	Access to the wetland
Sex	-			
Household size	-0.18**	-		
Income	0.02	-0.28*	-	
Access to the wetland	0.18**	-0.24**	0.48**	-

*, **, Correlation is significant at the 0.05 and 0.01 level (2-tailed) respectively

Source: Field survey, 2017

4.3 Ecosystem Services, Use and Ranking

4.3.1 Ecosystem services identified in the study area

Result of the analysis revealed that almost all the respondents (99.6%) agreed that they obtain several benefits from the wetland. As presented in Table 4.6, a total of 12 key ecosystem services were identified by the respondents. Eight (8) of these services were provisioning, one (1) regulating, one (1) supporting and two (2) were cultural services. These services were reported to be important for the sustenance and improvement the people's livelihoods. Provisioning services provided by the wetland was however regarded as the most important by the community members.

The information obtained from the analysis of the questionnaire was supported by the findings from the participants in the FGD sessions who identified the various benefits they derive from the wetland. The participants explained that they get immediate returns from these services either

in form of cash or other direct benefits such as food availability for the family. Also, ease of use of firewood which was regarded as a major source of energy for cooking was noted as one of the most important services they derived from the wetland. However, use of firewood obtained from the wetland is among the factors contributing to the degradation of the wetland. Human dependence on provisioning services is widely acknowledged, especially in developing countries, as people are highly dependent on natural resource (Van Oort et al., 2015; and Bhatta et al., 2015).

Table 4.6: List of ecosystem services identified in the study area

Ecosystem Services Category	Ecosystem Service Recorded
Provisioning services (8)	Agriculture (Crops/Fruits/Vegetables farming), fodder-leaf litter, water availability (drinking), firewood gathering, horticulture, game/hunting, medicinal herbs and availability of meat
Regulating services (1)	Irrigation water (Agricultural purposes)
Supporting services (1)	Habitat provision for (Fish farming)
Cultural services (2)	Religious, game and sporting activities

Source: Field Survey, 2017

4.3.2 Ecosystem Services use by individual household and their ranking

From Table 4.7, the top ranked service provided by the wetland was crop production (37.5%) followed by water availability (irrigation and drinking), fish farming, horticulture, livestock grazing, religious activities, firewood gathering, meat availability, sporting activities and medicinal herbs collection. The least ranked (0.8%) was game hunting. These services were ranked based on their use at the household and/or ability to sell them for economic returns. Opinions expressed during the FGDs shows that the respondents were found to be highly dependent on the identified services provided by the wetland, showing the high contribution of ecosystem services of wetland to their livelihoods. This result supports the assertion of Paudyal et al. (2015) that farming communities are mostly dependent on ecosystem services such as water, forest products, grass, and fodder for livestock, fisheries, for their livelihoods, although the priority of ecosystem services may vary depending on different interest groups.

Table 4.7: Ecosystem services, their use and ranking by communities around Eleyele wetland

Wetland *(Lower number indicates higher preference in the ranking column)*

Ecosystem Services	Use	Frequency	Percentage	Ranking
Crops farming	Food, crop production and sales	90	37.5	**1**
Water provision	Irrigation, drinking, boost farming activities	70	29.2	**2**
Fish farming	Food and selling in the market	25	10.4	**3**
Horticulture	For beautification and selling also in the market	12	5.0	**4**
Fodder, leaf litter	To feed the animals	11	4.6	**5**
Religious activities	Available lands for various religious activity	9	3.8	**6**
Firewood gathering	Cooking and heating	8	3.3	**7**
Meat availability	Food and selling in the market	6	2.5	**8**
Sporting activities	For recreational and leisure	4	1.7	**9**
Medicinal herbs	To cure diseases	3	1.2	**10**
Hunting	Food and selling in the market	2	0.8	**11**
Total	**-**	**240**	**100**	**-**

Source: Field Survey, 2017

4.3.3 Gender analysis of wetland use

Figure 4.3 shows the different activities performed by both males and females. Activities such as hunting, horticulture were mainly performed by male which they see as alternative sources of livelihood. This fact was further buttressed by participants during FGD meetings. By implication, despite the fact that both genders derive benefits from ecosystem services, more men engage in agricultural related activities in the study area. Both genders are involved in activities like artisan, vegetable crop and fish farming but the men are more involved in each. Finally, more women are involved in activities such as livestock rearing. Other activities not directly related to wetland involved in by both gender are transportation and trading. This result shows that gender involvement in different activities around the wetland tends to be dynamic.

Chinsinga (2007) found that wherever wetland cultivation competes for time and attention with seemingly lucrative alternatives, it becomes predominantly a feminine activity.

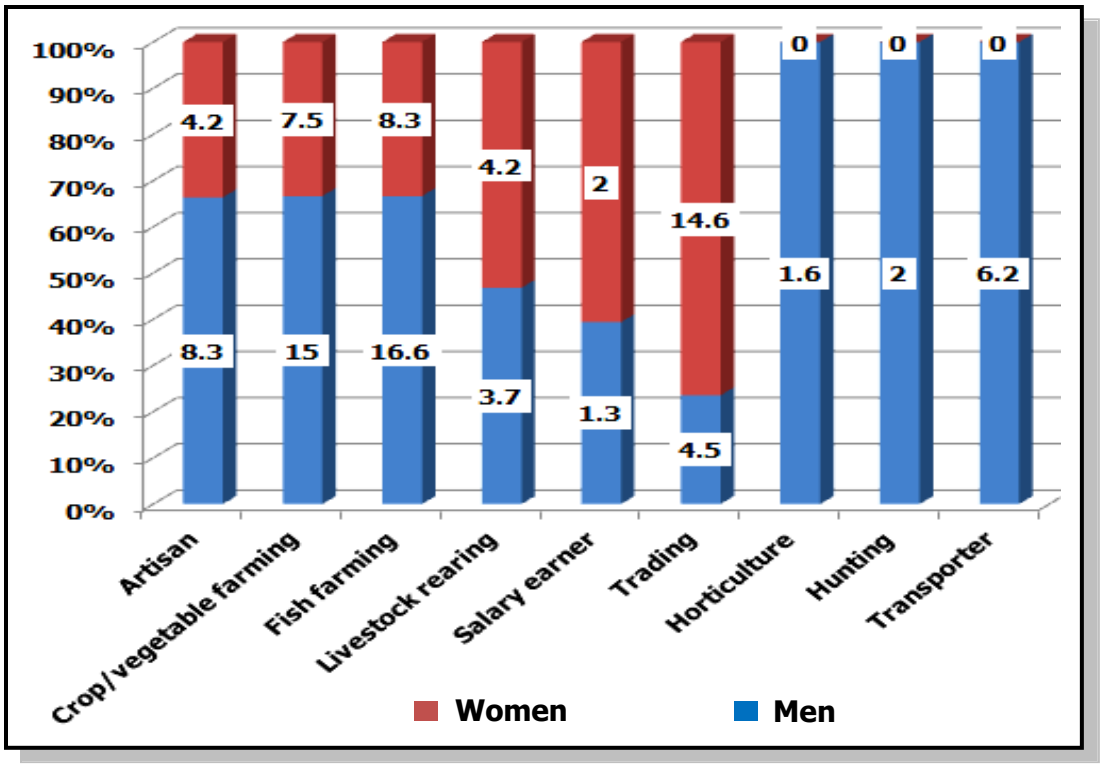

Figure 4.1: Activities engaged by men and women in the study area

Source: Field survey, 2017

4.3.4 Relationship between socio-economic characteristics of respondents and their perception of benefits of wetland

The Pearson correlation analysis was used to understand the strength of relationships and level of significance between the respondents' socio-economic characteristics and their perception of benefits of the wetland. Socio-economic characteristics variables used were respondents' gender, household size and income, and level of education. Results of the analysis in Table 4.8 show that respondents' perception of benefit of the wetland is positively correlated to each of the socio-economic variables under consideration.

From the result, only educational level was significant. This indicates that the level of respondents' perception increase with an increasing level of education. The more educated the

respondents are, the better they appreciate, manage and use the wetland in a more sustainable way. Study done by Olanrewaju et al., (2011) on perceived benefits of selected wetlands in south-west Nigeria concludes that wetland benefits are lowly perceived by the people especially their roles in ecosystem balancing and ensuring food security.

Table 4.8: Correlation coefficient among selected respondents' socio-economic characteristics and their perception of the benefits of the wetland

	Gender	Household size	Income	Education level	Perception of wetland benefits
Gender	-				
Household size	-.179**	-			
Income	.015	-.277**	-		
Education level	-.055	.104	.080	-	
Perception of wetland benefits	.078	.038	.061	.056**	-

*, **, Correlation is significant at the 0.05 and 0.01 level (2-tailed) respectively

Source: Field survey, 2017

4.4 Perceived changes and drivers of change in the wetland

4.4.1 Perceived changes in the wetland

4.4.1.1 Perception of respondents on changes in the wetland in the last ten years

Millennium Ecosystem Assessment (2005) demonstrated the strong links between ecosystem services and the livelihoods of people and how the decline of ecosystem services across biomes has resulted in changes to peoples' livelihoods (Figure 2.2). From the field survey, majority of the respondents (91%) perceived that the wetland has changed over the years in terms of size, vegetation cover, water stream flow as well as availability of both plants and animals. Equally, more than half of the respondents (54%) noted that some plant species such as cherry trees, mushroom, palm, and bamboo trees have disappeared while 15 percent opined that some animal species such as antelope, cheetah, monkeys, and wolf have been lost possibly due to land encroachment. These responses were corroborated by the participants in the FGDs who claimed that the lost of these services negatively impacted their means of survival and economic opportunities. This means that perceived declining trends in the availability or supply of these services is a threat to the livelihoods and food security of the local communities.

4.4.1.2 Perceived trends of change in Ecosystem services

Figure 4.2 shows the trends of change in ecosystem services as obtained from the analysis of the questionnaire. Most of them claimed that the ecosystem services have changed over the last ten years. These changes were perceived by the respondents to be either positive or negative. From the figure, it can be clearly seen that services such as, fodder for livestock, religious activities, horticulture, medicinal herbs irrigation farming and crop farming have positive change. The positivity of the change implies the abundance of the services or their increasing appreciation and use over the years. This result was corroborated by participants during the FGD sessions.

On the other hand, services such as water availability (for drinking), hunting, meat availability and fish farming have changed negatively. This observed negative change implies increasing scarcity or reduction in the availability of these services in the wetland. However, firewood availability, a major source of energy for domestic cooking, was perceived to be constant.

Furthermore, during the FGD session in Obokun community where fish farming is predominant, the participants mentioned that the rate at which they catch fish either for household consumption or economic benefits have drastically reduced thereby leaving them to hunger and poverty. This implies that decline of ecosystem services could negatively impact the livelihoods of wetland-dependent communities as especially in cases where they have limited options for livelihood diversification. These results support the findings of Bhatta et al. (2015) that declining trends in the availability or supply of ecosystem services threaten the livelihoods of local communities.

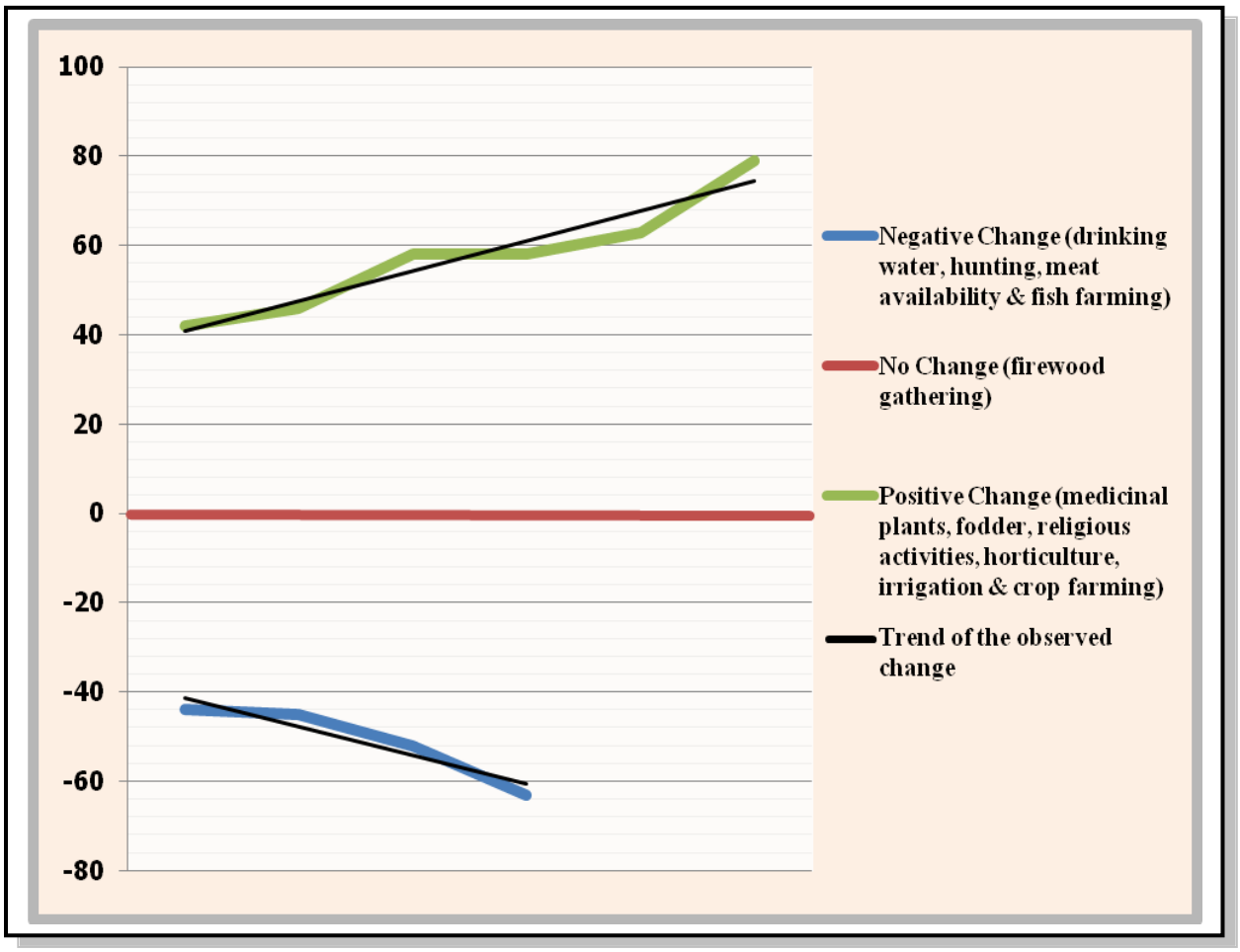

Figure 4.2: Trends of change in ecosystem services in the study area

Source: Field survey, 2017

4.4.1.3 Relationship between socio-economic characteristics of respondents and their perception of change in the wetland

The Pearson correlation analysis was used to understand the strength of relationships and level of significance between the respondents' socio-economic characteristics and their perception of benefit of the wetland. Socio-economic characteristics variables used were respondents' gender, household size, income, level of education, number of years lived in the community, and age.

It is evident from the correlation matrix that gender (0.07), household size (0.06), income (0.01), level of education (-0.16*), number of years lived in the community (-0.10), and age (0.19**) have correlation with respondents' perception of the change in the wetland. From the result, gender, household size and income have positive correlation with the perception of change in the

wetland while the level of education, number of years lived and the age of the respondents were negatively correlated with their perception on the change in the wetland.

However, it was evident from FGDs that the older people who lived in the community for a long period recalled the change in the wetland more than the younger ones as a result of their accumulation of experience. Furthermore level of education plays key role in information regarding the sustainable use and management of the wetland to enhancing their livelihoods.

3. Correlation coefficient among selected respondents' socio-economic characteristics and their perception of change in the wetland

	Gender	Household size	Education level	Number of year lived in the community	Income	Age	Perception of change in the wetland
Gender	-						
Household size	-0.18**	-					
Education level	-0.06	.104	-				
Number of year lived in the community	-.022	.151*	.126	-			
Income	-.304**	.077	.092	-.057	-		
Age	-.064	.319**	.181**	.519**	-.158*	-	
Perception of change in the wetland	.073	.063	-.155*	-.096	.010	-.187**	-

*, **, Correlation is significant at the 0.05 and 0.01 level (2-tailed) respectively

Source: Field survey, 2017

4.4.2 Drivers of ecosystem change on the wetland

Analysis of household surveys and focus group discussions revealed seven direct and one indirect drivers of change in ecosystem services. These drivers of change are classified as both natural and human induced. The lack of a wetland management plan and changes in weather condition were reported as indirect drivers of change. Siltation, aquatic weeds invasion, erosion, encroachment, over exploitation of resources, sewage, organic, chemical and other toxic pollution were reported as direct drivers of change threatening the wetland. From the result presented in Table 4.9, 74 percent of the respondents indicated that siltation is a major noticeable

change in the wetland. Aquatic weeds invasion (86%), erosion (90%), encroachment (84%) are other major drivers of change in the wetland.

Siltation occurs as a result of human activities that lead to fine soil leaching into nearby rivers. This results in an artificially large accumulation of silt that stays in that particular area of that river. This affects sensitive marine life and freshwater fish by suspended silt in their native waters. In addition, waterways and irrigation canals were reported affected in their functions by silt accumulations. Other harmful impacts of siltation reported during FGDs are human health concerns, the loss of wetlands, and changes in fish migratory patterns.

Aquatic weeds invasion was also reported as one of the major reasons for decline in fish catch. Similarly, siltation was reported to negatively impact flood control and disruption of aquatic animal in the deep water and hence low yield in agricultural productivities and scarcity of fishes respectively. This has seriously affected the economic opportunities the people derived from the wetland as the water was seen to be covered by aquatic plant called water hyacinth.

Erosion by definition is the removal of soil particles by wind, water and other forces of nature. The naturally occurring process is accelerated in areas where the soil has been disturbed by human activities. In the study area, erosion brings about accumulation of sediments. These sediments actually fill in and affect wetlands. Wetlands affected by sediments can lose their open water areas and become choked with aquatic vegetation as earlier reported with the invasion of water hyacinth.

With respect to encroachment, the wetland has been drained for agricultural activities most especially due to their fertile soils. Equally, human settlements such as building of houses, construction of dams and other commercial activities were observed during the field survey.

Furthermore, the result of the analysis shows the respondents' perceptions on the effects of variation in weather condition on farming activities. A larger percentage of farmers (67%) reported that there have been changes in the onset of raining season, temperature as well as the length of growing season over the years. During the FGDs, farmers further explained that fluctuation in rainfall amount, extreme temperature, flooding incidences and diseases infestation among others were on the increase in and around the wetland in the past ten years.

It was revealed that the observed changes have negatively impacted the farmers' level of production. For instance, siltation caused by erosion, flooding damaging crops, high temperature is affecting livestock health, pest and disease infestation. This brings about reduction in crop growths and quantity, proliferation of aquatic plants preventing fish growth and shortage of water for irrigation. All these pose serious challenges to food security and livelihoods of the farmers. This result corroborates the assertion that a negative impact of climate and climate variables on the ecosystems exposes people to composite externalities including poor resilience, environmental shocks, poor health and economic under-development which deepen the dynamic and context specific poverty-environment linkages at local levels (UNDP-UNEP, 2009).

It could be asserted from the result of this study that wetlands are increasingly being lost or degraded due to conversion to agriculture, settlement and infrastructural development, solid waste disposal, or degraded due to overexploitation, pollution and among other factors. Thus, it can be concluded that the consequences of Eleyele wetlands degradation resulting from a wide range of human activities and other factors have negative impacts on food security, water supply and water resources management, ecosystem services and livelihoods of the people around it. This result corroborates the assertion of Aekola and Mitchell (2011) that direct drivers of change such as siltation and invasive species are key drivers damaging wetlands and causing negative changes in human well-being in Africa. In addition, Adeoye and Dami (2012) revealed that in Nigeria, wetlands are among the country's most threatened ecosystems, due to urbanization, pollution, continued drainage, overexploitation or other unsustainable uses of their resources.

Table 4.9: Drivers of Ecosystem change on the wetland

Drivers of Change	**Yes**		**No**	
	Freq.	**%**	**Freq.**	**%**
Siltation (reduction in depth)	177	74	63	26
Aquatic weeds and alien species invasion	207	86	33	14
Erosion	215	90	25	10
Encroachments	201	84	39	16
Overexploitation of resources	53	22	187	78
Sewage and other toxic pollution	157	65	83	35
Organic and chemical pollution	93	39	147	61

Source: Field Survey, 2017

4.5 Coping mechanisms with changes in the wetland

4.5.1 Respondents' coping capacity with observed changes in ecosystem services

Wetlands are considered sustainable when people have the ability to cope with and recover from stresses and shocks, which allows them to maintain or improve their capabilities in the future. A necessary condition for conserving these resources is the ability of the local communities to detect, measure, and reverse ecological changes (Lamsal et al., 2015). Figure 4.3 shows that 56 percent of the respondents engage in alternative livelihoods to cope with changes in the wetland while 44 percent of the household does not have any means of coping. This implies that household that have no means to cope may not be able to overcome the shock brought by these changes, hence the reason for their vulnerability to food crisis and poverty.

Furthermore, during the FGDs, diversification of farming enterprise such as mixed cropping, horticultural practise, intensive fishing (where fishes are reared in containers and are fed with fish feeds) and vegetable garden farming, were found to be the livelihood strategy adopted by the people to cope with changing conditions of the wetland. Equally, informal/rudimentary irrigation farming (a situation where the people use generating set to draw water from the dug well and lay some pipes to supply water to their crops), transportation, business ventures and teaching were regarded as other alternative livelihood strategies in the communities surveyed.

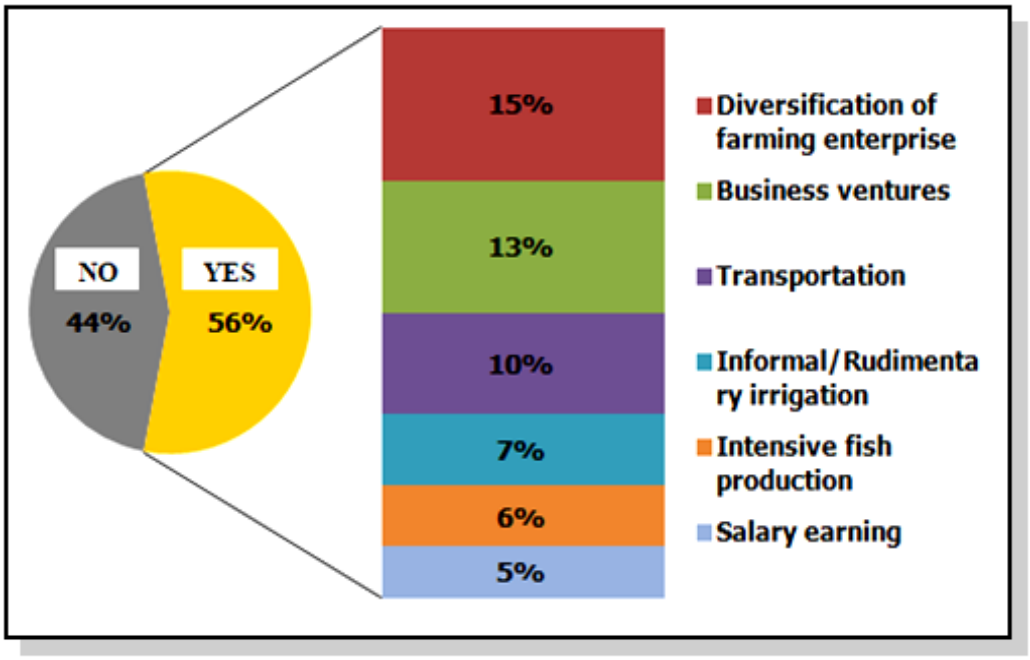

Figure 4.3: Respondents' coping capacity to observed changes in ecosystem services
Source: Field survey, 2017

4.5.3 Suggested wetland management practices

Wetland ecosystems are important from conservation and sustainable management viewpoints because of their rich diversity of flora and fauna (Lamsal et al., 2015). Respondents were asked what needs to be done to ensure sustainable use of the wetland. Results presented in Table 4.10 shows ways in which the wetland can be put into sustainable use as suggested by the respondents. The need for enlightenment on the importance and wise use of wetland topped the list of suggestions given by close to half of the respondents (45.8%). One-quarter of the respondents (25%) suggested the construction of good/adequate drainage system in the area to help to prevent and control erosion which is a major factor affecting the wetland. It will also prevent pollution which is endangering the lives of both flora and fauna in and around the wetland. Another suggestion was the need to enforce laws and its implementation at household and community level as reported by 14.6 percent of the respondents.

Also important is the need to constantly maintain the wetland as suggested by 8.3 percent of the respondents. This suggestion was reinforced by participants at the FGD session in Eleyele community which is predominantly a fishing community. The people tied the drastic reduction in the availability of fish to poor management of the dam located in the wetland. They further revealed that the wetland has been covered by water hyacinth. This is a major hindrance to fishing as stated by FGD participants in Obokun farming community. Other suggestions hinged on intervention programmes such as promotion of mechanized farming by government, dredging of the river to avoid siltation caused by erosion and training in improved natural resource management (soil conservation, sustainable fishing etc). Interventions that would reduce community dependency on wetland resources such as tree planting, water sources like dams, boreholes, gravity and piped water and fish ponds were also suggested.

From the results, it could be concluded that there is link between social and ecological systems. Social transformation is the key to reach the capacity to manage utilization of wetland resources in a sustainable way and thus, achieve food security, improve nutrition, harness sustainable conservation and improved livelihood while human well-being is strengthened in the long run (Lamsal et al., 2015).

Table 4.10: Sustainable use of the wetland as suggested by the respondents

Sustainable use of the wetland	Frequency	Percentage
Enlightenment programmes on the importance of wetland	110	45.8
Construction of good/adequate drainage system	60	25
Enforce laws and its implementation at community level	35	14.6
Constant maintenance of the wetland	20	8.3
Intervention programmes (tree planting, dams, boreholes, gravity and piped water, soil conservation and fish ponds)	11	4.6
No response	4	1.7
Total	**240**	**100**

Source: Field Survey, 2017

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The importance of wetlands in Nigeria cannot be overemphasized as evidences suggested. Almost all households surveyed in farming communities around Eleyele wetland derive benefits from the wetland in various ways. Meanwhile, lack of readily available information about the values of wetlands has been identified as a major reason why they have been mismanaged by people most especially in developing countries like Nigeria. Therefore, knowledge on wetlands importance, management and its degradation will help to formulate policies that can improve its conservation and sustainability. It is against this background that this research work was focused on identifying ecosystem services, the drivers of change of wetlands ecosystem, and the impacts of those changes on people's livelihoods in farming communities around Eleyele wetland, Ibadan, Oyo State, using both primary and secondary data.

The result shows that majority of the respondents have access to use the wetland for the purpose of agricultural activities. Findings show that access to the land is not free but largely depends on individual's income capacity. There are many ways by which the people can gain access to the land either directly from the government or from other individual who resell the land. The average size of land owned was half an acre. The land is open to all for use as both male and female have equal access to the land.

Furthermore, majority of the respondents indicated that they enjoy a lot of benefits from the wetland. Twelve (12) key ecosystem services were identified from which eight (8) were provisioning, one (1) regulating, one (1) supporting and two (2) were cultural services. These services were reported important as people get immediate returns either in cash or direct use for the improvement of their livelihoods and maintenance of food security. This shows the high contribution of ecosystem services from the wetland to people's livelihoods. Gender involvement in different activities in the study area tends to be dynamic.

In addition, majority of the respondents perceived the wetland has changed over the years as evident in reduction in size and flow of the river, loss of some reasonable numbers of plants and

animal species. Some ecosystem services were reported to either diminished or gone into extinction. A negative change was observed in water availability (drinking and irrigation purposes), hunting, meat availability and fish farming. The decreasing trend in the services was reported to have negative impact on their livelihoods. There are a number of direct and indirect drivers negatively impacting the availability of such services. Siltation, aquatic weeds invasion (water hyacinth), encroachment of wetland resources among others as identified by the people, weak implementation of laws and the lack of a management plan for the area are important factors contributing to the wetland's degradation.

Furthermore, respondents' adaptive capacities vary from one community to the next. Most of the respondents have means of coping with the changes. Diversification of farming enterprise, use of informal/rudimentary irrigation farming, business enterprise, transportation were alternative livelihood strategies with which they cope with the observed changes in the wetland. With respect to sustainable use of the wetland, respondents and participants at the FGD sessions suggested the need for capacity building institute such as education and clarification on the importance and wise use of the wetland. Interventions that would reduce community dependency on wetland resources such as tree planting, water sources like dams, boreholes, gravity/piped water, soil conservation and fish ponds were also suggested.

5.2 Recommendations

Based on the findings of this study, the following are recommended:

1. There is need to build the capacity of the people by giving more education and enlightenment programmes on the importance, use and protection of the wetlands
2. A holistic management plan for wetlands participatory as well as multi-sectoral investment may help communities to reduce their high dependency on wetland resources.
3. Government and other relevant agencies should empower those living around the wetland to improve their livelihoods, enhance their resilience and coping capacities.
4. Provision of alternative livelihoods for people living around wetlands will help to reduce pressure on it.
5. Government and other relevant agencies should make more financial resources available for wetland protection.
6. There is need to strengthen and implement existing laws and policies for wetland use, management and protection.

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APPENDIX I

ECOSYSTEM SERVICES AND LIVELIHOODS OF FARMING COMMUNITIES AROUND ELEYELE WETLAND IN IBADAN, NIGERIA

This study aims to assess ecosystem services and livelihoods of farming communities around Eleyele wetland in Ibadan, Nigeria. It is part of the requirements for the award of M.Sc. in Climate Change and Human Security in the University of Lomé, Togo. Information obtained through this study is meant purely for academic purpose. You are assured of the confidential treatment of the valuable information provided.

Thank You.

Researcher's Name: Peter Boluwaji OYEDELE

Affiliation: West African Science Service Center on Climate Change and Adapted Land Use, Université de Lomé, Togo.

LOCATION/IDENTIFICATION

Questionnaire No.: ……..DATE: ...../……../2017: Interviewer's Name: …….....

SECTION A: GENERAL INFORMATION ABOUT THE COMMUNITY		
Variables	**Questions**	**Response**
A1	Major Community	**1. Eleyele [ ] 2. Ijokodo [ ] 3. Apete [ ]**
A2	Farming communities	1. Obokun [ ] 2. Mechanic Village [ ] 3. Orioke [ ] 4. Waterwork/EleyeDam [ ] 5. Cele [ ] 6. Agbaje [ ] 7. Oluseyi [ ] 8. Babalegba [ ] 9. Papa Laogun [ ] 10. Lakoto [ ] 11. Morubo [ ] 12. Ibadan Poly [ ]
A3	Geographical coordinates	*X(Long)* *Y(Lat).*

SECTION B : RESPONDENT'S SOCIO-ECONOMIC CHARACTERISTICS		
Variables	**Question**	**Response**
B1	Gender	1. M [ ] 2. F [ ]
B2	Age	/____/____/ years
B3	Marital status	1. Single [ ] 3. Divorced [ ] 2. Married [ ] 4. Widow/Widower [ ]
B4	Ethnicity	1. Yoruba [ ] 3. Hausa [ ] 2. Igbo [ ] 4. Others, please specify_____
B5	Household size	/____/____/
B6	Position of respondent in household	1. Husband [ ] 2. Wife [ ] 3. Child [ ] 4. Others (specify) _____
B7	Education level	1. Primary [ ] 2. Secondary [ ] 3. Tertiary [ ] 4. Vocational training [ ] 5. No formal education [ ]
B8	Do all school-age children attend school?	1. Yes [ ] 2. No [ ]
B9	If no, why?	1. Cannot afford school fees and other school requirements [ ] 2. Children do not want to go to school [ ] 3. Lack of schools in the area [ ] 4. Other *(please specify)*_____
B10	What is the main source of food for the household?	1. All food is produced on farm by Household [ ] 2. Partly produced by household and partly bought [ ] 3. All is bought [ ]
B11	Does your household have any of the following items? *(please tick all that apply)*	1. Motor Vehicle [ ] 2. Motorbike [ ] 3. Bicycle [ ] 4. Canoe/boat [ ] 5. Radio **[ ]** 6. Television **[ ]** 7. Mobile phone **[ ]** 8. Refrigerator [ ] 9. Video [ ] 10. Others *(please specify)*_____
B12	How long has your household lived in this community?	1. <5 years **[ ]** 2. 5-10 years **[ ]** 3. 11-15 years **[ ]** 4. 16-20 years **[ ]** 5. above 20 years ago **[ ]**
B13	Why did you choose to settle here?	1. I was born here [ ] 2. Availability of land for cultivation [ ] 3. Availability of land for grazing [ ] 4. Dry season alternative(water availability) [ ] 5. Good climate [ ] 6. More productive compared to uplands [ ] 7. Availability of fish [ ] 8. Availability of infrastructure [ ] 9. Displaced by conflicts [ ] 10. Other *(please specify)*_____

B14	What are the main sources of income for your household?	1. Farming [ ] 2. Farm Labour [ ] 3. Trading [ ] 4. Craftsman [ ] 5. Fishing [ ] 6. Salary [ ]
B15	On the average, how much do you earn from all your sources of income per month?	1. Less than ₦20, 000 [ ] 2. ₦20, 000 – ₦40, 000 [ ] 3. ₦41, 000 – ₦60, 000 [ ] 4. ₦61, 000- ₦80, 000 [ ] 5. ₦81, 000 – ₦100, 000 [ ] 6. ₦100, 000 & above [ ]
SECTION C:	**ACCESS TO THE WETLAND USE**	
Variables	**Question**	**Response**
C1	Do you own a land in this area?	1. Yes [ ] 2. No [ ]
C2	What is the estimated size of your land?	1. Less than 0.5 acres [ ] 2. 0.5 – 1 acre [ ] 3. Greater than 1 acre [ ]
C3	How did you acquire the land you owned?	1. Inherited [ ] 2. Bought [ ] 3. Rented/Leased [ ] 4. Others *(please specify)*_____
C4	From whom did you acquire the land?	1. Individual [ ] 2. Local Authority [ ] 3. Government Agency [ ]
C5	Was it easy to acquire land here?	1. Yes [ ] 2. No [ ]
C6	If 'No' to C5, why? *Please give reason(s)*	_____ _____
C7	Do men and women have equal access to the wetland?	1. Yes [ ] 2. No [ ] 3. I don't know [ ]
C8	If 'No' to C7, why? *Please give reason(s)*	_____ _____
SECTION D:	**ECOSYSTEM SERVICES, THEIR USE AND RA NKING**	
Variables	**Question**	**Response**
D1	Do wetlands have any benefits to the community?	1. Yes [ ] 2. No [ ]
D2	What are benefits the community derive from this wetland?	1. Fish farming [ ] 2. Hunting [ ] 3. Water availability (Drinking/ Irrigation) [ ] 4. Firewood gathering [ ] 5. Horticulture [ ] 6. Fodder, leaf litter [ ] 7. Crops/Fruits/Vegetables farming [ ] 8. Meat availability (considered for consumption) [ ] 9. Medicinal and aromatic herbs plants [ ] 10. Religious, cultural importance if any [ ] 11. Any other services (please use separate page if needed)

		_____
D3	Which wetland resource does the household use?	***Please list in order of importance*** _____ _____
D4	In your own opinion, what are the activities mostly engaged by men and women?	Men / Women i. _____ / _____ ii. _____ / _____

SECTION E: CHANGES AND DRIVERS OF CHANGE IN THE WETLAND		
Variables	**Question**	**Response**
E1	Has there been any change(s) in the wetland condition in terms of size, water level, management, etc.?	1. Yes [ ] 2. No [ ]
E2	In your own opinion, is there any plant species that has disappeared in the last 10 years?	1. Yes [ ] 2. No [ ] 3. I don't know [ ]
E3	If yes to **E2** above, please list them	_____ _____
E4	In your own opinion, is there any animal species that has disappeared in the last 10 years?	1. Yes [ ] 2. No [ ] 3. I don't know [ ]
E5	If yes to **E4** above, please list them	_____ _____

E6. Ecosystem services –trend of change (compared to last 10 years)

Variables	**Items**	**Trend**	**Variables**	**Items**	**Trend**
A	Fish farming		**G**	Crops/Fruits/Vegetables farming	
B	Firewood gathering		**H**	Meat availability (considered for consumption)	
C	Drinking water		**I**	Medicinal and aromatic herbs plants	
D	Irrigation water		**J**	Religious, cultural importance if any	
E	Hunting		**K**	Fodder, leaf litter	
F	Horticulture				

Trend: Decreasing = 1; No change = 2; Increasing = 3

E7. Drivers of Ecosystem change on the wetland: *In your opinion, please what are the major reasons (drivers) of change in the wetland?*

Variables	**Drivers of change**	**Response (*please tick as appropriate*)**
A	Siltation (reduction in depth)	
B	Aquatic weeds and alien species invasion	
C	Erosion	
D	Encroachments (local residents, builders and govt.)	
E	Overexploitation of resources	
F	Sewage and other toxic pollution	

G	Organic and chemical pollution	

E8 (a). Does weather condition have impact on your farming activities?
E8 (b). If "Yes" to **E8(a)**", what are these impacts?_____
_____

SECTION F: COPING MECHANISMS WITH THE OBSERVED CHANGES IN ECOSYSTEM SERVICES FROM THE WETLAND		
Variables	**Question**	**Response**
F1	Are local communities aware of the changes in the wetland?	1. Yes [ ] 2. No [ ] 3. I don't know [ ]
F2	Do you engage in alternative activities to cope with the observed changes?	1. Yes [ ] 2. No [ ]
F3	If "Yes" to **F2**, what are the alternative activities?	_____ _____
F4	In your own opinion, what can be done to ensure sustainable use of the wetland?	_____ _____

Thank you!

Focus Group Discussions

1. How important is wetland to you and what are benefits being derived from it?
2. What are the chief regulations about wetland resource access that the people understand to apply to their activities? Do people comply with these regulations?
3. How are the regulations policed? What is the penalty for noncompliance? Is this an individual penalty or community-imposed one?
4. What indicates ownership of land by a farmer around this wetland?
5. Do men and women have equal access to land around the wetland?
6. Compared to the past 10 years, has there been any change in the wetland condition in terms of area and water level? What are the causes these observed changes?
7. How are people coping with changes observed in the area? In terms of activities engaged in and so on.
8. Are there any institutional set up or management modality available to manage your wetland? How did they work?
9. What is the legal status of the wetland?
10. Please express any thought, concern or topic related to wetlands which you feel is important to you that had not been adequately addressed by any preceding question(s)

APPENDIX II

A. Relationship between socio-economic characteristics of respondents and access to the wetland

With respect to their income, the result shows that most of the respondents (20.4%) own less than 0.5 acres of land and they are low income earners, earning less than ₦40, 000 per month (**Table A**. This result shows that most low income earners own smaller parcels of land. A hypothesis was stated to test the significance of the relationship between access to the wetland and income of respondents. The result of the analysis shows Chi-square value = 0.005 at the 5% level of significance. The result shows that there is a positive correlation and the relationship is significant, implying that income is a significant determinant of access to the wetland. Respondents can only have access to the wetland with the income capacity. This implies that respondents with more income are more likely to have access to larger parcels of the wetland.

Table A: Relationship between estimated size of the wetland and respondents' average income from all sources

Estimated size of the land (acres)	Average income from all sources						Total
	Less than N20,000 (%)	N20,000– N40,000 (%)	N41,000– N60,000 (%)	N61,000- N80,000 (%)	N81,000– N100,000 (%)	N100,000 & above (%)	
Less than 0.5	20.7	22.1	16.6	4.1	3.7	0.5	67.7
0.5 – 1	2.8	9.2	6.0	3.7	1.4	0.9	24
Greater than 1	0.9	0.9	3.7	2.3	0.5	0	8.3
Total	24.4	32.3	26.3	10.1	5.5	1.4	100.0

Source: Field Survey, 2017

B. Socio-economic characteristics of respondents and their perception of benefits of wetland

The results of analysis of the relationships between the respondents' perception on the benefits of the wetland and some of their socio-economic characteristics are presented in Tables 4.8 and 4.9. On gender basis (**Table B1**), both sexes hold a positive perception of the benefits derived from the wetland. However, more males have a positive perception of the benefits of the wetland (59.2%). A hypothesis was stated to test the significance of the relationship between respondents' perception of the benefits of the wetland and their sex. The result of the analysis

shows Chi-square value = 0.228. This means that sex of respondents and their perception of benefits of the wetland are positively correlated but is not significant at 0.05, implying that there is no significant difference in the perception of the benefits of the wetland among males and females.

With respect to their level of education (**Table B2**), variations exist in ways the respondents perceived benefits derived. Respondents with secondary level of education hold highest positive perception (30.8%). A hypothesis was stated to test the significance of the relationship between respondents' perceived benefits of the wetland and their level of education. The result of the analysis shows Chi-square value = 0.033. This value shows a positive correlation but not significant at 0.05, implying that there is a significant difference in the perception of the benefits of the wetland and their level of education.

Table B1: Relationship between perception of benefit of wetland and gender of respondents

Wetland have benefits	**Gender**		**Total (%)**
	Male (%)	**Female (%)**	
Yes	59.2	40.4	99.6
No	0	0.4	0.4
Total	59.2	40.8	100.0

Source: Field Survey, 2017

Table B2: Relationship between perception of benefit of wetland and level of education respondents

Wetland have benefits	**Level of Education**					**Total (%)**
	Primary (%)	Secondary (%)	Tertiary (%)	Vocational training (%)	No formal education (%)	
Yes	19.6	30.8	20.4	8.3	20.4	99.6
No	0	0	0	0.4	0	0.4
Total	19.6	30.8	20.4	8.7	20.4	100.0

Source: Field Survey, 2017

C. Socio-economic characteristics of respondents and their perception of change in the wetland

The result of the analysis of the relationships between the respondents' perception of change in the wetland and their socio-economic characteristics is as presented in Tables 4.11 and 4.12.

With respect to their level of education (**Table C1**), variations exist in ways the respondents perceived change in the state of the wetland. Respondents with secondary level of education hold highest perception (27.9%) of negative change in the wetland, 20 percent with formal education, while only 17.9 percent are with tertiary education. From the result, the people were of the opinion that many of the services once enjoyed had decreased. This may be due to how well informed they are on issues regarding the wetland as well as experiences gathered overtime. A hypothesis was stated to test the significance of the relationship between respondents' perception of change in the wetland and their level of education. The result of the analysis shows Chi-square value = 0.099. This value is not significant at 0.05, implying that there is no significant difference in the perception of change in the wetland and their level of education.

Analysis in **Table C2** shows there are variations in the ways respondents perceived changes in the wetland based on the number of years lived in the community. Most of the respondents (47.1%) who lived less than 11years in the community perceived a negative change in the wetland. Respondents who lived more than 20 years (21.4%) also perceived the wetland to have negatively changed overtime. Worthy of note is the perception of change from respondents who lived just below 5 years in the community (12.2%). This group despite the number of years lived, believed the wetland has changed negatively. This is an indication that the wetland and ecosystem services provided are seriously decreasing. The perceived negative change implies an increasing scarcity or reduction in the availability of ecosystem services provided by the wetland at an increase rate. A hypothesis was stated to test the significance of the relationship between respondents' perception of change in the wetland and the number of years lived in the community.The result of the analysis shows Chi-square value = 0.266. This value is not significant at 0.05, implying that there is no significant difference in the perception of change in the wetland and the number of years lived they in the community.

Table C1: Relationships between the respondents' perception on change in the wetland and their level of education

Change in the wetland	Level of education					Total (%)
	Primary (%)	Secondary (%)	Tertiary (%)	Vocational training (%)	No formal education (%)	
Yes	16.7	27.9	17.9	8.8	20	91.2
No	2.9	2.9	2.5	0	0.4	8.8
Total	13	39.9	13	11.7	22.3	100.0

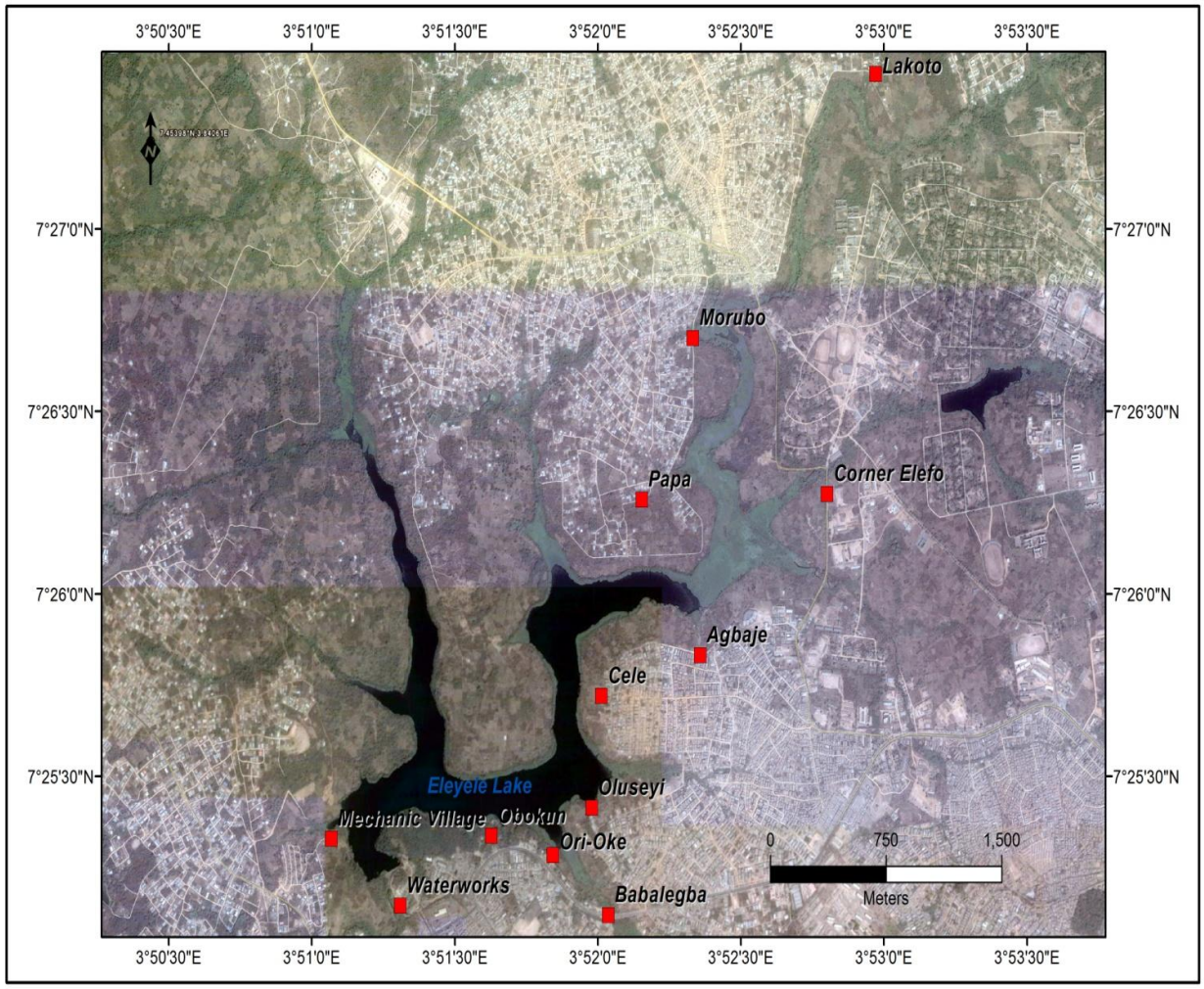
Source: Field Survey, 2017

Table C2: Relationships between the respondents' perception on change in the wetland and the number of years household lived in the community

Change in the wetland	Number of years household lived in the community					Total (%)
	<5 years (%)	5-10 years (%)	11-15 years (%)	16-20 years (%)	>20 years (%)	
Yes	12.2	34.9	11.3	11.3	21.4	91.2
No	0.8	5	1.7	0.4	0.8	8.8
Total	13	39.9	13	11.7	22.3	100.0

Source: Field Survey, 2017

APPENDIX III



Aerial Photo of Eleyele Wetland showing the selected farming communities

Source: Google Earth Imagery of Ibadan

APPENDIX IV

Plate 1

Interviewing women whose major source of income is vegetable production around the wetland areas

Plate 2

Interviewing one of the Fish farmers in Obokun community wetland

Plate 3

Questionnaire administration with one of the farmers in Ijokodo community

Plate 4

Questionnaire administration with the Secretary Farmers' Association around the wetland area

A cross-section of the wetland in Apete Area (one of the study Areas visited)

Myself and my Supervisor, Dr. Felix Olorunfemi in one of the communities during FGD meeting

Plate 5

Group photographs after the FGDs meeting with farmers in Eleyele Community

Plate 6

My Supervisor, Dr. Felix Olorunfemi, Mr. Moshood, one of the field assistance, and the researcher taking notes at the FGDs meeting at Eleyele Community

Plate 7

Farmers paying rapid attention to the researcher as he guides them during the meeting in Apete community

Plate 8

Group photographs with farmers after a successful FGDs meeting at Ijokodo Community

Researcher making observation on the field

Respondents' means of transportation

Picture showing the invasion of the wetland by aquatic plants (water hyacinth)

One of the livelihood strategies of the respondents in the community

Local way of making palm oil in the community