

**THE IMPACTS OF
LAND USE PRACTICES ON THE ENVIRONMENT:
A CASE STUDY IN BUTAW, SINOE COUNTY, LIBERIA 2012-
2016**

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DECLARATION OF THE RESEARCHER

I hereby declare that the study on an Investigation of the “Impact of Land Use Practices on Environment: A case study in Butaw, Sinoe County, Liberia 2012- 2016” is my own work and that this information is truthful and reliable. I also declare that this research has not been submitted to any other university or any other personality for any award whatsoever.

Signed: _____ Date: _____

Elizabeth Saysay Dede d’Almeida

DEDICATION

This work is dedicated to the Almighty God for giving me the strength to go through this journey and to all those who lost their lives during the EBOLA outbreak in Liberia.

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ABSTRACT

Historically it has been acknowledged that regional economic growth and structural changes can directly affect land use patterns within a region, but little is known about the inverse: how a change or intervention in land use influences regional economic performance either from the direct anthropogenic (human-caused) perspective or from the indirect changes in climate. Alternatively, what are the barriers for development that slow the pace of economic growth? Under which circumstances and how can authorities promote the potential contribution and/or formulate programs and policies that will minimize unexpected economic consequences of land use practices? Several studies have been analyzed to learn more about those questions which framed the analysis of the Liberian case.

This study investigates the impact of land use practices on the environment, using Butaw, Sinoe County as a case study in Liberia. The significance of this study is to improve the design and implementation of policies and practices related to land use in Liberia, using the outcome and recommendation from this research as a working document to help promulgate policies, practices and forester agendas that will improve ways and method of land use in Liberia. With a target population of 250 inhabitants, a sample size of 154 was selected based on purposive and random sampling. Questionnaire survey, key informant interviews and field observation were carried out. Secondary data was collected from reports and government policy documents.

The study identifies that rural households depend on the forest and land for livelihood in the absence of sustainable alternatives. It also notes that existing land use practices such as shifting cultivation, chain sawmilling, commercial logging, artisanal mining and plantation agriculture are responsible for wide ranging environmental impact such as soil and water degradation, and the loss of forest and biodiversity. These impacts are attributed to the limited implementation and enforcement of laws and regulations in Liberia.

The report recommends amongst other things the development of a comprehensive land-use policy and plan for the management of land; enactment of land reform initiative to enable rural people to formalize ownership to customary land; building the capacity of the FDA, Liberia Land Administration and the EPA to perform their monitoring and enforcement roles;

and improve awareness about the harmful environmental impacts of existing land use practices while offering viable alternatives.

CHAPTER ONE: INTRODUCTION

This chapter provides the introductory chapter with a detailed background of the study, problem statement, research questions, delimitation, and limitation, the significance of the study and the organization of the whole documents.

1.1 Background

Land use in Liberia is highly unregulated, and has therefore proven to be the major cause of deforestation (FDA, 2005); illicit mining (including for alluvial gold and river sand), uncontrolled forestry practices, agriculture (slash and burn and plantation) and human settlements have all greatly contributed to land degradation. But the root of these land use impacts on the environment points highly to the 14 years of civil war. This period left not only the Liberian infrastructure destroyed, but displaced people who exploited the land for food (GOL, 2005). Specifically affected by migration due to the Liberian civil conflict is one of Liberia's forested region-Sinoe County. Located in the south-east of Liberia, Sinoe is home to two of Liberia's largest rain forests: The Sapo National Forest (Liberia's largest and oldest protected area) and the Krahn-Bassa National Forest. The two sum a total of 5,816 square kilometers (National Geospatial-International Agency, 2010). The war, increased dependence of the population on traditional fuels, particularly charcoal contributed to 9% of GDP in 1999 compared with 2% in pre-war times. Overexploitation and accelerated degradation of forest resources especially in this region became a serious issue of concern, especially since the area is rich in biodiversity, most of which are endemic and rare species (e.g. pygmy hippo and forest elephants). Large migration flows with some 500,000 internally displaced persons has created a pressure on forest resources. Non-timber forest products such as bush meat became important assets for the heavily populated region. Mangrove ecosystems were also particularly threatened by the overexploitation, with their wood harvested to produce smoke fish.

It is common knowledge that land and natural resource management and their planning are strongly sector-driven in Liberia with little to no coordination among sectors. The forest, agriculture, and mining sectors are all competing for the same landscape. With different land use rights been granted by different institutions there may be an overlap of claims in the

absence of coordination and or a consolidated land use plan. There are even cases where the same institutional issues conflict land use rights over the same land and to the same group beneficiary.

Commercial logging rights, for example, are assigned over registered community forest lands where conservation is a major objective; or agriculture concessions areas are granted to different companies on the same land.

Result of the Sinoe County land tenure rights inventory shows a plotted land dividing the region into four major components:

- Enacted public land (the Sapo National Park)
- Customary land - this corresponds with community land or communal land acquired through ancestral heritage; even though there is not an available deed, the 2013 ‘Land Rights Policy’ and ‘Land Rights Acts’ adopted by the Government of Liberia grant equal protection to customary land, deeded or not as to the rights obtained for private land ownership;
- Presumed collectively deeded land - these are similar collective land deeds but for which no reliable documentation is yet made available;
- Individual (family) public land sale deed.

This goal includes an analysis of the land use planning as information production and exchange as well as the macroeconomic effect on land use regulation in Butaw, Sinoe County that harbors at least two agriculture companies that are actively involved in land use activities on a large scale.

1.2 Contextual Framework of Land Use in Liberia

Tropical rainforests are globally valued for their richness in biodiversity, economic assets and their ability to store large amounts of carbon, thus mitigating global climate change (Myers et al. 2000). For instance, in Liberia, tropical rainforests are intimately connected to the livelihoods and culture of rural communities, who often depend on forest for subsistence agriculture, hunting, timber, non-timber forest products, and cultural and religious purposes (Wunder 2001). Despite these benefits, large- scale logging, intensified after the 14 years’

political instability. Unsustainable Agricultural practices, because of shifting cultivation, and illicit mining have driven widespread deforestation and degradation of tropical rainforests.

The 14 years of civil conflicts, and a much longer history of social divisions, coupled with insecure land tenure, and large scale migration, many Liberians suffers extreme poverty. This impoverished lifestyle has also led to some form of environmental degradation. This report documents impacts such as soil and water degradation, habitat loss and threat to biodiversity that the imposed lifestyle caused by the fourteen years of civil unrest has caused on land se, covering the period of 2012-2016.

1.3 Problem Statement

The overarching laws related to natural resource management in Liberia, Land Use Policy 2013, Environmental Protection and Management Laws of Liberia (EPML), 2003 and the Forest Reform Law of 2006 provides clear guidance and direction for the sustainable management of land and activities conducted on them. However, the implementations of these instruments are very much inadequate due to institutional challenges including limited capacity at the institutional and human resource level, and little or no funding.

Consequently, deforestation, hunting of rare animal species turns out to be a common daily practice for the locals and business people since there is an inability to monitor and enforce these laws by the responsible government agencies. For environmental protection and natural resources utilization to happen in a sustainable manner, there is a need for effective implementation of the management laws and policy framework through a robust monitoring system and the enforcement of the regulations.

Consequent of the above, even the publicly protected areas in the region, the Sapo National Park and the proposed Krahn-Bassa National Forest, are gradually experiencing deforestation and extinction of biodiversity because of increase hunting activities. The benefits of having straighter regulations on land use may bring more development in Liberia. This is necessary to save the wild- and subsequently avoid the animals going into extinction (by hunting), or the forest being lost due to deforestation. Environmental conservation laws are good if they are well implemented, but in the context of Sinoe County, it is seemingly not implemented as it should. With the intention to be able to assess those practices, this study is focused on the impacts of Land Use practices on the environment through the case study in Butaw, Sinoe County, (2012- 2016).

1.4 Research Questions

The researcher seeks to find answer to the following questions:

1. What are the environmental impacts of land use practices in Butaw, Sinoe County?
2. How do the land use practices in Butaw, Sinoe County impact the environment in association to the owner's profile?
3. What can be done to mitigate the impact of land use practices in Butaw, Sinoe County?

1.5 Research Boundaries

The research setting is the Equatorial Palm Oil and the Golden Veroleum Oil Palm Plantations in Butaw, Sinoe County in the Southeastern part of Liberia. At present, these are the two major agriculture companies in Butaw and the entire Sinoe County. Both companies have a concession agreement signed into Law by the Liberian Government that covered over 30,973ha of land with each company occupying 8,750ha and 22,223ha of land respectively. This study is focused on only on county due to the project time restriction.

1.6 Limitation

Limitations to carry out this research was foreseen since its planning. Firstly, because of the tied schedule for the whole project and secondly, but most importantly the bad road condition in the southeastern part of the Liberia especially during the raining season, at which time the study was commissioned. This research should be conducted on a small suburban population in Butaw, Sinoe County. Thirdly, interviewing, gathering information from key informants within various communities of the Equatorial Palm Oil and Golden Veroleum Oil Palm Plantations was a huge challenge primarily because of the sensitivity of this research study, as such many participants declined to provide information. Moreover, to generalize the results the study should have relied on past research in the study area, but availability of these documents was limited within the timeframe of the study.

1.7 Significance of the Study

The significance of this study is to help provide a working tool that would serve as a road map to the development and promulgation of policies, practices and programs that will positively heightened the level of land use in Butaw, Sinoe County, which by default could automatically be extended to other parts of Liberia primarily because areas such as Grand Kru, River Gee, Maryland and Grand Gedeh counties are experiencing similar land use attributes, as report by GREENCONS Liberia.

1.8 Definition of key Land Use Terms

- **Productive:** land underpins many life support systems, through production of biomass that provides food, fodder, fiber, fuel, timber and other biotic materials for human use, either directly or through animal husbandry including aquaculture, and inland and coastal fisheries;
- **Biotic environmental:** land is the basis of terrestrial biodiversity – it provides the biological habitats and gene reserves for plants, animals and micro-organisms, above and below ground;
- **Climate regulation:** land and its use are a source and sink of greenhouse gases, and form a co-determinant of the global energy balance – along with reflection, absorption and transformation of the sun’s radioactive energy, and the global hydrological cycle;
- **Hydrologic:** land regulates the water storage and water flow of surface and groundwater resources, and influences their quality;
- **Storage:** land is a storehouse of raw materials and minerals for human use;
- **Waste and pollution control:** land absorbs, filters, buffers and transforms many hazardous compounds;
- **Living space:** land provides the physical basis for human settlements and everything done from there that go through industrial sectors, to sports and recreation;
- **Archive or heritage:** land stores and protects the evidence of the cultural history of humankind; it is also a source of information on past climatic conditions and past land uses; and
- **Connective space:** land provides space for the transport of people, inputs and products, and for the movement of plants and animals between discrete areas of natural ecosystems.

1.9 Organization of the Study

This study is organized into five chapters: chapter one provides the introduction to the topic object of this study. Chapter two covers the related literature review including studies associated to this research at three levels: global, regional and in Liberia. Chapter three discusses the methodology used in conducting the research, that includes the research design, the population description for the data collection, sampling techniques, data analysis and findings presentation process. Chapter four focuses on data analysis and its presentation, while chapter five discusses the conclusions, and recommendations.

CHAPTER TWO: LITERATURE REVIEW

Firstly, the main land use activities in Liberia take the attention of this section, and continue later with their environmental implications that can be reflected at global scale, (climate change) or local level.

2.1. Land Use Practice in Liberia

Land use involves the management and modification of natural environment into a built environment such as settlements and semi-natural habitats, which includes arable fields, pastures and managed woods. In Liberia, the case is no far difference. Liberia is found in sub-Saharan nation in West Africa, located at 6⁰N and 9⁰N. Its landscape is about 110,000 Square kilometers (43,000 sq. mi).

Generally, there are three (3) distinct categories of land use in Liberia: Arable land 4.04%, Permanent cropping 1.62 and others 94.34% (www.en.wikipedia.org/wiki/GeorraphyofLiberia) On the other hand, forested land in Liberia accounts for 44.63% (www.tradingeconomics.com/liberia/forest-area-percent-of-land-area).

However, arable land use practice in Liberia is conducted by shifting cultivation in most rural parts of Liberia. This is basically done for subsistent purposes by use of the traditional slash and burn method, which also leads to deforestation and habitat loss, but in most instances preventive measures are put in place to prevent soil and water degradation, because water sources are also important for the enhancement of livelihood in these rural areas.

On the other side, permanent cropping in Liberia involves large scale agriculture production. In Liberia, there is a huge lack of capacity and supports to enable farmers engage in large scale agricultural production. As such and in most instances, large scale production is undertaken by concessions companies. These activities whether on a smaller or larger scale, contribute severely to land use impact on the environment. Hence, the most common land use impact associated with these activities in Liberia includes, but not limited to the following; Soil and Water degraded, habitat loss, deforestation, threat to biodiversity amongst others.

As evident in many local communities in rural parts of Liberia, especially the Southeastern region, where there is more forested land, the major threat faced by these communities because of large scale permanent cropping include soil degradation, water contamination, habitat loss, deforested and threat to biodiversity ([www. Greenconsliberia.com](http://www.Greenconsliberia.com)).

The Butaw, Sinoe County case study provides a clear picture of the land use practice impact in Liberia; taking queue from the traditional and cultural dimensions on land use amongst the different tribal grouping in Liberia and the attributes thereof.

2.1.1 Charcoal Production in Liberia

Firewood and charcoal production and supply are generally managed by many Liberian smallholders and entrepreneurs. Despite the constraints of traditional technology and poor transport infrastructure, the market is supplied adequately and efficiently. The provision and supply of these commodities have become a major industry and commercial activities in most parts of the country, mostly the urban sector. Besides accommodating household energy needs, about 35 percent of former industrial workers in Liberia have engaged in charcoal production and trade as means of survival in the private sector (www.Fao.org/docrep).

Additionally, the destruction of the electricity production and distribution network in the early 90's resulted in a massive increase in the use of charcoal. For that reason, the rehabilitation of the hydroelectric plant is critical to the survival of Liberia's remaining forests. Also, the method of charcoal production in Liberia is unsustainable as majority of charcoal producers are using the earth mount kilns methods to produce charcoal.

2.1.2 Chainsaw Milling (CSM)

Commonly referred to as pit-sawing in Liberia, CSM is one of the drivers of forest degradation. It is the felling of tree species and converting the logs into sawn timber with the use of a mechanical saw for different purposes on site. It started long before the civil crisis but on a small scale. Chainsaw milling permits are issued for operations only in community forests and private or deeded forest land.

On the contrary, these millers are still working within various forest concessions and even protected forest areas. Consequently, Blackett et al estimated that about 240-260 timber traders exist in Liberia, with an average monthly sale volume of 27.3 cubic meter per traders (FDA, 2005). This is considered a problem because normally, deforestation causes a drastic reduction in oxygen production, and exposes the environment to the increased sunshine, which is inversely caused by charcoal production by most of the millers.

2.1.3 Bush Meat Trade

Flora and fauna are integral part of the forest ecosystem. Despite that, bush meat trade drives forest degradation in Liberia as fauna are hunted and killed by poachers. Majority of Liberians

regard bush meat as a major source of protein. Overtime, trade in bush meat has intensified. This intensity is associated with the increasing demand for bush meat from increasing urban population and the high income generated from the trade. In fact, some rural people have abandoned farming for hunting animals that they believed bring “*quick money*”. Moreover, most Liberians are of the notion that animals are abundant and cannot face extinction. An increase in the commercial trade of bush meat in Liberia is posing a serious threat to several hunted species and it is thought that Liberia’s rate of bush meat consumption may be among the highest in Africa (FDA, 2005).

2.1.4 Commercial Logging

Per Brown & Katrina commercial logging started in the 1960s after the first and only intensive national forest inventory. As the legal custodians of the Country’s forest estate, the Forestry Development Authority (FDA) regulates logging activities in Liberia. They remained highly centralized institution that predominantly focused on the commercial harvesting of forest products.

Unsustainable commercial logging drives forest degradation in Liberia rather than deforestation. A large amount of logging companies has operated in Liberia and currently there are several FMCs, TSCs and PUPs. As seen in table 1, from 1990 – 2000, the removals of forest products from Liberia’s forest increased. During that time, the removal of industrial round wood increased from 609,000 cubic meters to 856,000 cubic meters and the quantity of wood fuel removed increased from 3.8 million cubic meters to 5.2 million cubic meters over bark respectively. However, in 2005, industrial round wood removal reduced to 370,000 cubic meters over bark while the removal of wood fuel further increased to 6.6 million cubic meters over bark (FDA, 2008). However, this reduction in the removal of industrial round wood is a consequence of the sanction imposed on the exportation of wood products from Liberia by the United Nations Security Council in 2003. On the other hand, the removal of wood fuel increased continuously because it was mostly used for domestic consumption.

2.1.5 Mining Activities (Artisanal and Commercial)

Liberia has many mineral resources – which include gold, diamond, iron ores, and etcetera. These resources are of immense importance to the economic growth and development of the country. Prior to the civil crisis, several mining concessions operated across Liberia. The mining for natural resources in forested land has also driven D&FD in the country. Gold and diamond mining in Liberia consists largely of alluvial and small-scale operations with artisanal miners found working in mineral-rich areas which are mostly located in the forests of

the southeast. They mostly used shovels, diggers and other crude tools to drill into the soil in search of minerals. However, a lot of them are without mining licenses but still mine since government lacks the capacity to regulate these activities. The Ministry of Lands, Mines and Energy (MLM&E) estimates that there are over 100000 artisanal miners operating in Liberia. Forestry Development Authority of Liberia (FDA), estimates that in Sapo National Park alone, there are over 6000 artisanal miners; it was also reported that illegal artisanal mining is taking place in nearly all of Liberia's protected areas (FDA, 2008).

Moreover, an estimated of about 13-20 million men, women and children from over 50 developing countries of which Liberia is no exception is heavily engaged in artisanal mining activities as a way of enhancing a sustainable but unreliable livelihood (www.en.wikipedia/wiki/artisinal/mining).

2.1.6 Plantation Agriculture (Oil Palm Plantation)

Habitat loss driven by agricultural expansion to feed people and livestock is the main threat to biodiversity globally (Wilcove & Koh, 2010; Dobrovolski *et al.*, 2011). Agriculture uses approximately 11% of the earth's land for crop production (FAO, 2011), with most the 13 million ha of forested land that is been converted annually mostly due to agricultural expansion (FAO, 2010). Most those expansions were done in tropical forests (Balmford & Whitten, 2003; MEA, 2005). The biophysical processes relating agriculture and biodiversity are numerous and even more interactive. As agriculture expansion evolves, whether through arable or permanent means, it possesses threat to biophysical values such as soil, water and climate change and habitat loss and deforestation, which also imposes direct threat to biodiversity. (Firbanks *et al.*, 2008). The conversion of land to agricultural plantation and the associated intensification for efficient management of output is concerned with increasing the amount of primary production that is directed to human consumption, causing the rest of nature to suffer as companies endeavour to meet demands through intensification and industrialization (Kerbs *et al.*, 1999). With 995,000 ha of land made available to private companies for the establishment and expansion of plantations – mostly oil palm (RRI, 2013), the recent explosion in the amount of land available for large-scale agriculture conversion is having a negative toll on forested landscapes (Global Witness, 2015).

2.2. The Environmental Impacts

This section discussed the lack of adequate policy or policy failure in Liberia to help reduce land use impacts on the environment

2.2.1 Policy Failure to Protect the Environment

The execution of existing policies is significant in conserving the forests. Several studies have concluded that “policy failure is usually a more important driver of tropical deforestation than market failure” (Barder & Boness, 2005). From a clearer perspective, inability to develop adequate policies and enact laws and/or regulations that could shape and improve forest conservation is very pivotal to reducing deforestation in many areas. In most instances, deforestation occurred because of the demand for forest resources. However, the availability and implementation of proper policies framework that tend to protect forest is very important in achieving proper forest conservation particularly in Liberia and could also be applicable to other parts of Africa (Guinea, Sierra Leone, Ghana etc.) that has similar challenges and even the world.

Nowadays, Liberia has several environmental policies like the Land Use Policy, laws and regulations to govern the environment. However, the full implementation of these legal frameworks remains a very big challenge to the government, as they have been constantly violated by forest contract holders, thus creating room for environmental degradation and the misapplication of revenue from the forestry sector. On the other hand, components of these instruments did not employ the bottom-up approach wherein stakeholders, most especially rural people, should be involved. The lack of local involvement in policy formulation limits the awareness of local people about the policy and takes away the local ownership of the policy which is critical for implementation purposes.

2.2.2 Impacts at Large Scale: Climate Change

Climate change has been stated as the most important environmental threat facing humanity in this century and it is caused by the emissions of greenhouse gases (GHGs) into the earth’s atmosphere. It is at both ends of D&FD and it can be regarded as a driver or an impact. Although forests are playing a significant role in the sequestration of carbon dioxide (CO₂), they can also be a source by emitting CO through human activities. It was reported and increasingly clear that during the 2000s, D&FD were major contributors to global climate change.

Despite the absence of substantial climate change data (temperature and rainfall) in Liberia, the country’s emission of GHGs into the earth’s atmosphere cannot be overlooked. While it is a low carbon emitting economy, been absent from the list of countries of high CO₂ emissions per capita (in tons of CO₂ per year). Liberia emissions from land use, land use change and forestry(LULUCF) has been on the rise in recent years.

In 2013 Liberia prepared and submitted its Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), which contains a national inventory of anthropogenic emissions by sources and removals by sinks of GHG, as well as a description of steps to be taken by the country to contribute in achieving the objective of the Convention. In the absence of Land Use, Land-Use Change and Forestry (LULUCF), the table below shows that Liberia’s total national GHG emissions for the year 2000 is estimated to be 8,022 Gg of equivalent CO₂. Of the four non-LULUCF sectors responsible for the country’s sources of GHGs, the Energy sector accounted for the most significant, accounting for about 67.5% of the national total. This is trailed closely by the agriculture sector’s contribution of about 31.9%, with the waste sector accounting for 0.6%.

Table 1: GHG Emissions by Sector (without LULUCF), 2000 (Liberia INDC 2016)

GHG Emissions by Sector (without LULUCF), 2000		
GHG Source and Sink Categories	Total Gg CO₂ Equiv.	Sector Share (%) (without LULUCF)
Energy	5,414	67.5
Industrial processes	NO	NO
Solvent and other product use	NE	NE
Agriculture	2,562	31.9
LULUCF	-96,811	
Waste	46	0.6
Other (please specify)	NO	NO
Total without (LULUCF)	8,022	100
Total (with LULUCF)	-88,789	
Note: LULUCF – Land Use Change and Forestry		

contributing 51.6%; Carbon dioxide (CO₂), contributing 44.5%; Nitrous oxide (N₂O) contributing 3.9%. Other important gases for consideration include Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

Liberia’s carbon stock in living forest biomass has reduced increasingly over the last decades as the country’s emissions of CO₂ from human activities including plantation agriculture,

shifting cultivation, charcoal production, commercial logging and natural causes has increased significantly.

2.2.3 Environmental Impacts: Locally

Scholars have reported that low process efficiencies, combined with unregulated actions of many producers, cause large volumes of wood to be harvested from nearby forests. These areas are often sections of communally-owned land, but can also make up large portions of nationally protected forests. Unlike the use of fuel wood for cooking and heating, which is often supplied from ground harvesting and has no major impact on environmental degradation, current methods of charcoal production require vast amounts of resources for relatively little return.

This issue becomes compounded when considering the lack of an active reforestation program and poor land management practices that have been identified across the region. Lack of resources at different levels (educational, financial, among others) have been cited (GOL, 2008) as the major reason for such trends. Like most parts of Sub Saharan African, land tenure in Liberia is also particularly volatile, contributing to unsustainable practices.

Customary land tenure often conflicts with the one of a statutory nature, preventing adequate land management practices and ultimately contributing to the widespread degradation that exists today. This can be especially devastating in post-conflict nations, where large in and out-fluxes of refugees and destruction or lack of ownership documentation further exacerbates already existing challenges. In some cases, whole communities live on land owned by a third party, ultimately leading to greater confusion among all stakeholders and creating an essential need for land tenure reform, a process well underway in Liberia.

Liberians are highly dependent on charcoal as a source of heating and cooking fuel, and this condition is set to continue for the foreseeable future. Charcoal has a much higher social, environmental and economic impact than previously thought. In its current state, while the charcoal industry is economically valuable, it has disproportionately adverse effects on social development of rural producers in addition to environmental degradation because of inadequate and disjointed policy measures that tend to benefit urban users to rural both on a commercial and domestic scale ([www. Fao.org/docrep](http://www.Fao.org/docrep)).

The improper land use practices such as soil degradation, threat to biodiversity and climate change that are derived from the traditional production method of charcoal in Liberia embodies health and safety risk to rural dwellers, who offer the benefit of cheap, reliable fuel. organized efforts on the part of government and aid agencies, as well as organizations like the National Charcoal Union, highlight this imbalance, as most charcoal related programs are

aimed at the dissemination of improved cook stoves for urban consumers or technologies that reduce pressure on forest resources.

These policies, where available fail to address indirect, but significant, impacts sustained by the large rural labor force who often depend exclusively on income generated from charcoal production. In addition, current practice in SSA, as in Liberia, suggests a duality of charcoal regulation, where charcoal production in rural areas is often seen as a punishable act or one where financial gain can be achieved in the form of bribes or unsanctioned taxes (GOL, 2006). In urban areas, charcoal retailers are commonplace, with very few opportunities for extortion.

2.3 Analytical Framework

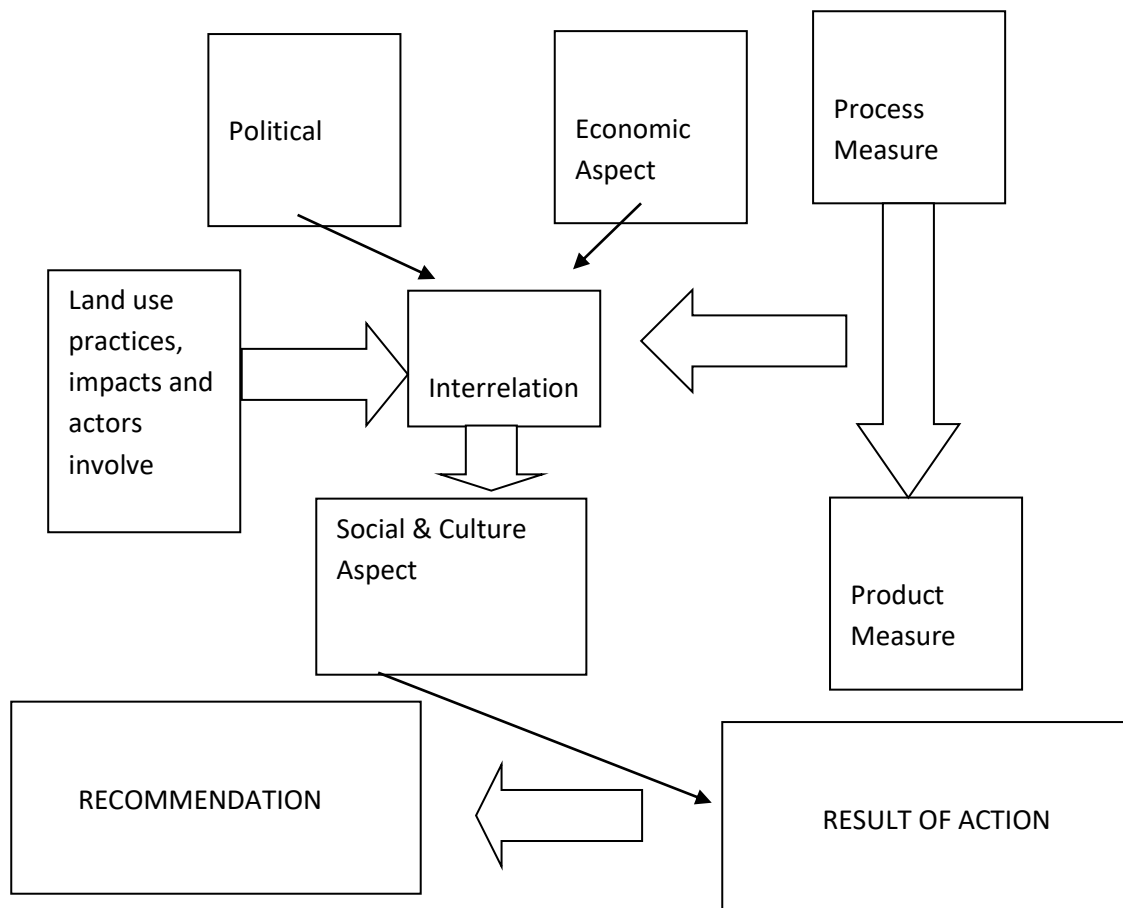


Figure 1: Schematic presentation of the Analytical framework

CHAPTER THREE: RESEARCH METHODOLOGY

The purpose of this chapter is to give an understanding of the research technique employed in the present study. This chapter shows the methodology that the researcher used to collect the data needed to answer the research questions mentioned in section 1.4. It includes the research design, research description, population description, sample and sampling techniques, data instruments and the collection procedures along with data analysis.

3.1 Research Design

The research design refers to the overall strategy that integrates the different components of the study in a coherent and logical way, thereby, ensuring the research problem was addressed effectively; it constitutes the blueprint for the collection, measurement, and analysis of data (Trochim, 2006). The researcher conducted a Qualitative descriptive study design, to obtain information for the study.

3.2 Research Description

This study focus on Liberia, a developing country, located in the tropical rainforest belt of West Africa. It lies between the longitudes of 7 degrees 30' and 11 degrees 30' west and latitudes 4 degree 18' and 8 degrees 30' north. The country has a land area of 9.58 million hectares (111,370 km² or about 43,506 square mile). As shown in figure 1, Liberia contains tropical rainforest which covers about 4.32 million hectares and accounts for approximately 45 percent of the land area. Most of Liberia's forest cover is found in two blocks - northwest (semi-deciduous forest) and southeast (evergreen forest). Moreover, Liberia is situated in the fragmented band of forest known as the "Upper Guinean Forest" which is one of the two most significant forest blocks in Africa, the other being the "Congolese Forest".

The country accounts for about 42% of West Africa are remaining Upper Guinean tropical forest which may provide the last remaining opportunity to protect significant habitat for Upper Guinean biodiversity. To make a depth analysis, the regional focus of this study Sinoe county as the Liberian location for this study because it is the county in the entire country that is affected by all the different Land Use Practices.

3.3 Population Description

A research population is generally a large collection of individuals or objects that is the focus of a scientific query. It is for the benefit of the population that the research is done (Trochim, 2006). The research considered “Investigating the Impact of Land Use Practices on Environment”; A case study in Butaw, Sinoe County, Liberia: 2012- 2016. The total combined population of the Equatorial Oil Palm and Golden Veroleum Oil Palm Communities is 2,501 inhabitants (*2008 National Population Housing Census (NPHS)-LISGIS*). The **target population** for this research was 10% of the total population which is 250 inhabitants. Hence, we are using a sample size to draw up our questionnaire respondents.

3.4 Sample Size Determination

Per Wills and David (2008), sample is part of the target or accessible population that has been procedurally selected to represent it. A simple sampling technique was used to arrive at the desired sample size, using the Yamme formula. The Parroe Wammane Yamme, 1967 formula to compute the sample size in this study as shown below:

Sample size formula: $n = N / [1 + N(e)^2]$, where

n = the sample size, N = the target population, e = 5% is the maximum allowed error. Thus,

Solution:

$$n = N / [1 + N(e)^2]$$

$$n = 250 / [1 + 250(5\%)^2]$$

$$n = 250 / [1 + 250(0.0025)]$$

$$n = 250 / 1.625$$

$$n = \text{sample size} = 154 \text{ Respondents}$$

3.5 Data Collection Methods

A mix data collection methods was applied for this research: desk research and interviews. To gather empirical data, structured questionnaires were elaborated to interview people from different groups of interest, e.g. the Oil Palm Plantation, Equatorial Palm Oil and Golden Veroleum Oil Palm Community, among the most important.

3.6 Sampling Technique & Data Collection Procedures

To review and analyze the current situation of the environment in the study area, this paper used both primary (empirical) and secondary data. Firstly, a thorough review of existing reports relevant to the study was carried out to obtain information and data. Primary and secondary data was gathered from reputable government and international institutions. Also, primary data and information was collected through constant review of theses written by

others on the subject. During these reviews, the researcher intends to review literatures on several forests in different regions of Liberia, during the period of 2012-2015. In other to obtain the data respondents of the Equatorial Palm Oil and Golden Veroleum Oil

Palm Communities, the researcher used the simple random sampling technique, where respondents were chosen entirely by chance.

3.7 Data Analysis Procedures

Data Analysis procedure is the process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making (Judd et al, 1989). The Information gathered from the survey questionnaire was graphically presented in tables and charts. These graphical representatives were used to comparatively analyze the results from the survey leading to a logical conclusion of the impact of land use practice on the environment in Sinoe county.

CHAPTER FOUR: DATA PRESENTATION AND DATA ANALYSIS

The purpose of this chapter is to give a chronological presentation of the data gathered and the methodology employed in analyzing the data collected during the study.

4.1 Data Presentation based on key informants' interview from the questionnaire given.

Table 2: Land Use Practices that have negatively impact on the environment in Butaw, Sinoe County?

Responses	Frequency	Percentage (%)
Oil palm Plantation	25	16%
Chainsaw Milling	29	19%
Commercial Logging	64	42%
Artisanal Mining	36	23%
Total	154	100%

From artisanal mining to chainsaw milling to commercial logging and deforestation, the unregulated unsustainable use of the land as revealed during the collection of data is only seen as a good practice for the inhabitants, but not the soil, forest, or minerals found in the soil. Of the 154 interviewees, 64 respondents (42%) which is the highest in this regard consists of those practically involved in commercial logging. But this statistic says more than that, it also reveals that most of the inhabitants- despite their education, ages or gender are mainly involved in commercial unsustainable logging. Follow by commercial logging is the highly risky, so called artisanal mining, which occupies 23% (36 respondents) of the harmful distributive percentages of harmful land use in this part of the country. This figure may be little lower than that of commercial logging, but those involved in this kind of directly manipulating the land are doing this excitedly with unfailing regularities. Even when asked about the harmful implications of their actions, respondents seemed not to care about the land but of their livelihood only. Regrettably, they are not considering the risks of erosion, earthquake, or flooding- which are highly detrimental to sustainability of the land and its resources. Chainsaw milling which comprises of 29 respondents (19%) is one of the most risk-packed harmful land use practice-if done un-relatedly. The risk involved in this form of

land use is firstly directed to the person doing the milling- since it's possible that he becomes killed in the process.

As stipulated in table 2, oil palm production, which consists of 25 (16%) of the 154 respondents is the least harmful land use practice in this part of the country. When those working on the plantation were asked about their awareness of the impact it has on the land, their level of education was enough to reveal their innocence. More clearly, they are plantation workers- working for a higher authority and for sustenance, so this detail seems of less gravity to them. In terms of grouping by educational level, it appears very vividly that those involved in oil palm production are the least educated as revealed by the collected data. More closely, it appears also obvious that those involved are most likely doing it for subsistence purpose. Secondly, the availability of market opportunities due to the presence of major oil palm companies in the area is one of the many factors observed by the researcher to accelerate the gradually increasing number of smallholder oil palm producers with the study area, as gathered from key informants during the time of the study.

Table 3: Community Involvement in land use practices in Butaw, Sinoe County?

Responses	Frequency	Percentage (%)
Completely involved	28	18%
Partially involved	32	21%
Not involved	67	44%
Lack Interest	27	17%
Total	154	100%

Table 3 reveals that 44% (67) of the respondents are not involved in preventing harmful land use practices in the community. Not only that, but it appears much clearly that they aren't even willing to sustainably use the land due to various factors- ranging from ignorance, denial, support of higher authority, and the likes. And for the (21%) 32 respondents who are partially involved are doing so as a self-regulated measure- and not in observance of any government policy. Which seems to be more regrettable is the substantial 27% (17) of the respondents who lack interest in preventing harmful land use practices. But interestingly, per the total of 28 (18%) respondents, it looks like they are completely involved in

the sustainable prevention of harmful land use practices. And as observed during data collection, it's due not to government policy influence.

The table below presents a cumulative data on farmers' awareness of cropping in Butaw, Sinoe County

Table 4: Level of awareness of farmers about the importance of mixed cropping in Butaw, Sinoe?

Options	Frequency	Percentage (%)
No knowledge at all	70	45%
Average knowledge	28	18%
Completely aware	26	17%
No awareness	30	19%
Total	154	100%

Table 4 shows the percentage distributions of the level of awareness of farmers about the importance of mixed cropping in the county, this revealed that (45%) 70 respondents have no knowledge of the importance of mixed cropping in this part of the country. When their educational level was reviewed, it became evident as the key supporting factor. Also, high on this table are the 30 (19%) respondents who appeared to have some knowledge of mixed cropping, but when asked about their level of awareness carried on in their community who said no awareness has been rose. Twenty-Eight (28) of the respondents which represent 18% said they have an average knowledge of the importance of mixed cropping, and even illustrated by showing the researcher some samples. Six 6 (17%) of respondents admitted to have a complete knowledge of the importance of mixed cropping, and said also that it helps for all year planting- since the nutrients in the soil are not wiped out by one short season of large panting of a particular crop.

Additionally, the table below also shows the community's willingness to help promote and uphold sustainable land use practices.

Table 5: Community willingness to promote sustainable land use practices

Options	Frequency	Percentage (%)
Not willing	35	23%
Partially willing	31	20%
Completely willing	49	32%
Limited idea on sustainable land use	39	25%
Total	154	100%

Community willingness to promote sustainable land use practices as presented in table 5

showing that 32% (49) of the respondents are completely willing, and said offered their voluntarisms. But contrarily, a significant 23% which comprise of 35 respondents said that they are not willing to do it. Here also, education seems to be the undoable factor for their choice of decision. 39 (25%) of the 154 respondents said that they have limited idea on sustainable land use (and therefore could not decide ‘willing’ or ‘not willing’). Those that are partially willing (as stated in the table) consist of 31 (20%) respondents, and their partial willingness is due to their less decisiveness on such issue as land use.

4.2 Data Analysis

Q1. What are the environmental impacts of Land Use Practices in Butaw, Sinoe County?

This research work identified several environmental impacts that have been caused because of the land use activities in butaw, Sinoe County. Such impacts include: Soil and Water degradation, threat to biodiversity, erosion, destruction of vegetation etc.

- Soil and Water degradation-These impacts include compaction, loss of soil structure, nutrient degradation and soil salinity. The impacts go further beyond the loss of fertile land in any given instances, in that it also leads to contamination of water sources. However, sustainable land use practices can help reduce these adverse impacts significantly on the environment.
- Erosion-Half of the topsoil on the planet earth has been loss over the last 150 years (Frederick J. Weyerhaeuser-WWF-Canon). The health of soil in preventing erosion remains a primary concern to farmers and the global community. Erosion occurrences

in the study areas have led to increased pollution and sedimentation in streams and rivers, clogging these water ways and causing decline in fish and other species. Furthermore, erosion in these places has also led to flooding and the loss of valuable land.

- Threat to Biodiversity-anthropogenic activities in Sinoe County has posed serious threat to biodiversity. The unrestricted hunting practices of bush meat and huge shifting cultivation activities in the study have led to significantly loss of animal species. The Sapu National Park in Sinoe County that is supposed to be a haven by statue for biodiversity has become a major target for hunters because of the huge demand for supply of bush meat in the area. The threat to biodiversity is driven by population increase and the creation of access road due to the presence of companies such as the logging and oil palm operations
- Destruction of Vegetation-The lack of capacity for farmers to maintain a fertile land in the study area has increased the practice of shifting cultivation in Sinoe County. Locals in the area solely depend of the forest for the survival, hence the slash and burn practice is a prominent practice in the area to enhance subsistence farming for the support of livelihood. Another factor also responsible for the destruction of vegetation in Sinoe County is the increase practice of artisanal mining. The southeastern region in Liberia is home to abundant natural resources. Because of the huge abundances, couples with government inability to effectively protect and regulate these activities, illicit miners randomly navigate through vegetation in search of their target resources. These factors have drastically contributed to the huge vegetation loss within the study area.

The impacts identified above are noted as negative impacts because they affect the quality of the environment and have the tendency to impact on human and the productivity of the natural systems such as soil, forest and wildlife ([www. Greenconsliberia.com](http://www.Greenconsliberia.com))

Q2. How do the land use practices in Butaw, Sinoe County impact the environment in association to owner's profile?

The land use practices Sinoe County in relations to owner's profile can be assessed from two dimensions: Firstly, from the Company stand point and secondly from the community's angle.

The land use impact in Sinoe County as result of anthropogenic activities from the assessment point of view can be put in two folds: threat to biodiversity and vegetation destruction or

habitat loss. The effect of hunting practices either for food purposes or commercial means possess threat to biodiversity by endangering species existence. The other factor is that of shifting cultivation that has become a culture among inhabitants within the study area. Nearly every year, the slash and burn practices by locals re-enforces the preparation of new farmland (shifting cultivation) gradually contributing to the degradation of vegetation and subsequently habitat loss.

On the other hand, the company's land use activities also possess several threats on the environment, these threats, rated as impacts are as follows: Loss of Habitat, threat to biodiversity, erosion and water pollution.

Considering these variables, one can conclude that the presence of the company possesses much more adverse impacts to the environment than of the community taking in keen consideration the scale at which the impact is made.

Q3. What can be done to mitigate the impact of Land Use Practices in Sinoe County?

From several Environmental and Social Impact Assessment reports (ESIA) conducted by Green Consultancy Liberia in Sinoe County, the impacts on Land use practices in Butaw, Sinoe County can be managed and or mitigated from a two (2) way angle:

Firstly, the Central Government must put in place proper implementation mechanisms that will strategically enforce management and protection laws on restricted forest areas and all high and medium densities forest areas which provides unique habitat for biodiversity, especially the Sapo National Park. The Sapo National Park is considered as a home for many species that are very rare in many parts of Liberia.

To enhance these protection and management policies, governments needs to put in place proper monitoring strategies by using trained forest monitors to enforce the straight no hunting and farming policy within these areas. This will help strengthen the local authorities in these places to ensure that these laws are fully enforced.

Secondly, local communities within these areas must accept the fact that the ongoing practices of hunting, shifting cultivation, illicit mining and other unfriendly environmental practices possess serious adverse threat to the environment. They must also understand that using these land areas in a sustainable way that keeps the environment intact is even more

helpful to the environment, in terms of water quality, soil fertility, erosion prevention and a better living environment.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

This chapter discuss the conclusion and recommendation of the research work.

5.1 Conclusion

Without exception, households interviewed depend on the forest and land for livelihood including income and food sources. Forest in Sinoe communities contributes to livelihoods in different ways. For example, forest-based agriculture, fuel wood, wild fruits, bush meat and wild fruits/nuts also provide income from sale of forest products in communities with significant forest land such as in Sinoe County, forest land is a land reserve for agriculture expansion, tree crop plantation or establishment of new settlement. The high dependence of rural people on forest for livelihood was common in all the communities visited though the scale of dependence varies with the amount or type of forest available and the presence of no-cost alternatives or low labor requirements.

Though most of the land use practices mentioned in this study (shifting cultivation, chainsaw milling, artisanal mining and charcoal production etcetera) are harmful to the environment, the communities are highly willing to do their part by improving their primitive measures to sustainable ones-as testified by some who lost their relatives to artisanal mining and other land use practices. The greatest challenge facing the communities is the lack of viable alternatives and support, which makes livelihood outside forest almost impossible. In the absence of sustainable alternatives and support, community people will continue to rely on existing land use practices in r order to meet their livelihood needs irrespective of the consequences to the environment.

On the other hand, there is a limited capacity in central and local government to monitor and enforce instruments related to land use practices. While much of the legal, policy and regulatory frameworks for the country are generally good, implementation and enforcement of laws and regulations is generally weak (this is a validation of a similar finding in the Liberia Forest Diagnostic study and the Liberia: Assessment of key governance issues for REDD+ implementation).

5.2 Recommendation

To address the challenges associated with unsustainable land use practices in Sinoe County, going forward, there is an urgent need to consider the following activities:

1. One of the fundamental issues regarding agricultural concessions is that they relate to the allocation of large parcels of customary land that is connected to rural livelihoods.

Hence it is important that the policy recommendations of the Land Rights Policy of 2013 be enacted into the land laws of Liberia as part of the land reform initiative. This will enable rural people to formalize their ownership to land through the acquisition of land deeds. In my judgment, this would provide opportunity and means for the local people to secure their ownership rights to customary land and the resources thereof. At such they will be in a better position to dialogue and negotiate tangible benefits and compensation for the lease of those lands under concession by the Government of Liberia.

2. Enhance the skills and capacity of the regulatory authorities, particularly the Liberia Land Administration, FDA and the EPA to enable them monitor and enforce regulations related to land use. This capacity building can include financing for adequate personnel compensation, logistics including transportation and gadgets (software and hardware) for assessment, monitoring and enforcement in keeping with their statutory functions. These institutions must by themselves demonstrate the political will and commitment to exercise those responsibilities.
3. Reconsider land-use issues in Liberia and develop a comprehensive land-use policy and plan of the country, with a focus on sustainable livelihood and poverty eradication in rural communities such as Sinoe.
4. Improve awareness about the harmful environmental impacts of existing land use practices while at the same time proffering viable alternatives that guarantee sustainable livelihood for communities. Communities depend on the forest and land for livelihood but if they are given viable alternative livelihood skills and support they can transcend their existing traditional practices. For example, training and support for sedentary agriculture in place of shifting cultivation; promotion of fishery and livestock activities in communities to reduce bush meat hunting; promotion of sustainable harvest of non-timber forest products as an income generation source for forest communities.
5. Promote community participation in the formulation of policies and laws related to land use planning and management to ensure community ownership as well as to ensure that communities have a say in laws and policies that affect their livelihood.

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APPENDICES

Appendix I: Research Questionnaire

Informed Consent

Dear Ms./ Mr./ Mrs.

My name is Elizabeth Saysay Dede d’Almeida; I am student of the University of Twente in The Netherlands. As part of my Masters in Energy & Environmental Management. I must carry on a research project which title corresponds to the “**Impact of Land Use Practices on the Environment in Butaw, Sinoe County, Liberia during 2012-2015**”.

As one of my research tools, this document contains 8 open questions that were specially formulated to contribute to my master’s thesis. Even further, your responds to those questions are very important for my research. Therefore, I am kindly asking seeking 30-minutes of your time for an interview. But it can also be that you filled it up by your own and you sent it to me.

Please note however that all the information provided during this interview will be kept confidential as no part of it will be traced back to you. The research is strictly academic! if you agreed being part of this study, please check “Yes” or “No” if you choose to decline.

Yes

No

Thank you very much for your time.

Sincerely yours,

Elizabeth Saysay Dede d’Almeida

PART 1: Survey Questionnaires

Date of interview: _____

Direction: Please select and circle the letter with the answer of your choice below.

Section I: BIO Data Information

1. What is your age?
 - A. 18-23
 - B. 24-29
 - C. 30-35
 - D. 36-41
 - E. 42-47
 - F. 48 and above
2. What is your gender?
 - A. Male
 - B. Female
3. What's your highest level of education?
 - a. High school
 - b. Bachelor Degree
 - c. Master Degree
 - d. Vocational Certificate
4. What is your occupation?
 - a. Informal sector
 - b. Formal sector
 - c. Contractors
 - d. Others

Section II: Research Data Information

5. In your opinion, what are the following land use practices that have negatively impact on the Environment in Butaw, Sinoe County?
 - A. Oil palm Plantation
 - B. Chainsaw Milling
 - C. Commercial Logging
 - D. Artisanal Mining

6. What is the community involvement in land use practices in Butaw, Sinoe County?

A. Completely involved

B. Partially involved

C. Not involved

D. Lack Interest

7. What's the level of awareness of farmers about the importance of mixed cropping in Butaw, Sinoe County?

A. No Knowledge at all

B. Average Knowledge

C. Completely aware

D. No Awareness

8. What is the community willingness to promote sustainable land use?

A. Not willing

B. Partially willing

C. Completely willing

D. Limited idea on sustainable land use

Appendix II: Data of Survey respondents

Table 1: Gender of the Respondents

GENDER	Frequency	Percentage %
Male	102	66%
Female	52	34%
Total	154	100%

Table 1 shows the percentage distribution of male to female in relation to the role gender plays on harmful land use practices on environment in Sinoe County. Of the 154 respondents, 102 (66%) of them are male- depicting that there are more men involved in land use practices than their female counterpart, which consists of 52 respondents, constituting 34% of the total in this region.

Table 2: Age range of the Respondents

AGE-RANGE	Frequency	Percentage %
18-23	10	6%
24-29	21	14%
30-35	20	13%
36-41	32	21%
42-47	40	26%
48 and above	31	20%
Total	154	100%

Of the 154 respondents with regards to age range, table 2 shows that 10 respondents which comprises 6% are between the ages of 18 to 23 years; 21 respondents comprising 14% are between the ages of 24 to 29 years; 20 respondents comprising 13% are between the ages of 30 to 35 years; 32 respondents comprising 21% are between the ages of 36 to 40 years; 40

respondents comprising 26% are between the ages of 42 to 47 years, while 31 respondents comprising 20% are 48 years and above. This shows that people between the ages of 40-42 are more involved in land use practices like farming, commercial logging, deforestation, etc., followed by people between 18-23 and 36-40 who are less involved in the likes. All this is important because it can explain why their level of involvement presents differences such as older adults are more represented than young adults.

Table 3: Educational level of Respondents

Option	Frequency	Percentage
High school	60	39%
Bachelor Degree	48	31%
Master Degree	22	14%
Vocational Certificate	24	16%
Total	154	100%

Table 3 showed out of a total of 154 respondents regarding Educational level of Respondents, 60 respondents comprising 39% are said to be High school graduates; 48 respondents comprising 31% are said to be Bachelor Degree holders; 22 respondents comprising 14% are said to be Master Degree holders, while 24 respondents comprising 16% are said to be Vocational certificate holders. The level of lack of education as stipulated in table 3, the largest percentage of respondents are high school graduates (most of whom are in pursuit of higher education, but due to the lack of finances, see commercial logging for example as a source of finance and sustenance).

Table 4: Occupation of Respondents

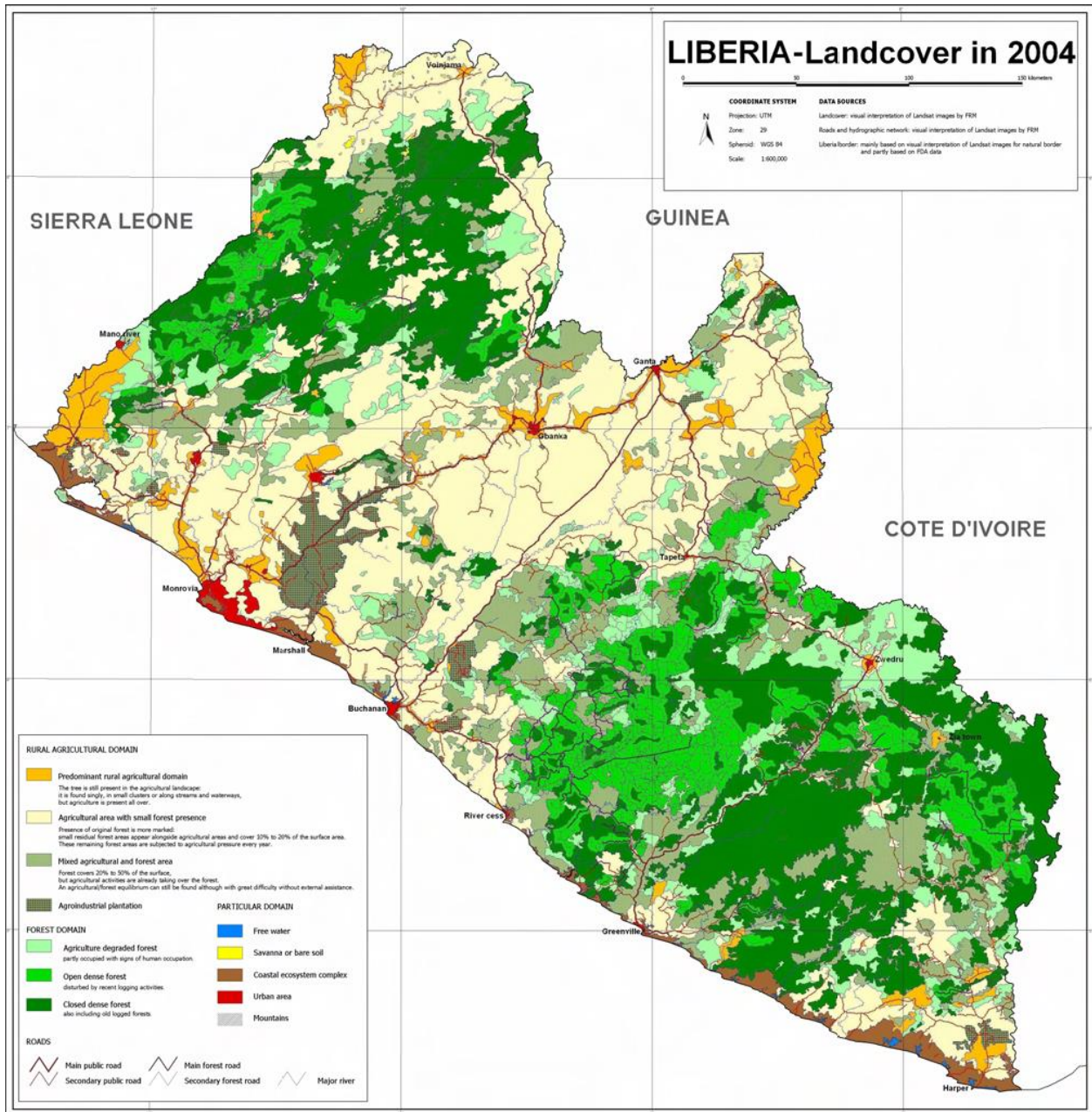
Occupation	Total	Percentage
Informal Sector	55	36%
Formal sector	52	34%
Contractors	30	19%
Other	17	11%
Total	154	100%

Table 4 showed out of a total of 154 respondents regarding Occupation of Respondents, 55 respondents comprising 36% are from the Informal sector; 52 respondents comprising 34% are from the Formal sector; 30 respondents comprising 19% are Contractors, while 17 respondents comprising 11% are from other areas. This shows vividly that almost entirely; all the respondents have no other occupations other than the various forms of land use practices.

Appendix III: List of Key Informants

1. Mr. Harrison S. Karnwea, Sr.----- Managing Director
Forestry Development Authority
Republic of Liberia
2. Mr. Ernest C. B. Jones, Jr -----CEO
Land & Housing Development Incorporation
3. Mr. Urias Goll -----Deputy Executive Director
Environmental Protection Agency
4. Mr. Shadrach Kerwillain----- Fauna & Flora International

Appendix: IV: Map of Liberia land cover in West Africa



Appendix V: Map of Liberia with the fifteen (15) counties

