AMOS -ZAIZAY FARMERS PERSPECTIVE ON LAND SPARRING MASTER THESIS

NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF ENVIROMENTAL EDUCATION AND MANAGEMENT

LAND SPARING AS A TOOL IN MITIGATING AGRICULTURE INDUCED DEFORESTATION IN LIBERIA: FARMERS' PERSPECTIVE

M.Sc. Thesis

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Approval

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Declaration of Ethical Principles

I hereby declare that all information, documents, analysis, and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of the Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

Amos Gayflor Zaizay

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Abstract

Land Sparing as a Tool in Mitigating Agriculture Induced Deforestation in Liberia: Farmers' Perspective

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One of the major environmental issues globally is deforestation, and thus, policies are formulated to minimize deforestation or its effects on society. Some of the leading but general factors provoking or causing deforestation are; the expansion or development of farming land, logging, production of charcoal, urbanization, and mining activities. Because of the looming danger that deforestation harbors to our society several measures and studies have been recommended on how the vice can be minimized; one among them is land sparing otherwise known as land separation whereby at the field level, there is a compromise of agricultural output to develop or rehabilitate non cropland habitat in a farming environment. To assess the farmers' perceptions in Lofa County, Liberia on land sparing in reducing agriculture-induced deforestation, the study used a mixed research method. The survey employed 150 farmers from the seven districts and the six major ethnic groups available in the county. The revelation of the study in the context of Lofa County, Liberia, maps out the existing approaches connecting or discussing land sparing in a way and reveals that while a few farmers understood the essence of land sparing for the preservation of natural forests, more than half care little about it since they do not know how it is started because of-economic constraints and lack of expertise.

Modern ways of large-scale farming persist with agri-business employing conventional and new technologies in growing food crops including rice, cassava, and sugarcane. This, combined with the fact that modern practices like agroforestry, for example, have not been practiced is perhaps why training programs are needed. This is an indication that the type of farming and productivity is linked with the ground; thus,

raising questions about input costs and sustainability. Agriculture has made forests a source of farmland for farmers after which the exercise of conserving the habitats for the species continues to be intensive hence the required setting of gradual measures on the use of natural land. Its implications are altered in policy-making and deal more with education improvement, capacity improvement, and participants' involvement in both farming and protection. Most importantly, it is suggested for the next study to investigate the socioeconomic variables and evaluate the effectiveness of education to enhance positive change in development and living standards in Lofa County Liberia. Thus, respective people underlining and implementing the wise policies, strengthen and improve the future and effective agricultural using the present and future generations performance that is also becoming more protective to the environment.

Key Words: deforestation, land-sparing, conservation, sustainability.

Özet

Liberya'da Tarım Kaynaklı Ormansızlaşmayı Azaltmada Bir Araç Olarak Arazi Koruma: Çiftçilerin Bakış Açısı

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Küresel çapta önemli bir çevresel sorun, orman tahribatıdır ve bu nedenle, orman tahribatını veya toplum üzerindeki etkilerini en aza indirmek için politikalar oluşturulur. Orman tahribatını provoke eden veya neden olan önde gelen ancak genel faktörler arasında tarım arazisinin genişlemesi veya gelişmesi, kereste kesimi, odun kömürü üretimi, kentleşme ve madencilik faaliyetleri bulunur. Orman tahribatının toplumumuza taşıdığı tehlike nedeniyle, bu sorunun nasıl en aza indirilebileceğine dair birçok önlem ve çalışma önerilmiştir; bunlardan biri de tarım arazisinde, tarım üretiminin bir kısmının fedakarlık edilerek tarım dışı habitatın geliştirilmesi veya yeniden assavatee edilmesi olan toprak ayırma veya ayrılma olarak bilinir. Lofa County, Liberya'daki çiftçilerin, tarım kaynaklı orman tahribatını azaltmada toprak ayırmanın algısını değerlendirmek için, çalışma karma bir araştırma yöntemi kullandı. Anket, ilçedeki yedi bölgeden ve altı ana etnik gruptan toplamda 150 çiftçiye uygulandı. Lofa County, Liberya bağlamında yapılan araştırmanın ortaya koyduğu şey, bazı çiftçilerin doğal ormanların korunması için toprak ayırmanın önemini anladığını, ancak ekonomik kısıtlamalar ve uzmanlık eksikliği nedeniyle bunun nasıl başlatılacağını bilmediklerinden, daha fazlasının bundan pek umursamadığını gösteriyor.

Tarımın yoğunlaştığı yerlerde, tarım işletmeleri pirinç, viassava ve şeker kamışı gibi gıda ürünlerinin üretiminde geleneksel ve yenilikçi teknikleri uygulamaktadır. Bu, modern tekniklerin, örneğin agroforestry'nin benimsenmemiş olması nedeniyle eğitim programlarına ihtiyaç duyulduğunu göstermektedir. Bu, tarım türü ve verimliliğin toprak kalitesi ile ilişkili olduğunu gösterir ve bu da girdi maliyetleri ve sürdürülebilirlik konularıyla ilgili endişelere neden olur. Ormanlar, çiftçiler için temel bir tarım arazisi

kaynağı haline gelmiştir ve bu nedenle habitatların korunması için sürekli çaba harcanır, bu nedenle doğal arazinin kullanımı için aşamalı prosedürlerin belirlenmesi gerekmektedir. Bulguları politika yapımını etkiler ve eğitim, kapasite artırma ve paydaş katılımı üzerinde odaklanarak hem tarımı hem de korumayı teşvik etmektedir. Son olarak, çalışma, sonraki araştırmaların sosyo-ekonomik faktörleri incelemesi ve eğitim müdahalesinin etkisini değerlendirmesi gerektiğini önermektedir, böylece Lofa County, Liberya'da adil kalkınma ve geçim fırsatlarını iyileştirmeyi olumlu yönde etkileyebilir. Bilge politikaları vurgulayarak ve uygulayarak, ilgili kişiler tarım alanının geleceğe dayanıklı ve çevre dostu performansını artırabilirler, böylece mevcut ve gelecek nesiller için faydalı olabilirler.

***Anahtar Kelimeler*:** orman tahribatı, toprak ayırma, koruma, sürdürülebilirlik.

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List of Abbreviations

EPA:	Environmental Protection Agency
FAO:	Food and Agriculture Organization
FDA:	Forestry Development Agency
GDP:	Gross Domestic Product
IUNC:	International Union for Conservation of Nature
NGO:	Non-Governmental Organization
SDG:	Sustainable Development Goals

CHAPTER I

Introduction

Land sparing or land separation can be seen as the trade-off of field-level agricultural output to create or re-establish non-farmland habitat in an agricultural landscape (Sidemo-Holm et al., 2021). For example, forests, natural grasslands, and other habitats are established on cropland sites still visible today; wetlands have been left behind after abandoning rice fields, although they were never food sources themselves (Zhang et al., 2018). The land-sparing concepts originate from a fascinating debate between conservationists and ecologists as they compare it with another technique known as land sharing. They argue and compare the two techniques in terms of how and what is best to integrate into agricultural production within a region and would present the least harm to biodiversity (Green et al., 2005). This reasoned effort was firmly focused on the overall potential of biodiversity by taking into consideration a large spatial scale taking into consideration the need for farmland to produce sufficient food (Balmford et al., 2005). Deforestation refers to the shrinkage of forest territory yielded up for use as agricultural farmland, areas of urban development, or mining operations (de Oca et al., 2021).

Deforestation is one of the most significant environmental problems worldwide, and policies are often enacted to reduce deforestation or its impact on society (Didenko et al., 2017). The most common reasons for deforestation are the development of farming land, logging, production of charcoal, urbanization, mining activities, etc. Deforestation accounts for about 10% of global warming and driving up temperatures (Goulart et al., 2023). Additionally, animal and plant species lose their natural environment when the forest is cut down, they disappear due to deforestation. Some 70% of land animal and plant species live in forest shelters and the canopy helps to regulate their temperature (Johnson et al., 2011; Sodhi et al. 2008; Donald, 2004). Deforestation also brings more extreme changes in temperature between day and night, like a desert killing many inhabitants. The forest trees also help atmospheric water levels by regulating the hydrologic cycle. For example, the Amazon rainforest is one of the most significant forests for controlling our planet’s water cycle (Goulart et al., 2023). Its

millions of trees cooperate to produce moisture in the air as if they were atmospheric rivers used by Earth's weather systems. In response to the global wave of deforestation, studies have been undertaken and plans formulated to prevent further depletion of this forest (Rödig et al., 2018). According to some studies, agriculture is the primary cause of forest loss. Therefore, land conservation might help arrest this process that farming has fostered (Gorte and Sheikh, 2010).

Some 432,900 hectares (about half the land area), or nearly one-half of Liberia, are forested. According to United Nations Food and Agricultural Organization figures, eloping trees cover approximately two-thirds of it. However, by comparison with the civil war that prevailed in West African nations as recently as two decades ago, these levels are now reasonably reducing. Liberia's designated primary forest is one of the most bio-diverse and carbon-dense types of forest, making up 40% (172,000ha) of that total. The living biomass of Liberia's forests contains 585 million metric tons of carbon. Liberia has about 881 known species of amphibians, birds, mammals, and reptiles that live in its forest (Mongabay, 2011).

Of said species, 4.2% are threatened, and 0.8% are endemic, meaning found only in their own country. Vascular plants may number at least 2,200 species, some 4.7% of which are native to the country. IUCN classifications I through V cover 1.3% of Liberia. As Liberia is a large country and compared to the pace of global urbanization, deforestation is gradually becoming an issue though not pressing at the moment. The unofficial sector has many advantages to offer communities as each year, the chainsaw milling industry employs 24,000 regular workers and investments worth $41 million-almost as much as a percent of the GDP (Kofron and Chapman, 1995). As many as 28,000 persons are used in the charcoal industry. Most people living in the countryside work for their income from fruits, honey, meat, nuts, and various plants. Liberia's forests were destroyed by war when the cash generated from dealings in forest products was used to purchase arms; as it disintegrated under mounting social pressures and a burgeoning population (Mongabay, 2011).

Statement of the Problem

From 1990 to 2010, the total forest area in Liberia declined by an average of about 30,000 acres per year. Deforestation is a significant problem in Liberia; about six hundred thousand acres 14.2% of the forest area in Liberia were lost between 1990 and 2010. This loss over the last 20 years is expected to quadruple by 2030. More than half of all Liberians live within 2.5 kilometers of a forest. These families spend more than three hours a day collecting forest products for personal use and commercial purposes, which accounts for about 35% of their income. Forestry is the fifth most significant sector in terms of contribution to the economy after services, agriculture, fisheries, and mining (Mongabay, 2011). Thirty-nine thousand eight hundred thirty-eight (39,838) full-time equivalent employees, of whom about one-third are women who work in an official forest sector, contributing as much to the GDP as a whole. Other research suggests logging, the making of charcoal, urbanization, and agriculture are chief causes of the country's deforestation problems. According to some research, if laws relating to the forest are not passed swiftly enough, in 2030, Liberia may have lost anywhere between a quarter and half of its original woodland area. These problems will lead to but not limited to increased carbon dioxide in the atmosphere and harsher climate, water cycle disturbance, biodiversity loss, droughts, and severe heat (Kofron and Chapman, 1995).

Purpose of the Study

The main purpose of this study is to analyze farmers 'perception of land sparing by focusing on the use of spared land as an anti-deforestation mechanism, given that other studies indicate that deforestation has increased rapidly over recent years, with farming or farm expansion being one crucial factor.

Research Questions/Hypotheses

- Which farming practices are in use and how does it impact the decision on what crop to grow, agriculture yield, and production challenges in Lofa County, Liberia?

- What landscapes are utilized for farming in Lofa County Liberia and what is the economical outlook?
    - ✓ What are the major practices being practiced in the farming sector of Lofa County, Liberia?
    - ✓ Is the size of farms proportional to the annual production yield and the farming revenue?
- What are farmers' awareness of the concept of 'land sparing', their attitudes, their observations on how it is being implemented, and their perception of the yield difference?
    - ✓ How have the stakeholders viewed cutting and burning natural forests for agriculture?
    - ✓ What is the stakeholder's perception towards the quality of teaching concerning land sparing and forest prevention?
- What are farmers' perceptions regarding the monitoring of farming techniques, their awareness of deforestation, interest in forest deterioration, stakeholders' roles in the protection of forests, and the importance and sustainability of the land-sparing approach?
- What are farmers' belief systems, opinions, and stances on agricultural practices and decisions on land use are intertwined with their feelings and outlook on policies made by various levels of government on agriculture?
    - ✓ What are the perceptions of farmers to the current agricultural practices and the process of decision-making on land use?
    - ✓ What are farmers' attitudes towards different policies of government concerning agricultural activities and their use of land?

Significance of the Study

The results of this study reveal a relationship between farmers 'understanding that deforestation is occurring and their willingness to save the land since deforestation remains one of Liberia's most critical problems, and agricultural expansion accounts for much damage done. In addition, the study's findings also explore how the Jevons conundrum and land sparing are related. It also analyzed the importance of protecting

land in eliminating deforestation in Liberia. In doing so, this research provided insight and suggestions on the crafting of deforestation policy for Liberia, Africa, and the world at large.

Limitations

This is a sensitive research area; however, there are no doubts about the study's ethical guidance. This study's shortcomings include the small sample size, population traits, or specific participants who may be in limited numbers for widely extensive analysis of the data collected. There is also a need for previous studies on this topic in the research area to provide material that can compare results, so there has yet to be an even more extensive expansion upon previous theories. In addition, these findings that arise from this study may not be extended to a larger population because the research is based on data taken from the investigation population in a single county in Liberia, and counties 'agriculture generally differs by landscape, ethnical traditions, and activity. Also, the study's definition is that it sets down research goals or questions that are feasible to achieve. It also attacks a section of the population that may represent other areas and can serve as another door to future research.

Definition of Key Terms

Agriculture Yield: The number of crops gathered per unit area (Sumberg and Giller, 2022).

Biodiversity: all life on earth, in the different species of plants and animals; numerous bacteria, fungi, and other microorganisms, as well as their component genes. It encompasses living things alone or interacting with each other, forming various terrestrial, marine, and freshwater ecosystems to live together (Marshall et al., 2020).

Conservation: This is to safeguard the earth's natural resources for today and tomorrow (Ducarme and Couvet, 2020).

Deforestation: This term refers to a global shrinkage in forest territory yielded up for use as agricultural farmland, areas of urban development, or mining operations (de Oca et al., 2021).

Jevons's paradox: Improvements in resource efficiency over the long term will cause an increase, rather than a decrease, in using those resources (Giampietro and Mayumi, 2020).

Land sparing: This means converting or creating areas of non-farmland habitat in agricultural landscapes at the cost of lost farm yields, including woodlands, natural grass, and wet meadows growing on arable land (Grass et al., 2021).

Land Sharing: It refers to the practice that farming ensures the balance of nature within agricultural areas (Baudron et al., 2021).

Sustainability: It is meeting present needs without compromising the ability of future generations to meet their own (Barboza et al., 2022).

CHAPTER II

Literature Review

Land sparing—land or land separation can be seen as the trade-off of field-level agricultural output to create or re-establish non-farmland habitat in an agricultural landscape. Repairing forests, natural grasslands, marshes, and meadows on arable land is a common form of this measuring policy. This strategy, however, only sometimes means high-yield farming on the unrecovered area of agricultural land (Goulart et al., 2023).

Protected Areas and Poverty

Ecosystem conservation and ecosystem restoration go hand in hand. Of course, the least expensive solution remains to avoid the destruction of ecological function in a landscape to begin with. However, restoration can also revive some degree of ecological fitness in post-degraded landscapes (Mansourian and Vallauri, 2014). Research has revealed inconsistent effects of conservation measures, such as protected areas (national parks, conserved forests, marine protection zones, etc.), on poverty (Gibson & Marks, 1995; Cernea & Schmidt-Soltau, 2006; Montanarella et al., 2018). Moreover, keeping locals away has sometimes been necessary to do conservation work. People's livelihoods depend on these natural resources; therefore, new poverty was expected to worsen (Cernea & Schmidt-Soltau, 2006). On another hand, protected places may benefit local economies by creating jobs, preserving infrastructure, and fostering the development of livelihoods (Brockington & Wilkie, 2015). Natural landscapes are resources that allow people to live comfortably.

Studies that have analyzed the impact of protected areas in Costa Rica and Thailand indicate that poverty levels tend to be lower around protected areas than outside them (Andam et al., 2010). Nevertheless, recent studies (including long-term research in Costa Rica) have indicated that this positive impact is usually the result of increased income and employment generated by tourists coming to see protected areas. (Ferraro & Hanauer, 2014). Another two mechanisms have also been studied to determine the effect of protected areas on prices, infrastructure, provision, and access to

ecosystem services, which had no detectable impact on poverty rates (Cernea & Schmidt-Soltau, 2006).

Multi-Scale Restrictive Agriculture and Sustainable Ecology

Besides food and biofuels, agricultural systems also affect water regulation and climate control and regulate the cycling of nutrients (including carbon) in nature disturbance dynamics. However, land-use decisions must also take account of varied ecosystem processes that underly agriculture. The high external inputs of intensive agriculture, in terms not only of fertilizers but also pesticides and other chemicals amount to an inflow into farmland systems (Gaston et al., 2013). This put a significant strain on the ecological functions provided by species commonly found therein. High-input farming does have the effect of disintegrating each variety into its parts. Ecological intensification has been considered to help make such a kind of agriculture more sustainable (Bommarco et al., 2013). Biodiversity keeps high yields using biodiversity-conserving and so-called 'intermediate ecosystem services,' like decomposition and carbon capture. The goal here is to provide diversity that can ensure pollinating services or biological control of pests and diseases while being based on a demand-driven interpretation (Mitchell et al., 2015; Ekroos et al., 2016).

This depends on how far field production lands are spread in terms of space. Below, we explain how these demands can be met within a system of multiple-scale land sparing. Numerous keystone plants and other significant contributors to ecosystem services at the landscape scale, including pollinators and biological pest control agents, can be integrated into production landscapes through planned interventions (Mitchell et al., 2015). For honeybees, home-range foragers with variable intra-habit dispersal and various noncrop habitats serve as nesting sites. Within their home ranges, flowery places provide feed. Its life histories and body ecology are all too massively diverse, meaning that over several spatial scales, bee communities respond to changes in land use. However, the two become divorced when noncrop habitats (those providing nest sites for bees) are far from fields with insect-pollinated crops. In such cases, the extinction of wild bees leads to a loss in pollination service and poor crop yields, creating an environmental threat (Garibaldi et al., 2011). However, Feral honeybees take over under

these conditions, and the quantities and quality of pollination services they render remain the same. In this way, to realize the land-sparing policy of allowing wild pollinators to become protectors against high floral diversity production can take all its lands and divide up into noncrop habitat patches which are even over between them; one insect-pollinated crop could then have just entered the foraging area. In addition, a larger share of natural habitats in the scenery will buffer wild bee communities from local blow-offs caused by pesticides (Park et al., 2015; Ekroos et al., 2016).

However, boosting pollination services does not necessarily mean that rare species with special ecological conditions will win (Kleijn et al., 2015). Nevertheless, in terms of these limitations, some important habitats for habitat specialists provide an overlap between biodiversity conservation and the supply of ecosystem services. The examples are given by Macfadyen et al. (2012) and (Ekroos et al., 2014). As one illustration semi-natural grasslands efficiently provide nesting places for many pollinators. How far pollination by agricultural landscapes overlaps with the distribution of communities designed to grow species listed for conservation is an area that needs to be clarified. The quality of local habitat in natural grasslands has nothing to do with pollination around agriculture (Benjamin et al., 2014).

With the disappearance of semi-natural grasslands, the utility at more minor spatial scales of sparing habitats (e.g., noncrop field boundaries) becomes increasingly important in these kinds of landscapes for insects that crawl and wiggle about because they bring significant effects to befall them. However, no specialist species dependent on those will likely live happily ever after. Unlike wild bees, generalist arthropod predators are not restricted to being confined by their nest site and nearby areas (Ekroos and Kuussaari, 2012). Other local assemblages of generalist predators are vulnerable to the level and type of disturbance within their home field (where they forage) (Ekroos et al., 2016). This is greatest when land use intensity presses right up against them. The result is that the same thing happens—landscapes will have less diverse populations or mixed species groups composed sometimes only of butter. This process can be slightly modified by increasing surrounding landscape heterogeneity, noncrop habitat, and spared habitats, which act as source populations for other constructs with accumulative extinction thresholds (Knapp et al., 2014).

It can be practice multi-level land Reserves in which space above and around fields are affected. All of these together will hit the nail on its head, forming a local Treaty. Therefore, to fortify the biological. In bio-pest control, it becomes necessary to explore the relations among small-scale ground interventions and changes that affect all aspects of landscapes, such as service compositions and unit services (Jonsson et al., 2014). For instance, increasing landscape complexity by leaving parts of the land uncultivated can push pests 'host-parasite relationships in a beneficial or deleterious direction (Jonsson et al., 2012; Menalled et al., 2003). Such fluctuation in abundance is partly due to the different impacts local farming practices have on natural enemies and pests (Rusch et al., 2010; Ekroos et al., 2016). So, such in-field management interventions have the most significant potential to evolve into biological control services where no or low alternatives exist other than poison (Tscharntke et al., 2005; Ekroos et al., 2016).

Atmospheric nutrients are essential functions, but if they provide all raises for arable production, these cannot be sent off on their own in the cycling process. In the long term, maintaining soil fertility is necessary for sustainable agriculture. Alone, fields must be managed so that their flora and fauna biodiversity will increase rather than decrease. In the case of European arable land, at least over the past few decades, soil quality has been in continuous decline. Such a trend concerns sustainable food production (Verheijen et al., 2009; Jones et al., 2012). Agricultural land must retain nutrient-rich top soils to prevent erosion and maintain soil moisture and fertility (Boardman, 2013). However, given that the quality of soil is something that can be changed only on a local level (Tscharntke et al., 2012), no multiple-scale land-sparing strategy counts for much if we do not have field measures such as using organic fertilizer or more intensive tillage systems and not the excessive consumption with high yield by adding legumes.

Demand for Livestock Feed

The need for livestock feed is also extensive in concentrated animal feed operation (CAFO) production systems (Montanarella et al., 2018). In particular, pork and fowl are high-flying. This is being driven by two factors: a higher animal protein

diet plus an increasing world population. Seen in positive light production, Steinfeld et al. (2006) point out that some of this additional land used to produce inputs for the CAFO systems will be saved by efficiency within these production chains (Herrero et al., 2010).

Demand for Bioenergy

As crop-derived bioethanol and biodiesel became favorites, the land had to be sacrificed absolutely (i.e., 81 Mha in absolute terms, or equal to five percent of the world's croplands). This speed was impressive in itself: in just a single year, there had been an increase in the impact on human health (Barata et al., 2016). Due to their intense nature, they are often included. In Brazil and the United States, biofuels have become a top priority. European Union to other countries whose goal is enhancing energy security and assisting in reducing CO2 emissions (Birur et al., 2008). Such a total approach first became stressed as a package of biofuel supports. However, from her concerns about the social and environmental effects caused by biofuels, she has changed direction to re-emphasizing limits on how much should be produced. Bioenergy is a severe source of land degradation. A survey of 53 reports on the effects of bioenergy crops may have found that negative influences on biodiversity predominate (Immerzeel et al., 2014), particularly in tropical areas. Second-generation bioenergy crops, too, will rarely do much harm in temperate regions. To provide land for bioenergy crops, habitat loss and changed species richness or abundance have been reported as a consequence of the resultant changes in land use. Joly et al. (2015) believe that meaningful land-use planning can reduce the capture of critical habitats by bioenergy crops and thus limit these adverse effects. However, using biomass energy with carbon capture and storage to regulate climate change requires putting high-quality agricultural land into production or felling more than 50 %of our remaining forest (Boysen et al., 2017).

Theoretical Framework

The land-sparing-sharing concept came about on the condition that nonhuman animals have worth regardless of whether or not they contribute to human welfare. It attempts to determine how human needs (in this case, food) can be satisfied without

disturbing nonhuman creatures. It is gradually understood that humans have many ethical obligations to other species (Cafaro and Primack, 2014; Kopnina, 2016; Batavia et al., 2017; Phalan, 2018). The model does not provide directions on how to rank food production objectives or defend species populations, nor do these simultaneously form a single objective function. However, although the model can be used to compromise competing anthropocentric goals, that was different than what it was intended for initially, and its neglect of wild species 'instrumental value is a mistake (Bennett, 2017). The wild species' inherent worth is one of the most important but often ignored reasons many writers came to different conclusions about sparing and sharing (Phalan, 2018).

Mainly speaking, concern over the extinction of wild species naturally lends support to land-sparing and sharing logic and its analysis. The preservation of biodiversity is viewed as just one small piece; replacing this species with that becomes harmful only when it threatens human interests. The priority of wild species coincides with egoistic ethics, which sees humans as just one out of many; they appreciate nonhuman animals for their own sake. Because of egocentrism, to consider humanity as one species runs the risk of ignoring injustices among different groups. Concentrating on human welfare remains more in keeping with an anthropocentric ethic, according to which nonhuman animals only have value as they affect people (Sandbrook, 2017), and the term biodiversity mainly means different types of crops, cattle, and farms. A threat of anthropocentrism is that, with our focus on human interests, we may neglect the needs of those animals that are useless or worthless to us. If we pursue just conservation, the needs of endangered human populations and those of nonhuman animals must be considered. Moreover, because human food production is limited, the sparing-sharing approach pays the closest attention to wild animals 'needs. As a result, it is shaped by an egoistic morality, but this should not mean that one must never forget social injustices and nature's gifts (Phalan, 2018).

Knowing more about one aspect of the elephant should also go with knowing how to deal with other aspects. Agricultural biodiversity for the sake of agricultural biodiversity (ecological intensification) differs from farmland or land shares to be shared between humankind and nature. The flow from its biodiversity, a farm ecology service can increase or maintain food production in many cases and often aid sustainable

yield increases. However, improving the provision of service-bearing biodiversity is insufficient to protect species having little direct value (Kleijn et al, 2015). Suppose man can produce the same volume of food on less land (including ecological intensification), coupled with maintaining and restoring other natural vegetation. In that case, species like these would not only account for 90 % or more life on earth by their simple addition but also come out ahead (Gorte and Sheikh, 2010; Phalan, 2018).

Agricultural Yield, Jevon Paradox, and Land Sparing

Sometimes, whether production will increase is confused with whether land preservation should be considered reasonable. The sparing-sharing approach only addresses the second of these two different difficulties. Land conservation requires high yields, but they are far from an ideal mechanism. Others are more effective as these include spatial planning, economic incentives, and determination during tendering for certification through active ecological infrastructure, including expertise, investment, and technology (Angelsen & Rudel, 2013). Nevertheless, the Borlaug theory may still have a role to play in passive land sparing, so it makes sense to go over both sides of the evidence. The Jevons paradox is sometimes contrasted with the Borlaug hypothesis, which holds that technical progress in agriculture will leave land for nature. Around the middle of the nineteenth century, C. W. Stanley Jevons noticed that as coal-fed engines became more efficient, they needed more significant amounts of coal than before (Alcott, 2005; Phalan, 2018).

Often, the Jevons paradox is considered identical to the rebound effect. However, Jevons identified an extreme kind of rebound: a backfire effect (De Sy et al., 2018). In an agricultural environment, rebound effects imply that less land is spared than would be the case if people could share in yield increases as they expected to; backfire implies even more dramatic—not only does no one save any land, what is worse, every square meter of farmland gets converted. No solid empirical evidence supports the Borlaug hypothesis or the Jevons paradox. Crop increases and deforestation have complicated links (Phalan, 2018). The kudzu introduced in the Peruvian Amazon has now diminished the clearing of the primary forest but opened up more significant areas for clearing secondary forests. Good pasture management practices in South America

occur concurrently with increased forest destruction, though this can be avoided if managed together with forest conservation programs (Phalan, 2018). In Malawi, agricultural aid users reduced commercial forest product extraction without clearing additional land. This suggests that increases in yield were advances relative to the use of forests for this purpose. Increasing agricultural yields frees land that can then be used for other purposes; on a national or even global scale, this is certainly advantageous, and efforts to increase the yield of crops may (and indeed should) be focused in areas with relatively low conservation values (Angelsen and Kaimowitz, 2001; Rudel et al., 2009; Phalan, 2018).

On a national scale, farmland area has risen more slowly than agricultural production. In developing countries, the proof is weaker for land savings—decreases in cropland and yield increases have been infrequent. Subsequently, in areas nearby, 20 million hectares—as opposed to the quantity predicted by Borlaug of upwards of half a billion—and with only about 2 million hectares under forest cover were spared because yield gains during the Green Revolution compensated for land lost due to soil erosion (Borlaug, 2007) in the region of 20 million hectares rather than 560 million, and of this, only 2 million hectares of forest (Stevenson et al., 2013), these higher yields of the Green Revolution were used to produce more food for less money, not spurring people on in nature's name. The bottom line is that the impact of Borlaug could be more modest and reliable indeed. It could not save even an area with the most excellent conservation value. To guard against the loss of land, environmental policies governing land-use zoning and forest protection have to be strengthened, in addition to those offering incentives for conservation and restoration (Angelsen & Rudel, 2013). Like conventional ones, high-yielding agroecological systems also require land sparing to prevent rebound effects. Advocates of alternative agriculture believe that raising yields, intercropping systems, and agroforestry could reduce the pressure on forests if the land were protected (Perfecto and Vandermeer, 2008; Ceddia et al., 2014).

This is all the more plausible when labor-intensive methods supply local markets and do not raise profitability at the forest edge. However, even under these conditions, the Borlaug effect will still need to be completed. Even when wildlife-friendly farming is high-yielding, we have to find strategies to preserve land for nature (Phalan, 2018). At

least as important a concept is the degree to which conserving habitats grades into yield gains (versus just shifting agricultural outputs). Ester Boserup found that raising yields is sometimes more of a labor-intensive process. Farms will expand their area under low-input farming until no land is available, so they raise the crop yield (Boserup, 2014). Though Boserup highlighted human population growth as the critical factor behind land scarcity, it is also clear from theoretical modeling and empirical investigations that maintaining natural vegetation would enhance agricultural productivity (Boserup, 2014). However, some displacement or leakage is also possible. This impact might not prove to be as severe as many feared. The leaking reservoir problem highlights the importance of combining enforcement and incentives for maintaining or restoring habitats with efforts to increase yields (Phalan, 2018).

Knowledge: The power of standards

The 1980s saw an introduction of sustainability standards that enabled supply chain leaders and producers in sustainable agriculture to take responsibility for themselves while providing a market demand for certified products (Komives and Jackson, 2014). As pioneers in defining auditable criteria, the Rainforest Alliance, Forest Stewardship Council, and organic agriculture have played a leading role (Loconto et al., 2020). Incorporated within the whole of environmental movements, including all aspects and branches of the World Wildlife Fund (WWF), they have become a weapon for setting standards on sustainable agriculture with extensive support from NGOs, commercial corporations, and governments. Out of the most important tropical commodities, in 2012, certified output accounted for over ten percent. Coffee and cocoa each took up nearly half of all land identified as being under certification, with an average yearly growth rate of 41%. Our food and beverage companies can use sustainability standards to achieve CSR reports, protect brand equities, and expand consumer markets (Cashore, 2004).

Land Sparing in Heavily Modified Landscape

Many scholars have said that such a sparing-sharing approach is not needed in temperate zones, the Brazilian Atlantic Forest, and other places with relatively little

intact natural flora. This outcome is not inevitable, however, in such places, restoration of habitat is also possible (Navarro and Pereira, 2012). To prevent other species from following the example of three Atlantic Forest birds that have recently become extinct, sections will require further widening, buffering, and reunion. In any landscape, regardless of the source site for these alternatives across the sparing-sharing spectrum, it takes a long time before one can reap restorative benefits. In areas of little native vegetation, where land clearing has only taken place over the past few decades, restoration may offer the best chance for reducing extinction debt (Newmark et al., 2017); moreover, it can provide ecological services and restore cultural value.

The difficulties are more significant when certain species have grown entirely dependent on agricultural landscapes and native megafauna have lost their structured habitats (Wright et al., 2012; Phalan 2018). Some 'traditional' agricultural practices may mimic the domesticated natural disturbance processes and provide ecological niches for early successional species (Navarro and Pereira, 2012; Phalan; 2018). However, these species might be preserved if carefully included in long-term habitat restoration and rewilding plans. In such settings, land-sharing methods can work in the short term. However, we should look at many alternative possibilities to cultivate a density of people and other species that are more balanced over time (Phalan, 2018).

Related Research

Land Preservation Debate

As such, agriculture's land use significantly affects agricultural output, the environment, and agrarian structure in agro-food systems. Finding the 'optimal farming method' capable of reconciling those trade-offs has been a bone between LSP and LSH that gnaws at each other (Fouilleux et al., 2019). The work of Green et al. (2005) is very relevant to our studies because they were the first people to directly use land sparing as a term and raise this question: How can increased food production be limited with some minimum damage? To answer their question, they used actual data on biodiversity for all nations about yield earned from them. This shows us that if, in establishing a biodiversity-friendly but lower-yield agricultural system, the production relationship is convex rather than concave (the same level of annual output requires proportionately

less area to be planted with crops), then the ratio between my gain and your loss will only fall short when expressed as a percentage on any land already cultivated. They discovered that empirical data affirmed a convex relationship between biodiversity and yield. As a result, land-conserving farming trumps wildlife-friendly agriculture (Loconto et al., 2020).

This is called land sparing, in the sense of saving (wildlife) nature and preserving natural places for biodiversity. It was initially referred to in a paper by Norman Borlaug, the idea of "preserving" land. In this survey, he called one column of a table in which yield figures were listed as "area saved by yield growth" and claimed that better-than-expected crops had released 29.9 million hectares for other purposes. Therefore, the 'Borlaug theory of land sparing' was born (Borlaug, 1987). This view aligns with the 'productions' argument of power production that sees global food security as a simple matter of increasing agricultural output. This results in undermining biodiversity-friendly agriculture, necessitating a smaller area planted with crops, which means more 'green' or higher environmental protection (Fouilleux et al., 2019).

Changes in the intensity and nature of cultivated areas or agroforestry

This expansion is affected by sets of different combinations pointing to varying levels or kinds of intensification between the demographic and economic sides on the one hand and institutional elements like technology on the other. Both also happen at a particular time, affecting land degradation or restoration (Alexander et al., 2015). Population growth and altered consumption patterns when comparing the 1963 situation with that of 2005, however, it is essential to note that between these years, the amount of food cropland in global terms grew by some Mha. However, only 26% of this expansion comes through a change in diet, and the latter figure overstates matters anyway since it takes account of both population increase (to 74%, which does not include more babies) and income increases. These numbers also change with income growth (Kastner et al., 2012).

Household income rise means higher consumption of coffee, tea, and cocoa-type leisure crops, animal products such as sugar, dairy cow's milk, eggs, cattle meat, etc. These commodities have contributed most to net growth in the area during recent

decades (Rueda et al., 2014). More than half (52%) of the growth in farmland output since 1963 was due to demand for animal feed (Alexander et al., 2015; Kastner et al, 2012). Recent inventions include markets for fruits, nuts, and other items (Hecht, 2014; Montanarella et al., 2018). Once an income threshold is reached, this demand could level off. However, data indicates that these thresholds are significant for many products. Stabilizing per capita demand for meat requires an annual income threshold of about US $36,375 (Cole & McCoskey, 2013). Only 30 countries have reached this level, and most others will need decades more to do so. Given that, many studies have indicated numerous possibilities for alleviating societal pressures without worsening pressure on natural ecosystems (Bajželj et al., 2014). Meyfroidt (2018) investigated the feasibility of various policy measures to alter dietary preferences.

Ramifications of land-use change

There's a knock-on effect of alternative local land use strategies on overall national policy about using or otherwise real estate, even internationally. For instance, if the land is shared as practice in one case, it would be unfavorable. Unless an accident occurs, the global footprint of agriculture's land will expand in proportion to this location which in turn presents an overall output shortfall (Salles et al., 2017). On the other hand, higher crop yields and reduced costs in a land-sparing situation may be evident. The benefits of land controls may not include reduced vulnerability to such price increases. Farmers are only encouraged to expand further when higher yields equal positive profits. Similarly, if the high price of labor washes away cost savings, the new technological efficiencies in production are passed onto the consumers as lower food prices. Consumers could adjust by buying more and stimulating production increases to get ahead of the coming wave of demand. Thus, the risk is that the overall distance increases as efficiency grows in food production (Fischer et al., 2017). On-demand and supply sides, this decentralization would lead to even less land being left over for nature conservation (Byerlee et al., 2014).

However, an in-between scenario may also be envisaged: Moderately effective can be land-sparing. When moderating, it should neither wholly counter on the one hand nor make conditions even worse on the other for the expansion of the agricultural

footprint. This is the practice case; some researchers support it and has happened to date (Phalan, 2018). An important point is that both supporters and critics of land-sparing agree about the importance of good governance. Rescue is needed to stop the land from disappearing, particularly those areas of high importance, as valuable ecological resources have been spared for nature and conservation (Phalan et al., 2018).

Cropland and Agroforestry Management

As of 2014, nearly one-third (1.58 billion hectares) of the world's natural ecosystems were grown as cropland. Besides permanent cropland, croplands are also arable lands with temporary crops and meadows; unchanged terrain for more than five years is considered fallow; the rest all counts. These land-use indicators also reflect the production of woody perennials, including trees, shrubs, palms, and bamboo, in some spatial arrangement or sequence along with crops. Agri-silvicultural refers to such systems that tie together crop planting rate and forestry; silvopastoral applies where livestock pasturing is integrated into a Second only to managed grazing, and croplands cover more of the earth's land area than anything else that man has ever done. On more than three-fourths of the earth's cropland, fewer than 20 crops are being planted (Foley et al., 2011; Mueller et al., 2012).

Fire Dynamic in an Emerging Deforestation Frontier in South Western Amazonia, Brazil

The major environmental problem in the Amazonas state in Brazil, especially in the biggest Amazon rainforest, is deforestation which destroys forest integrity because of human activities like agriculture and construction-related processes. This research is centered around comprehending the magnitude of deforestation and fire episodes in this region. The results of the study on data from 2003 to 2019 show that the effect of climate anomalies, particularly the changes in temperature and deforestation, is the major factor that results in increasing burned land. It underscores the point that all forest management plans should take into account factors such as fire hazard, climate change projections, and people interactions. Suggestions include zoning of conservation areas to

take care of the risks of fire and more research directed into fire management to promote forest conservation (Dutra et al., 2022).

Effects of human-induced habitat Changes on site-use patterns in large Amazonian Forest mammals

The research tries to gauge the effect of human-caused transformations on large Amazonian forest animals especially in the hotspots of the Amazon forest, an essential but fragile environment. Four endangered species like the giant armadillo, white-lipped peccary, lowland tapir, and jaguar were investigated by camera traps conducted in different 9 South American countries. Results show that there is a link between human-made habitat transformations and site-use patterns of those birds, and each one of them has its extent of influence. Suggestions comprise the establishment of boundary lines for land acquisition, economic growth, and sustainable development goals, prioritizing the protection of standing forests, and recommending rich countries make the necessary investments into conservation efforts in the Amazon region. This method entails the utilization of socio-ecological information to provide a platform for conservation efforts directed towards the protection and rehabilitation of Amazon ecosystems (Quintero et al., 2023).

Protected Areas Conserved Forests from Fire and Deforestation in Vietnam's Central Highlands from 2001 to 2020

This investigation centers on the pivotal role of the human population in forest management, the perturbation of forest cover by deforestation, and the establishment of forests by afforestation, by highlighting the priceless role that forests have in conservation and climate change adaptation. While attempts to save forests to some extent show results, the major factor, that prevents the conservation of wooded areas throughout the world, is the conversion of land for other purposes such as agriculture, deforestation for industrial crops and manufacturing, and urbanization. Setting up the Vietnam forest as its focal area, the study seeks to elucidate the reasons and consequences behind the changes in the forest of the Central Highlands in the last two decades. The involvement of satellite data and the spatial analysis methods establishes

the research which demonstrates the effect of fire on deforestation and the ability of protected spaces to reduce forest loss. To sum up, protected areas demonstrated that under the continuous existence of forested landscapes, unharmed by deforestation or fire, virgin forest deposits were intensely protected from deforestation and fire. A significant finding in this work is that human activities are the major contributors to changing the natural fire regime and the policy rule to enforce the regulation of human-made forest fire and deforestation is urgent. The researcher advises a cautious approach in further conservation works and suggests deeper studies on the depopulation of forests in this region so that the controls, interventions, and policies are more efficient in the future (Ebright et al., 2023).

CHAPTER III
Methodology

The study methodology provides the blueprint or the basis for how the study was conducted

Research Design

A sequential exploratory mixed-methods research design was used to assess farmers' attitudes toward two strategies for deforestation reduction – that is, land sparing and land use management in Lofa County, Liberia. Among the research strategies used to achieve the set goals and objectives of the research were both quantitative and qualitative approaches. Consequently, the research methodology revolved around the seven districts of Lofa County and was based on the given account of compositional differentiation and agricultural practices. In this way, evaluating these districts, the current work aimed at presenting as diverse and inclusive as possible impressions and procedures concerning deforestation and measures for the preservation of lands. The research also collected the quantitative data by using the survey questionnaires to establish the variables including land use, deforestation, and demographics. To measure farmers in the area's knowledge, attitudes, and practices about land sparing and land use, the researcher administered questionnaires or focus group discussions. Conversely, the quantitative approach was used to gather large volumes of quantitative, ordered data that resulted from surveys, polls, and questionnaires.

These methods helped the researchers to develop the ideas, attitudes, and historical aspects that may have affected the farmers' perceptions of deforestation and land use change. Quantitative and qualitative outcomes presented this top facet – the combination of two views helped to deepen understanding of the subject of the research and increase the reliability of the conclusions drawn. The incorporation of quantitative and qualitative evidence made the study more reliable according to the findings of the researchers. Furthermore, through the use of cross-sectional analysis, findings from prior empirical and theoretical research as well as experts' points of view have been

incorporated into the research framework, making the analysis denser. Therefore, by adopting the mixed method approach in this study, a more dimensional approach was achieved in the analysis of the various interconnections of deforestation, land use management, and farmers' perceptions in Lofa County, Liberia. To do this, the study employed a quantitative and qualitative cross-sectional survey design to offer policy recommendations, practicable advice, and user guides for sustainable land management and environmental conservation policy or framework.

Participants / Population & the Sample / Study Group

The study was conducted in Lofa County, Liberia, which is comprised of all its seven districts including Vonjama, its County Capital, Kolahun, Foya, Zorzor, Vahun, Salayea, and Quardu Bondi. Lofa County, having a population of 367,376 people according to the 2022 census and occupying an area of 3,854 square miles (9,980 km2), is the fourth most populous administrative division in Liberia (LIGIS, 2022). The research process used in this study did not involve the use of experimental paradigms rather; it employed sound integration of quantitative assessment and keen observation skills to decipher outcomes. Illuminating the interactions of the many as its processes, the study's concerns lie squarely in the identification of the group dynamics embedded within the defined population. Based on this study, the participants consisted mainly of farmers originating from the large areas of the seven districts of interest. Significantly, an attempt was made to obtain a sample of users that would be a fair sample of the ethnic diversity of these locations. Very carefully, 150 farmers were recruited in the above-said districts and ethnic concentrations. Furthermore, out of the chosen highly controlled sample of respondents, 25 people were selected by design due to their professionalism and motivation for promoting environmental sustainability practices.

From the fundamental demographic information which has been presented in Tables 1-5, one can get a glimpse into the population constituted by respondents from Lofa County, Liberia. First concerning the gender distribution, the outcome shows a clear male dominance as there are more of them while the female population is not that numerous. The difference here may suggest that there could be differences in terms of time taken to complete the survey or the accessibility or willingness of subjects to

participate in the survey between sexes, and this is why gender-sensitive programs should feature strongly when development research is being undertaken at the county level. This could be a step towards gender-balanced data collection methodologies that would help in influencing gender issues in future applications. Formerly, the dominance of the age distribution among the respondents belonging to 31-50 years denotes the majority of the extra sample working age group. Nevertheless, non-response from the youngest age (1-10) and responding weakness from citizens above 61 years might suggest data collection problems from children and old and adults. Therefore, survey distribution and involvement methods have to be discussed for these ages as well. Moreover, ethnicity distribution throws light into knowledge distribution among respondents: From the above table, it can be concluded that more people have attended primary school or have never attended any school.

Based on educational attainments diversified in the study area, it is realized that there is a necessity for fluid means of knowledge dissemination and capacity-building interventions in the study area. Moreover, the distribution of the marital status of the survey participants proves the fact that most of them were married since there were no responses that referred to the answer as "(other)". With this knowledge of the marital trends, one is presented with a view of the marital situation within Lofa County and therefore sheds light on the social relations as well as the family formation trends obtained amongst the community of Lofa County. As a last note, variation in the ethnic background of respondents, which includes a reasonable percentage of the main ethnical groups of the population, stresses on cultural diversity of society. This viewpoint encapsulates the need to recognize cultural sensitivity in devising and enforcing some strategies to address the community's concerns and ensure long-term growth in the region. Such an intentional combination of numerical analysis technique, ethnographic observation, and purposive sampling further enhances the substance and reliability of the methodological framework used in the study to reveal the richness of the interactional processes that exist in the paradigm of agriculture of the researched areas.

Data Collection Tools/Material & Procedure

In line with the principles of scientific scholarly undertaking in this study, a complex method of data collection was used with a clear understanding of the realities of the research enterprise. As for the data collection instruments, the questionnaires, and the structured interviews were adopted, integrated, and improved based on a prior study by Fentahun et al (2023); however, to suit the context and aims of the current study more accurately, modifications were applied. It was not a haphazard process, but rather involved sorting through the recommendations of more senior experts or specialists in their respective fields of study interested in these phenomena, to fulfill the standards of methodology by which scholars approach the subjects of the study. These specialists, recognized for their competence in environmental conservation and agricultural research techniques, regally contributed their critical analysis to enhance the appropriateness and efficiency of the instruments regarding harvesting detailed information from the mentioned target group. These refined instruments were further validated before deployment and went through a meticulously critical social validation by people with vast knowledge of agriculture, its research, and the tools used in its studies. The validation process was done both quantitatively and qualitatively to ascertain the validity of the content and construct of the instruments to the study's theoretical concept, methodological framework, and research goals. With the help of the experts' feedback and suggestions, the process of instrument development was improved throughout many cycles; therefore, the instruments allowed the collection of all the necessary data related to the goals of the study. In addition, the process of data collection was kicked off after getting the relevant ethical clearances from the University Ethics Committee, thus emphasizing this study's compliance with the tenets of ethics commonly applied in research.

Similarly, a lack of defined governmental permitting procedures for researchers in Liberia; thus, the study developed a strategy to recruit farmers in the research area of Lofa. Acting through the heads of farming communities, local knowledge, and cooperation with agricultural extension officers and grassroots organizations, the research team identified and explored farming communities with representatives in Lofa purposively. For the data collection process, it was prudent to adopt a mix of both the

quality and quantity instruments. Structured interviews prove useful in the sense that they involve a well-formulated interview protocol; this enables the investigator to delve deeper into the pertinent themes and phenomena of interest due to flexible but open-ended questions. In supporting this qualitative study, the questionnaire instrument, which was developed to capture the study's over-arching goals and objectives, allowed for the systematic quantification of the results. Stressing the applicability of close-ended questions revealed concerning targeted variables, it was possible to obtain systematic data and ensure analytical specificity with the help of the questionnaire instrument. The distribution and conduct of the questionnaire and interview were conducted from April 16-May 15. 2024. In addition, since this study relied primarily on the data collected from the respondents, a literature review that involved the analysis of the available academic works and expert opinions was carried out to strengthen the conceptual background of the study and enhance its analytical sensibility. This systematic combining of different research methods, supported by strict validity checks and based on the principles of ethical practice and advisers' recommendations, speaks about the methodological precision and academic responsibility in the data collection stage of this research.

Data Analysis Procedure

Based on the objectives set for this study, the data analysis procedure engaged both qualitative and quantitative approaches to capture a detailed analysis of farmers' attitudes towards deforestation reduction in Lofa County, Liberia. The interviews conducted and the questionnaires used in this study were structured and therefore, generated qualitative data which went through coding. Thus, the deductive approach that was employed involved the mapping of codes to pre-existing themes that were deduced from research objectives. Atlas TI tool enhanced the bottom-up analysis with the view of investigating beyond the identified codes and examining relationships between the coded data with a view of identifying commonalities amidst the farmers and the existence of multiple perspectives. Whereas, quantitative data that was gathered using structured questionnaires was analyzed quantitatively using packages like Zoho Analytics. The demographic features as well as key variables incorporating the land use

and deforestation parameters were computed and their frequency was demonstrated in descriptive statistics tables.

Tables and charts were used to help show relationships between quantitative variables. One major approach in the analysis of the research study was the combination of qualitative and quantitative data. Triangulation entailed the analysis of any commonalities as well as differences in the overall results from the two datasets to identify affirmations and diversities of opinions. Exploration of qualitative findings was subsequently synchronized with quantitative data for all cases, and congruency was used to enrich and create patterns in analysis. Data presentation included the use of tables, charts, and mixed text to consolidate the key findings neatly. Peer assessments ensured that the results of the research conducted met way and efficiency, with additional remarks from other scholars allowing for the detection of bias and miscalculations. Lastly, examining the analyzed information more strictly concerning the targets and objectives of the studies as a whole offered important information on the multifaceted processes of deforestation and land use management in Lofa County.

Validity and Reliability/Trustworthiness

The study was conducted in a manner consistent with the ethical norms of Near East University. Specialists in the topic matter and the study area validated the interview guides and questionnaire. In addition, the researcher did not fake or manipulate the data in any way, which is a fantastic demonstration of outstanding ethics in the study process. The research did not cause injury to any participant or candidate. Participants give their oral consent to partake or be included in the study. The researcher did not emotionally or physically abuse or injure participants, and they were permitted to quit the study at any time without being questioned. The research did not contain any sensitive information, nor did the participants' names. Participants received a participant number instead of their names, which was not disclosed due to ethical concerns. Demographic information about the participant was only included in the questionnaire. The focus of the investigation is objectivity. The collected data was not manipulated, and the results were presented objectively. The researcher's subjectivity and personal inclinations were kept

to a minimum, and the research adhered to ethical and moral standards. The researcher did not place his/herself in a difficult-to-vulnerable position after, or during the study.

Study Plan

The study is divided into six chapters to facilitate its readability and accessibility. Each chapter's information is organized according to its relevance to the chapter to achieve cohesion, organization, and logic.

Activity	**Time/Date**
Chapter 1: Introduction	October 2023
Chapter 2: Literature Review	November 2023
Chapter3: Research Methodology	December-January 2023-2024
Chapter 4: Results and Findings	March 2024
Chapter 5: Discussion	April 2024
Chapter 6: Conclusion and Recommendations	May 2024

Chapter 1 covered the study's introduction and context. The chapter discusses the study's goals and objectives after analyzing the study's problem. The review of existing literature is illustrated in chapter 2. This chapter is significant because it aids in analyzing the research and makes the research more pertinent and logical. This study's methodology and research design are presented in chapter 3. The chapter discussed the research's context, methodology, samples, and data collection method. In addition, the chapter detailed the data analysis procedure and ethical approval. Chapter 4 presented the results and the findings collected from the research population. Chapter 5 which is the discussion discussed the major findings seen in chapter 4 about the study objective and compared said findings to the findings of other studies. Chapter 6 concluded the study by summing up the major findings and providing recommendations based on the findings and based on the need for further studies.

CHAPTER IV

Findings and Discussion

Quantitative Data Findings

Farming Practices and Crop Cultivation

Table 1.

Farming Choices of Respondents in the Study Area (Lofa County)

Theme	Variable	Frequency	Percentage
Occupation as a Farmer/Cultivator	Yes	150	100
	No	0	0
	Total	**150**	**100**
Types of Farming Practiced	Subsistence Farming	51	34
	Commercial Farming	76	50.7
	Mixed Farming	23	15.3
	Total	**150**	**100**

As stated and hinted in the analysis of the result from Table 1 and its figure, it is possible to determine the particular farming options most preferred by the respondents of the study in Lofa Country, Liberia. The table also highlights the following basic demographic analysis: there were 150 participants in the study, all of the respondents considered themselves farmers, and this was the proportion of the population that was sampled. Nonetheless, 50.7% or 76 of the respondents were from commercial farming systems, a situation that saw 34% or 51 of the respondents practicing subsistence farming. In addition, far fewer, that is 15.3% (23 respondents), referred to their occupation as mixed farming. The result shows that the more commercial tendency

dominates among investigational subjects with the same score most of them are involved in marginal agriculture.

Table 2.

Types of Crops Grown by Respondents in the Study Area

Theme	**Variable**		**Frequency**	**Percentage**
Major type of Crop Cultivated	Cash Crop		55	36.7
	Food Crop		95	63.3
	Total		**150**	**100**
Specific Crop Cultivated	Cash Crop	Cocoa	19	12.7
		Coffee	10	6.7
		Oil palm	19	12.7
		Rubber	7	4.7
	Food Crop	Rice	35	23.3
		Cassava, Plantain, Sweet potato	30	20
		Vegetables	30	20
	Total		**150**	**100**

Table 2 presents general information on the types of crops that are grown by respondents involved in the study in Lofa County, Liberia. Out of the survey sample population, 36.7% (55 persons) have practiced cash crops with 63.3% (95 persons) practicing food crops. Subsequently, when disaggregating the survey participants who indicated a rise in cash crops, corresponding assertions were received concerning cocoa, coffee, oil palm, and rubber, namely 12.7%, 6.7%, 12.7%, and 4.7%, respectively. But for those people who are into the farming of food crops, the major crops grown are rice which accounts for 23% which is a staple food for the people of the area other crops grown include cassava, plantain, sweet, and various vegetables 20 each. These ultimately distribute the agricultural map of the study area leaving the crops produced to

be of different types indicating that a greater percentage of the families practice both cash and food crop farming.

Table 3.

Landscape Utilization for Farming in Lofa County, Liberia

Theme	**Variable**	**Frequency**	**Percentage**
Farming Landscape Preferences	Natural Forest Habitat	109	72.7
	Non-forest habitat	41	27.3
	Total	**150**	**100**
Farming Practices in Natural Forest Habitats	Swamp Forest	26	23.6
	Upland Rainforest	43	39.1
	Lowland Rainforest	39	35.5
	Montane Forest	2	1.8
	Total	**110**	**100**

Table 3 shows the role of Agriculture in Lofa County, Liberia's landscaping industry. Of the 72.7% (109 individuals) of the respondents identified natural forest habitats as those used for farming by the people, 27.3% (41) used non-forest habitats only. Further examination reveals that among those utilizing natural forest habitats, the distribution was as follows: Based on the findings, of the total respondents, 23.6% (26 persons) declared that they used swamp forests, 39.1% (43 persons) used upland rainforests, and 35.5% (39 persons) of the respondents used lowland tropical rainforests. 1.8% (2) Persons utilized montane forests according to the respondent's data. Most of the respondents did not use mangrove forests, or gallery forests for farming as observed

from the survey. The research brings out the dominance of agriculture over the natural forests especially swamps and rainforests in the study area.

Table 4.

Farming Methods Utilized in Lofa County, Liberia

Theme	**Variable**	**Frequency**	**Percentage**
Farming Methods Employed	Slash and burn	70	46.7
	Intercropping	40	26.7
	Agroforestry	0	0
	Crop rotation	31	20.7
	Terrace farming	0	0
	Zero tillage	9	6
Total		**150**	**100**

Table 4 translate into appropriate farming methods employed by farmers in Lofa County, Liberia. The result shows that the farmers adopted several practices for farming and slash and burn was prevalent accounting for 46.7% (70) of the respondents. Other specific strategies of crop rotation were also reported by 20.7% (31 individuals). Intercropping was shared by 26.6% of (40) respondents implying that intercropping enjoys a prominent position in the production practices in said area. However, none of the respondents had practiced extensive ways of farming such as agroforestry, raised bed gardening, conservation agriculture, terrace farming, organic farming, permaculture, or hydroponics and aquaponics. In contrast, the rest of the respondents' options issued a small percentage of 6% with (9) respondents stating that they did apply zero tillage. This stresses the point that in most of the community practices, popular practices such as slash and burn methods and crop cycling are employed, though, on the other hand, sustainable farming methodologies are not widely adopted.

Table 5.

Annual Production Yield and Revenue of Farming in Lofa County

Theme	Variable	Frequency	Percentage
Farm Size in Hectares	Less than 1 hectare	35	23.3
	1-5 hectares	84	56
	6-10 hectares	31	20.7
	More than 10 hectares	0	0
	Total	**150**	**100**
Annual Agricultural Yield per Hectare	Less than 1 metric ton	40	26.7
	1-3 metric tons	53	35.3
	4-6 metric tons	57	38
	7 Metric tons or more	0	0
	Total	**150**	**100**

Taking into consideration the data from Table 5 findings established from the respondents' data show that with regards to farm size majority of the study participants, 56% (84 respondents) reported that their farms were between 1-5 hectares. Additionally, 23.3% of the respondent reported that their farms were less than 1 hectare. 20.7% of the respondents also reported that the size of their farms was 6-10 hectares. Interestingly none of the respondents reported that their farm was above 10 hectares in size. Moreover, the data also show the annual production yield of the respondents with the majority of the sampled participants 38% (57) reporting agriculture yield of 4-6 metric tons/hectares annually. 35.3% (53) of the respondents reported an agricultural yield of 1-3 metric tons/hectares. 26.7% of the respondents reported an agriculture yield of less than 1 metric ton/hectare. However, no respondent reported having an annual agriculture yield of 7 or above metric tons/hectares.

Table 6.

Annual Production Yield and Revenue of Farming in Lofa County

Theme	Variable	Frequency	Percentage
Annual Household Crop Production Yield	Less than 30 households	64	42.7
	31-60 households	56	37.3
	61-90 households	30	20
	91 and more households	0	0
	Total	**150**	**100**
Annual Farming Income in USD	Less than 1,000 USD	41	27.3
	1,001 USD-5,000 USD	59	39.3
	5,001 USD-10,000 USD	49	32.7
	10,001 USD and above	1	0.7
	Total	**150**	**100**

Table 6 presents the yearly yield per household and income per household from small farming activities in Lofa County, focusing on individual-level data. Data analysis highlights that a considerable number of the respondents 42.7 (64 individuals) represent production yields supporting up to less than 30 households. Another significant proportion of respondents 37.3 (56 individuals) of the respondents yield enough for 31-60 households and below. A small share, corresponding to 20% (30 people total), indicated their annual yields to be sufficient for 61 to 90 households. Nevertheless, none of the interviewees could provide yields able to support even 91 households. As for income or revenue from farming as the main occupation, most respondents (39.3%, 59 individuals) have ranges of 1,001 USD to 5,000 USD. Then, there are 32.7% (49 individuals) reported 5,001 USD to 10,000 USD. A smaller number (27.3%, 41 individuals) of people indicated that they were paid an amount lower than USD 1000 per year. Interestingly, 0.7% (1) of the respondents here exceeded 10,001 USD in annual income earned from their farm. Such results reveal the major role of the agriculture section as one of the main sources of the livelihood of these families in the region. They also indicate the weaknesses in production yields and earnings levels among farming families.

Farmer Perspectives: Insights into Land-Sparing Practices

Table 7.

Understanding and Application of Land Sparing in Agricultural Practices: Awareness, Attitudes, Observations, Utilization, and Perceived Yield Differences

Theme	**Variable**	**Frequency**	**Percentage**
Awareness of Land Sparing Concept	Yes	27	18
	No	123	82
	Total	**150**	**100**
Attitudes towards Land Sparing Practices	Agree	27	18
	Strongly Agree	66	44
	Disagree	38	25.3
	Strongly Disagree	19	12.7
	Total	**150**	**100**
Observation of Land-Sparing Practices	Yes	65	43.3
	No	81	54
	Not Certain	4	2.7
	Total	**150**	**100**
Utilization of Land-Sparing Principles in Farming	**Yes**	79	52.7
	No	71	47.3
	Total	**150**	**100**
Perceived Differences in Agricultural Yield	Yes	97	64.7
	No	53	35.3
	Total	**150**	**100**

Table 7 shows the results of farmer's perception of land-sparing in Lofa County, Liberia on the questions related to awareness, agreement, observation, implementation, and expectation towards the principles of land-sparing. Thus, the respondents' knowledge about land sparing is low: only 27 of them (18% of the total number) have heard about it, while 123 respondents (82%) are not familiar with this concept. However, the respondents in the majority of 62% either agree or strongly agree that land-sparing preserves natural forest habitats for animals and uses non-natural forest habitats for agriculture and other uses. Respondents' exposure and acquaintance with land-sparing actions or practices within the community was also determined and the

outcome was as follows: yes=65(43.3%), no=87(56.7%). This acknowledgment depicts some level of implementation in the community. However, when asked whether their farming practices employ land-sparing approaches, the majority (52.7% or 79 participants) said yes though they indicated this could be a matter of 'lip service. ' In the same regard, 64.7% (97 individuals) of the respondents indicated that there will be a difference involving agricultural yield or production on account of the land-sparing as compared to traditional farming while 35.3% (53 individuals) hold the opposite opinion. These observations speak to the complex realities and multifaceted approaches towards implementing land-sparing ideas among farmers in the region, stressing the need for well-coordinated and highly pointed sensitization exercises, training, institutional support, and further enhancement regarding said principles and practices of sound land use among the farmers.

Table 8.

Farmer Perceptions of Agriculture Yield & Challenges (Questions 6-7)

Theme	**Variable**	**Frequency**	**Percentage**
Perceived Comparative Agricultural Yield	Land Sparing	69	46
	Traditional Farming	81	54
	Total	**150**	**100**
Challenges to Land-Sparing Practices	Lack of Expertise in land-sparing	21	14
	Lack of sufficient Economic Power or funding	79	52.7
	Lack of agro-industrial practices in agriculture in Liberia	50	33.3
	Other	0	0
	Total	**150**	**100**

Table 8 presents farmer's perceptions of yield and explains what are the challenges that are involved in the implementation of land-sparing practices in Lofa

County, Liberia with respondents' opinions on yield expectations and farmers' notions as to what can prevent the implementation of land-sparing practices. Let us consider those who answered yes to the question (Question 5 in Table 12) regarding whether, in their mind, agricultural yields that land-sparing are comparable or better to traditional farming techniques. It is clear from the data that 54% of the respondents (81 individuals) believe that traditional farming methods result in a higher yield as compared to land-sparing. Rationally, the other hand, 46% of the survey respondents (69 individuals) assert that land-sparing methods improve food yields. The diversity of attitudes towards productivity outcomes demonstrates the robustness of the technologies and leads to a conclusion that the social factors should be studied deeply to reveal the influences on farmers' yield expectations. Beyond that, the surveyed persons were asked about what they believed was the major problem as well in implementing land-sparing practices in the region as in Liberia, of which 52.7 of them (79 individuals) touched on it being lack of economic strength or the funds, while 14% (21 individuals) stated it was because they are lacking expertise in land sparing. 35.3%, (50 people) see naming agriculture in the country to be one of the major problems because of the absence of agro-industrial practices. This denotes a complex situation of barriers the land-sparing policy would encounter, such as inadequate funds, knowledge, and institutional gaps therefore the policymakers need to find a way to address these barriers to ensure more sustainable development and conservation of lands within the region.

Table 9.

Perceptions of Cutting and Burning Natural Forest Habitats for Agricultural Purposes

Theme	**Variable**	**Frequency**	**Percentage**
Perceptions of Deforestation Safety	Yes	93	62
	No	51	34
	Do not know	6	4
	Total	**150**	**100**
Perceptions of Personal Obligation for Forest Conservation	Yes	106	70.7
	No	44	29.3
	Total	**150**	**100**

Table 9 analyzes farmers' opinions in Lofa County, Liberia on chopping and burning natural tree habitats for agricultural purposes, paying attention to safety issues, and following tradition to save forests. The data shows that a large credible majority i.e. 62% (93 people) thinks that cutting down and burning the areas of natural forest for cultivation purposes is safe while, contradictory to this notion, just 34% (51 people) think otherwise. Along with that figure, 4% of our participants (6 individuals) reported being uncertain of the security of these techniques. The question of what's perceived as sustainable and elite often stands for different attitudes towards risks and environmental impacts stemming from traditional agriculture policies like 'slash and burn'.
Furthermore, in response to the question concerning their rationale of responsibility for preventing the forest loss, a large number (70.7%, 106 persons) of the respondents felt obligated to prevent the forest loss while only 29.3% (44 persons) did not think like that. The result shows a good level of consciousness among the respondents as regards forest conservation, and this can be an indication that people might be quite ready to listen to conservation initiatives or attend sustainable land management programs.

Table 10.

Perceptions of Land Sparing and Forest Prevention Teaching Quality

Theme	**Variable**	**Frequency**	**Percentage**
Perceptions of Safety and Effectiveness of Land-Sparing Principles	I slightly agree	5	3.3
	Fully agree	46	30.7
	Neutral	36	24
	I slightly Disagree	13	8.7
	I fully Disagree	50	33.3
	Total	**150**	**100**
Perceptions of Quality of Education on Forest Prevention and Land Sparing	Very poor	17	11.3
	Poor	80	53.3
	Adequate	38	25.3
	Good	15	10
	Excellent	0	0
	Total	**150**	**100**

Table 10 provides an overview of farmer perceptions of the quality of teaching involving forest immunity and land sparing in Lofa County, Liberia. Participants were asked to give their opinions on the safety and effectiveness of land-sparing ideas for agricultural production and forest preservation. In addition, the specific teaching methods used and the teacher's competence also surface in their responses to the survey. The results suggest a mixed reaction from respondents towards sustainable land-use principles including land-sparing and its application thus, 34% (51 people) agreed either entirely or respectively on the safety and functionality of land-sparing in crop and forest production Thus, on the flip side of that, 24% (36 individuals) were somewhat or very disagreed, and 44% (63 individuals) stood in a place of not knowing. However, these results come to show that such a decision is associated with a bit of doubt as well as inconsistencies and peoples' perceptions about whether the practice of the land-sparing technique is the right one for balancing food production and forest conservation. Also, the results for the surveying of all participants showed that most of them (64.6%, 97 individuals) graded the quality of the teaching on forest prevention and land sparing as either poor or very poor and a small part (10%, 15 people) gave it the highest grade, followed by average (25.4%, 38 individuals. This information echoes the necessity of the improvement of the educational programs and capacity-building procedures aimed at increasing the understanding and developing the willingness of the farmers to implement environmentally friendly strategies within the region. This will help pinpoint the most appropriate interventions that will allow for knowledge gaps elimination and integration of the elements of the more effective conservation strategy.

Farmer Perspectives on Forest Degradation in Lofa County, Liberia

Table 11.
Concerns about Forest Degradation

Theme	**Variable**	**Frequency**	**Percentage**
Concerns about Forest Degradation Consequences	Yes	122	81.3
	No	28	18.7
	Total	**150**	**100**

Table 11 explores the farmer concern regarding the forest degradation scenario in Lofa County of Liberia particularly the perceptions towards the complete forest degradation. In this regard, it is necessary to stress that the concern rate in this sphere has significantly increased among the respondents: out of 150 participants, 81.3% or 122 people are concerned about the possible outcomes in the case of total forest depletion, whereas 18.7% or 28 people are hesitating in this matter. This high level of concern marks the appreciation of farmers due to averted appreciation of the need for forests to support the health and sustenance of the farming system, and ecosystem services including climate regulation, water purification, and conservation of biological diversity. These conclusions all but call for the preservation of forests and combining efforts to support sustainable management of the land to prevent negative effects on the environment and preserve the native residents' health.

Table 12.

Stakeholders Responsible for Forest Protection

Variable	**Frequency**	**Percentage**
Central government	6	4
Provincial government	0	0
Local government	0	0
Ministry of Agriculture	12	8
Environmental Protection Agency	17	11.3
Forestry Development Agency (FDA)	52	34.7
Industries	0	0
General public	0	0
All Stakeholders	63	42
Other (Specify)	0	0
Total	**150**	**100**

The responsibilities about forest protection in Lofa County, Liberia, are described in Table 12, highlighting the dispersed distribution of the task among different organizations. The data shows that the Forestry Development Agency (FDA) emerges as

the principal stakeholder with 34.7% (52 people) of the respondents pointing an accusing finger at the organization. The central government transpires also as a minor stakeholder, 4% (6 individuals) respondents took it as a responsibility. The Ministry of Agriculture and the Environmental Protection Agency though are conspicuously mentioned, at a reduced rate of 11.3% (17 individuals) and 8% (12 individuals) respectively, with the former being considerate of forest protection leading to the latter's. Interestingly, the respondents given as 42% (63 individuals) consider the entire group of stakeholders (governmental and non-governmental entities) as responsible and it demonstrates joint responsibility among them. First of all, not any of the respondents mentioned the provinces or the local governments to be responsible or the industries, which could mean a lack of awareness in the role played by them in forest protection. The outcomes highlight the need for delineating of roles and responsibilities among different the parties, promoting cooperative and collaborative efforts, and building up the capacity of the institutions to solve the deforestation and sustainable forest management in the region.

Table 13.

Perceptions of Land Sparing Importance and Sustainability

Theme	**Variable**	**Frequency**	**Percentage**
Perceptions of Importance of Land Sparing for Forest Health	Unimportant	20	13.3
	Of little importance	56	37.3
	Very important	70	46.7
	Do not know	4	2.7
	Total	**150**	**100**
Perceptions of the Sustainability of Land Sparing	Yes	91	60.7
	No	47	37.3
	Do not know	3	2
	Total	**150**	**100**

Table 13 shows farmers' points of view about the absolute importance of land sparing in the maintenance of healthy forests and the well-being of the population in Lofa County, Liberia. The analysis reveals diverse views on the usefulness of land sparing for healthy forests, among which opinions of 84% (126 individuals) think it of little and very important for a healthy forest. A limited 13.3% (20) believed land sparing is unimportant to a healthy forest, while 2.7% (4) were uncertain. With regards to land sparing in ending deforestation and food security respondents 60.7% (91) think that it is sustainable for ending forest degradation and food insecurity. About a fifth of respondents (2%, 3 individuals) indicate reservation in the matter of the reliability of land sparing for controlling the degradation of forests and food insecurity. Moreover, a significant percentage of the respondents (37.3%, 47 people) revealed that they do not believe that land sparing is a sustainable option to end forest degradation and food insecurity. These findings show the complexity of land use in this part of the world and drive home the need for more dialogue and educational programs to equip farmers with enough knowledge to make balanced decisions, as doing so will promote a symbiotic relationship between protecting natural resources and food security.

Table 14.

Importance of Monitoring in Farming Methods and Forest Loss

Theme	**Variable**	**Frequency**	**Percentage**
Perceptions of the Importance of Forest Loss Monitoring	Unimportant	41	27.3
	Of little importance	43	28.7
	Very important	66	44
	Do not know	0	0
	Total	**250**	**100**
Perceptions of the Importance of Monitoring Farming Method	Unimportant	47	31.3
	Of little importance	35	23.3
	Very important	68	45.4
	Do not know	0	0
	Total	**250**	**100**

Table 14 focuses on the views of farmers about the importance of monitoring forest loss and farming practices in Lofa County, Liberia. The data reveals that over two-thirds of respondents (72.8%, 109 individuals) consider monitoring forest loss extremely essential marking the recognition of the significance of tracking changes in forest cover for conservation efforts and environmental management while 27.3% (41) finds it unimportant to monitor forest loss. Likewise, more or less half of the respondents (68.7%, or 103 persons) mark monitoring farming methods as very significant emphasizing the awareness of the need to monitor these practices for support of sustainable land management and productivity. However, in the case of monitoring farming approaches, fewer respondents 31.3% (41) enlisted them as unimportant or of minor priority. The presented data highlights the significance of the well-designed monitoring and evaluation tools in the agricultural and environmental management ventures and therefore the necessity of supporting capacity building along with investing in monitoring technologies and stakeholder engagement to facilitate effective decision-making and sustainable development in the region.

Qualitative Study Findings

Insights into Farmer Perspectives on Land Use and Conservation

Table 15.

Government Policies and Agricultural Practices: Farmers Perspectives

Question	Key Themes and Codes		Frequency	%
1. Government monitoring of crops produced, quality, and quantity in your region.	Yes, there is government monitoring		8	32
	No, there is no effective government monitoring		17	68
	Total		25	100
2. Land-sparing a viable option for ending deforestation.	Yes, land sparing is viable.	Offers better forest protection Offers sustainable farming practices	8	32
	No, land-sparing is not practical in our region.	Due to socio-economic constraints	**7**	**28**

		Due lack of awareness makes it not viable		
	Uncertain or mixed views on viability.	Could be but there is a need for further research	10	40
		There may be potential benefits and drawbacks		
	Total		25	100
3. Can the land-sparing method better solve food insecurities in your region or Liberia?	Yes, land-sparing can better solve food insecurities.	Offers diversified crops	8	32
		It increased yields		
	No, land sparing may not address food insecurities effectively (e.g., limited access to resources, market challenges)	Due to limited access to resources	14	56
		Due to several market challenges, it can not.		
	Uncertain or mixed views on effectiveness.	There is a need for supportive policies	3	12
		There is a need more community engagement		
	Total		25	100
4. Should the Liberian government issue permits to individuals before they can carry out extensive farming activities?	Yes, the government should issue permits.	There should be regulation	6	24
		There should be environmental protection		
	No, the government should not impose permits in our context.	Due to limited resources it will impact livelihood	15	60
		Would present , bureaucratic hurdles		
		Would Create Land tenure and access issues.		
	Suggestions for alternative regulation approaches.	There is a need for a community-based management instead permit issuance.	4	16

		There should be incentive systems instead.		
	Total		25	100
5. Should the government ban using natural forest habitats for agriculture and logging purposes?	Suggestions for sustainable forest management.	The government should focus on agroforestry.	8	32
		There should be selective logging.		
	No, a ban on forest use may not be practical in our region.	Due to livelihood dependence.	17	68
		Due to a lack of alternatives.		
	Total		25	100

The data from the interviews with the farmers in Lofa County, Liberia is displayed in Table 15. The data presents the farmer's perspectives on agriculture, land sparing, control by the government, and forest management. On government monitoring of crops' quality, quantity, and region's productivity, the majority answered (68%) that there is a huge lack of effective governmental monitoring systems in this area and underscored the fact that there is a shortage in agricultural practices' oversight and accountability. About whether the land-sparing strategy is needed to end deforestation, opinion was diversified, with almost half (40%) showing mixed or unclear stands, so demanding more research and evaluation of the advantages and disadvantages. However, as regards the opinion among the respondents that land sparing can help address the food security situation, they are also divided with 56% of them not confident of this mechanism, and they cited reasons such as limited access to resources and market constraints. Also, different people were against or for issuing permits 60% to prove that farming is the main factor that has affected the ecosystem as suggested that other regulation strategies could be used instead of these permits like community-based management. To the contrary, no interviewees advocated for a total ban on the utilization of forest habitat for agriculture and logging purposes. On the other hand, the largest proportion (68%) of the sample rejected the impossibility of this ban, bearing in mind the complexity and challenges of dependability on livelihood and the unavailability of good alternatives. Based on the outcomes the various homogeneous

points of view and intricate cognitive processes concerning agricultural activities, land management, and government interventions are explicitly illustrated in the region, suggesting that local knowledge needs to be considered and all the stakeholders should be engaged in the design and the implementation of sustainable land use policies and actions.

Notable Comments from Interviewees

"Where officials were checking out crops for standardization and prevention of the spread of diseases or contaminants, I was able to witness it through my watching eyes. That they did was really great as that supports the customary quality of agricultural products".

"Producing agricultural yields on smaller areas through land sparing is a relatively new approach, which helps to achieve the dual objective of demonstrated productivity and biodiversity conservation as well as diminishes the problem of deforestation".

"For the problem illustration, the use of land sparing as the major solution may disregard the contextual matters such as land tenure conflicts and market dynamics as the veritable causes of forest degradation. This may call for a systemic approach. "

"To me, the idea of land sparing is like the path of less spoiled earth and more cropland, while at the same time, reducing the harmful environmental side effects generated by traditional farming techniques".

"Given my concern about food insecurities I wonder about the merits of land sparing when it's not coupled with poverty elimination and other drivers like land ownership and market entry".

"While to the best of my knowledge the multi-faceted nature of this challenge integrates different elements which may hamper the ability of land sparing alone to solve food throughput, I agree that land sparing can be viewed as one of the components of myriad solutions".

"As a farmer advocate willing to secure the existence of agriculture for a long time, I believe the government should grant the necessary permits for regulating land use and prevent abuse such as conversion of forests and natural habitats into farmlands without careful planning".

"There exists possibility of instituting permits for massive agricultural activities with perhaps the undesirable outcome of creating barriers to entry for smallholder farmers and the marginalized people in the society what may translate in their absence of proper access to and livelihood chances on land".

"Encouraging a shift towards sustainable forest management techniques which include agroforestry and selective logging can work to keep forests in an ecologically sound condition while satisfying the socio-economic needs of the indigenous communities who inhabit them".

"Lumbar use ban implementation without measures to support and provide alternative income opportunities to affected population is unpractical as forest-based livelihoods are the only reasonable alternatives for now".

Figure 1.

Government Policies and Agricultural Practices: Farmers Perspectives

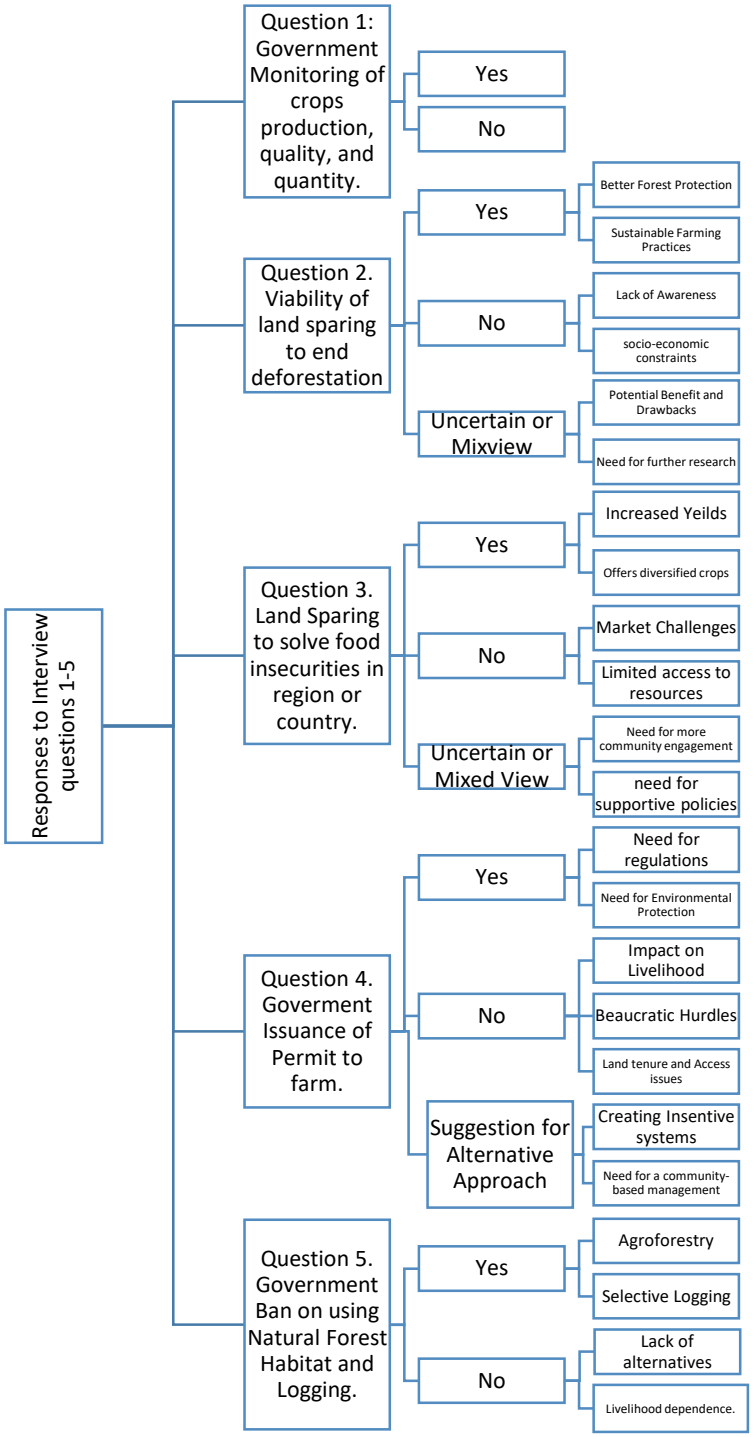


Table 16.

Attitudes and Perspectives on Agricultural Practices and Land Use Decision-Making

Question	Key Themes and Codes		Frequency	%
6. Should fines be imposed on farmers who cut or burn the forest for agricultural use?	Yes, fines should be imposed as a deterrent	Discourage illegal practices Promote compliance	3	12
	No, fines may not be effective due to socio-economic factors.	Poverty Lack of enforcement	22	88
	Total		25	100
7. With the growing demand for food, does land sparing provide a better chance of meeting the food demands?	Yes, land sparing offers a better chance.	Sustainable land use Increased productivity	8	32
	No, land sparing may not adequately address food demands.	Due to lack of infrastructure Lack of adequate market access	14	56
	Uncertain or mixed views on effectiveness.	Need for holistic approaches Need for Community Involvement	3	12
	Total		25	100
8. Do you think the demand for food contributes significantly to the expansion of farmlands, resulting in forest cut down and burning?	Yes, food demand significantly impacts forest loss (Because the more demand the more you increase farm size to grow more crop).		16	64
	No, other factors contribute more significantly.	Infrastructure development	9	36
		Logging and Land Speculation		
		Weak governance		
		Mining activities		
	Total		25	100

9. Which do you think is cheaper in the agricultural production of cash and food crops? Land sparing or natural forest habitat farming?	Land sparing is generally cheaper	Reduced input costs	4	16
		Provides long-term sustainability		
	Natural forest habitat farming is often cheaper due to traditional practices.	Lower initial investment	21	84
		Reliance on natural resources		
	Total		25	100
10. Do you think the size of the farmland is directly proportional to the production?	Yes, farm size correlates with production to some extent.	Economies of scale	17	68
		Efficiency		
	No, other factors also play significant roles in production.	Soil quality	8	32
		Water availability		
		Farming techniques		
		Climate		
	Total		25	100

Table 16 shows Lofa farmers' answers about cultivation techniques, production reduction, forest management, and food security in Liberia. Regarding the introduction of fines for farmers who use forests for agricultural purposes by cutting or burning them, the overwhelming majority (88%) disagreed, emphasizing that the measure is doomed to fail since green areas are widely used by those who live in poverty or even have no money and cannot pay fines. On the other hand, a few (12%) of them found fines also a probable means (a deterrent) to stop unlawful activities and encourage compliance with the rules. While respondents were divided, with 56% displaying a certain amount of skepticism about making this statement, based on factors like inadequacy of either infrastructure or market access. On the other hand, some (32%) of the participants trusted land sparing as a better alternative, whereby sustainable agriculture with increased land productivity will be the solution for the food demands. The farmlands expansion as a result of increased food demand as a reason for forest loss was raised, with 64% agreeing on the major creation of such impact on forest loss.

Contra distinctly (36%) of the respondents pointed to deforestation behaviors that include infrastructure development and mining activities. In the question of which type of agriculture is more economically viable: between land sparing and natural forest habitat, the majority (84%) of the participants argued that natural forest habitat is

cheaper as it is based on existing, traditional practices and has lower initial costs. However, the contrary 16% opinion on land sparing was the cheapness of the method owing to a reduced purchase of inputs and sustainability assurance in the long run. The last thing to mention is the views about the connection between the size of the farm and the production. Among the participants, 68% were very sure of this link, while 32% insisted that other critical factors were also important, such as the quality of soil and farming instructions. These results underscore the complexity and diversity of viewpoints among farmers concerning land management, agricultural practices, and food security in the area, underscoring the necessity of stakeholder engagement and context-specific approaches in tackling issues related to sustainable land use and conservation.

Notable Comments from Interviewees

"Fines for farmers who become involved in deforestation by cutting down or burning part of the forest for agricultural activities is inevitable to discourage practices that destroy the environment and promote responsible use of land".

"Fines on farmers could be an aggravation of the poverty situation and even social inequality, which is accompanied by a punishment of those who make a living from forest resources without leading to the solution of the causes that have helped the destruction of forests".

"Many people clear the forests or make fires because they are obliged by these things, such as scarcity of land, poverty, and absence of more workable alternatives. Therefore, this makes it wrong to put fines on such people".

"Land sparing is highly desirable in the increasing food demand challenge as it helps to maximize the land allocation efficiency by developing smart agricultural practices that boost yields and minimize environmental degradation".

"A two-pronged approach in which we focus on saving intact habitats while intensifying agricultural production on the already existing farms can help stave off hunger without consuming more land which is forested and in its natural state".

"With examples of location cases of inadequate infrastructure and market access increasing the agricultural productivity alone may not be sufficient to make food

availability and affordability in such cases distribution and accessibility can still be a big deal".

"How effective land sparing is contingent upon a lot of factors such as governance, market situations, and socio-economic conditions, which might bring about difference in context and regions".

"The conflicting opinions about the feasibility of area diversion as a way to produce food for meeting the demands presents a complicated problem that advises a location-specific analysis that takes into account local circumstances and priorities".

"Its simple link to the food demand and forest cover loss is shown through the deforestation of forests for setting up of farms as a way of meeting the needs of a large population".

"Nevertheless, along with food consumption, the factors including road building, urbanization, and industrial activity are major causes of deforestation, since deforestation occurs mostly in the areas of the world experiencing the quickest economic transformation".

"Notwithstanding the genus causing or irresistible need for food, other issues including insecure land tenure, weak governance and unsuitable practices governing land use have huge impacts on forests".

"In land-sparing allocation, commercial farming can be highly cost-effective since it ultimately allows for efficient utilization of inputs and resources, hence helping in lowering production costs over".

"As far as the land-sparing strategy is concerned, land conversion is focused on existing agricultural lands and avoids new forest habitats. Consequently, minimum land use and construction is needed which results in low initial investments".

"One of the reasons this kind of activity is cheaper because it is more of a dependent on traditional knowledge and less on technology is because you save on money being used on acquiring inputs and other technology".

"In most cases, big farmlands are the appropriate place to conduct economies of scale by investing in such farm mechanization, irrigation, and other tools that can be used to raise farm productivity".

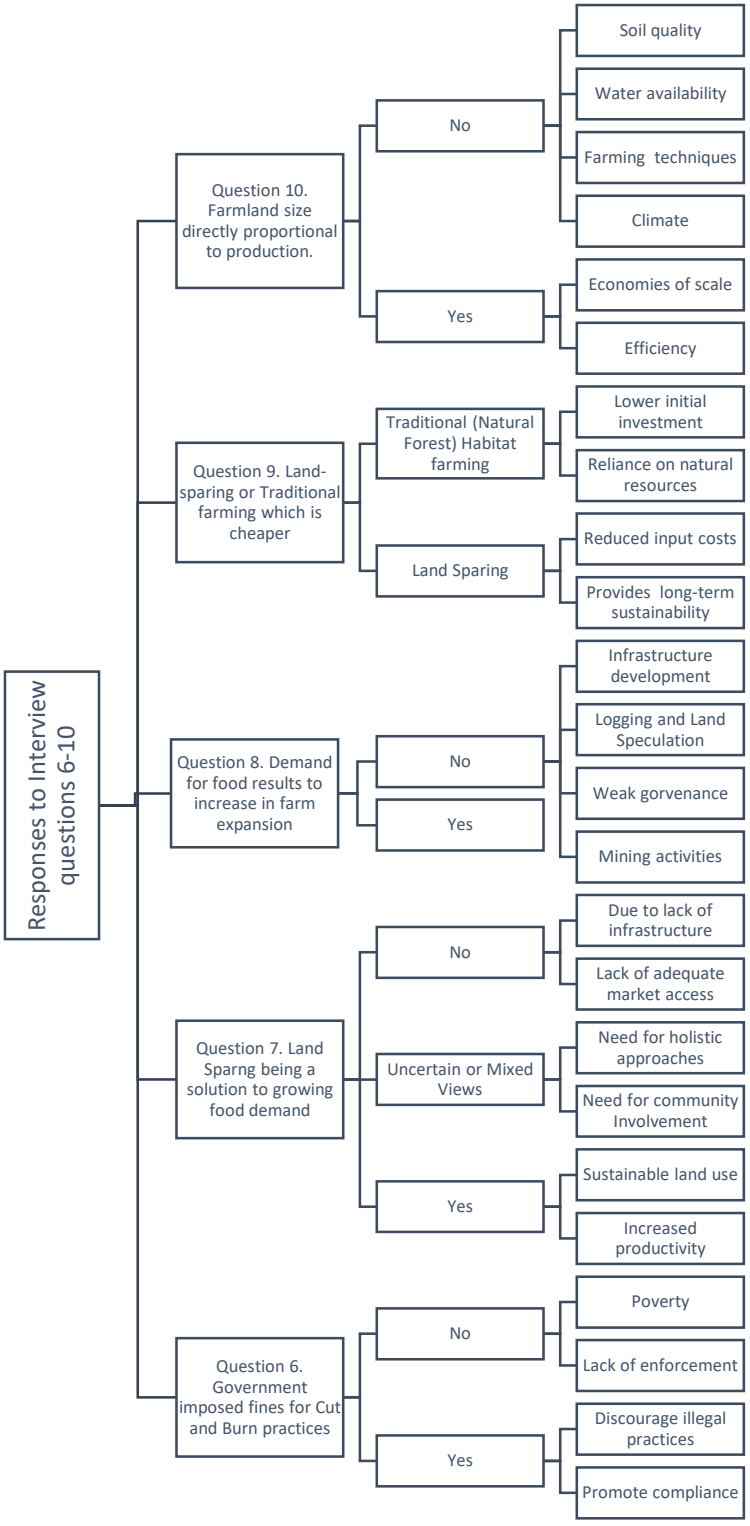
"One of the presumptions is that a larger-sized farm will provide more production quantities as a result of the possibility of adopting more intensive farming practices, using resources in a fuller manner within a wide-area enclosure".

"Farm size is surely a determinant in the levels of output but is by no means the most influential element. Other factors like soil fertility, climate, water supply, and farming techniques have an even bigger influence on agricultural productivity".

"The correlation between farm size and production is multiple and location-specific, while the attributes such as the administration practices, production materials consumption efficiency and market exposure are vital in determining the production rate overall".

Figure 2.

Thematic Map Presenting Attitudes and Perspectives on Agricultural Practices and Land Use Decision-Making



CHAPTER V
Discussion

Farming Practices, agriculture Landscape, and Cultivation

The information from Table 1-4 about agricultural practices and crops grown by study participants is summarized in the agricultural landscape of Lofa County, Liberia. Respondents a majority indicated that commercial farming was a preferred practice meaning that commercial farming practice remains dominant. Not surprisingly, the finding blends with high-level studies done in regions inhabited by commercial farmers like those of sub-Saharan Africa, where commercial farming has been observed to play a key role not only in driving economic growth but also in livelihood improvement (Barrett et al., 2010). Nonetheless, this traditional mode of farming practiced by the remaining respondents is evidence of the co-existence between modern practices and traditional ones and the overall agricultural livelihood dynamics in the area. The cropping patterns in Table 2 also reflect the varied agricultural landscape of Lofa County, and it turns out that a variety of both cash and food crops are cultivated there. The fact that major edible crops cultivated in this region are many including rice, cassava, plantain, sugarcane, and sweet potato just shows how important food security and self-sufficiency are for the local agricultural system. Such a vision is consistent with the conclusions drawn from several studies on agricultural diversification in developing countries where a well-balanced mixture of staple and cash crops often helps to provide food security as well as income stability (Lowder et al., 2016).

On the other hand, the use of natural forest habitats of rice and farming land including swampland and the rainforest, which is in Table 3, shows how agriculture and environmental conservation are closely related in the region. Studies conducted in tropical forest regions similarly point to a clear incapacity of agricultural practices to avoid conflicts with forest habitats, thus stressing the need for sustainable land-use approaches to counteract deforestation and prevent biodiversity depletion (Angelsen et al., 2014). As seen in Table 4, the farming practices are seen to be mainly traditional, using methods such as slash and burn and crop rotation. This finding also confirms the general pattern indicated by earlier research on agricultural development that despite

coming up with new agricultural technologies and best practices, poverty is still prevalent in some developing countries due to the lack of implementation (Pretty et al., 2018). The low implementation levels for modern sustainable farming methods such as agroforestry systems and conservation agriculture have created openings for training and transferring of knowledge programs which in turn aim at mainstreaming the environmentally friendly and resource-dues farming models. In general, the data in Tables 1-4 depict the agrarian environment in Lofa County, Liberia as one that is multi-faceted, which comes down to the fact that traditional and commercial farming exist side by side, the importance of diverse crops in food security and the need for sustainable land-use management strategies to allow agricultural production to happen even so we want to conserve our environment.

Farmer Perspectives: Insights into Land-Sparing Practices

The results from Table 7 demonstrate that farmer views on land-sparing practices in Lofa County of Liberia are complex and lend themselves to further exploration. On the positive side, however, a small but substantial proportion of the survey participants indicate that they have a good grasp of the idea. On the flip side, a greater percentage of the respondents do not even know the concept. Notwithstanding these, amongst this group, there have been widespread opinions about the advantages accruing from the practice of land sparing, predominantly, in the conservation of natural forest ecosystems. This goes in line with the previous studies which demonstrate the necessity of deliberate efforts in promoting conscientization and sharing of sustainable land management practices among rural communities. (Ouedraogo et al., 2009; Chalchisa and Sani, 2016) The contrast between consciousness and adopting the strategies shows the gap that is essential to building the capacity of farmers to make agricultural communities adopt the cited land-sparing strategies Phalan et al (2011). Table 8 ventures into the obstacles accompanying the execution of the land-sparing strategies, giving rise to different points of view on agricultural yields and failures for adaption. The different experiences of farmers concerning productivity results make us think of the necessity for a whole spectrum of social factor analysis that influences the judgments of farmers (Vinceti et al., 2013). These constraints which are economic and

lack of expertise were found to be the same with reports in other regions, therefore, pointing to the necessity for context-specific solutions in addressing the barriers (Castro et al., 2015).

In Table 9, farmers' point of view on native vegetation's cutting and burning approaches mentions the different perspectives of risk and conservation issues. This emphasizes the role of clearing out misinformation and communication as a top priority when building land-management strategies based on environmentally friendly principles. The fact that community members are aware of the need to preserve the forest and are receptive to conservation initiatives is a clear indication that they support the regenerative management of the land. In this regard, local communities should be engaged in the process of promoting sustainable land management (Vinceti et al., 2013). Table 10 demonstrates a lot of diversity in the evaluation of the quality of instructional programs on land-sparing techniques and forest conservation. This represents a gap that should be filled to provide improved educational programs and capacity development. These results highlight once more the necessity of immersing farmers in practices that are environmentally friendly and will make them glad to adopt them voluntarily. Secondly, it emphasizes the need for policies that are highly focused on addressing knowledge gaps in understanding ecological conservation strategies within the region (Ouedraogo et al., 2009; Phalan et al., 2011). Through this, the leaders of the country can be able to control the threats that come with land use and therefore they can highly encourage effective conservation, not only in Lofa County but also in the entire country.

Farmer Perspectives on Forest Degradation in Lofa County, Liberia

Table 11 demonstrates farmers' concerns in Lofa County, Liberia on forest degradation and their opinion about the implications in case they are degraded with irrefutable opinions among the respondents (Table 11). The resolutions of these studies correlate to many others which show clearly that there is a crucial link between the state of health of forests and the overall well-being of humans (Angelsen et al. 2014). Farmers' concern of forest degradation along with the necessity for the combination of efforts that seek to solve this problem and promote sustainable land management practices has radically been brought to the fore. Collaborative undertakings that bring

together both governmental and non-governmental players are an indisputable fact for forest protection and conservation to be indeed successful (Adhikari et al., 2004). Whereas the most obvious omission is the complete absence of information regarding the roles of local governments or industries, this gap also highlights the fact that public awareness is still lacking about the roles of various stakeholders in forest protection campaigns, and this necessitates advocacy efforts and capacity-building initiatives targeting such stakeholders (Sunderlin et al., 2005). Detailing of the farmers' opinions on the relationship between land sparing and the sustainability of forests and food unrest in Lofa County, Liberia are described in Table 13.

The mix of views among respondents must be seen as the counterpart of the environment/agriculture relationship, balancing conservation needs and agricultural necessities in the same area. Although many people believe that land sharing has the potential to minimize the rate of deforestation and food insecurity, a good number of them feel unsure about the productivity of land sharing. These results correlate with the findings that reached the overriding conclusion which emphasizes the problem of balancing conservation with agricultural activities in forested regions (Kremen et. Al., 2012). To the highest level, communication and educational programs need to be effective for farmers to acquire comprehension as well as to promote the adoption of sustainable soil management practices (Fischer et al., 2017). Through supporting conversations and giving farmers valuable tools and knowledge, stakeholders can make more insightful decisions and pave the way for the integral balance of agriculture with environmental conservation.

Table 14 solely concentrates on farmers' perceptions about the role of monitoring farmlands and forests, which are significant in Lofa County, Liberia, and respondents believe that tracking changes in forest cover and farming design is very important. The same results emphasize the fact that good monitoring and evaluation systems are among the support tools for sustainable land management and environmental conservation policy (Lindenmayer et al., 2012). The fact that monitoring has a big prominence in the outline is because farmers are getting more and more aware that they need to assess the effects of the applied agricultural practices on ecosystem health and productivity. Nevertheless, the area of monitoring allocated is smaller

compared to the area allocated for forest loss is an indicator of the need to invest more in monitoring technologies and stakeholder collaboration leading to timely and right decision-making and sustainable development in the region (Ewers et al., 2015). By tackling the problems and ensuring that the stakeholders work together, the policymakers can collaborate to help the creation of more sustainable land management practices with better conservation results not only in Lofa County but also in the whole country.

Insights into Farmer Perspectives on Land Use and Conservation

The farmer interviews across Lofa County, Liberia, as indicated in Table 15, highlighted multidimensional views that covered agriculture, agricultural expansion, government involvement, and forest conservation. The unanimous opinion on the inefficacy of the governmental systems of monitoring is harmonized with the previous research emphasizing challenges to governance and oversight within agricultural sectors (Adhikari et. Al, 2004; Fischer et.al, 2015). Hence, the debate about whether land sparing can contribute to the end of deforestation majority highlights the fact that conservation strategies are context-specific and therefore might be evaluated differently in varying socio-economic contexts (Phalan et al., 2011). This division among respondents concerning the role of land sparing in tackling food security are clear manifestation of the level at which people understand the complex relationships between the choice of land-use practices and factors such as resource access and market constraints (Kremen et al., 2012). Beyond that, the majority share the sentiment that forest harvesting and agriculture should not be banned completely reflects an intricate balance of conservation situation and livelihoods, and it is supported by the findings of Vinceti et al. (2013) about the role of local knowledge stakeholders' participation in the sustainability of land use policy design. Moving to Table 16, the same table that explains Lofa farmers' perspectives on cultivation techniques, production reduction, forest management, and food security, the top of the table highlights the overwhelming disapproval for the introduction of the fine system for the forest use in agriculture, among others, emphasizes the socio-economic backgrounds that shape land-use behavior, especially within the Besides this, a small group of people with the idea of

fines being a deterrent (Fischer et al., 2015) represents the ambiguity of opinions on the efficiency of using regulation measures. The majority of the respondents share that land sparing, which can be a solution to the forest use for agriculture is not free from mistrust as such it overlaps with infrastructure and market access. It echoes what the literature on the social-economic determinants of decision-making over land has found out (Kremen et al., 2012). Furthermore, the majority of the respondents show links between farm delineation and forest destruction as they highlight the underlying socio-economical dynamics behind land degradation, like those presented by Kremen et al. (2012) on the relation of agricultural expansion and biodiversity loss.

Whether the economic merit of the land-sparing approach or traditional agriculture, with the vast majority of respondents favoring the economical land-sparing nature-based agriculture system, shows how the initial costs and the current status of farming are the crucial factors (Miralles-Wilhelm, 2021). Nonetheless, although the minority perspective on the potential costs to growers of conservation approaches as a result of input purchase and long-term sustainability still points out the alternative views concerning the efficiency of nature conservation, the conservation-oriented approaches remain topical. Lastly, the contestants differed substantially in terms of the relationship between production and farm size. It emphasizes that a balance of soil quality and farming practices is necessary to ensure productivity in agriculture (Kremen et al., 2012). Altogether, the findings illustrated the importance of integrating the interdependent relationships and the uniqueness of each situation in finding lasting solutions for this region and sustainable development.

CHAPTER VI
Conclusion and Recommendations

Conclusion

To conclude, its results are more specific than just understanding the demographics, agricultural practices, perceptions, and constraints of the farmers of Lofa County in Liberia. Research questions established at the beginning have been articulated and fully explored, giving us knowledge of different aspects related to agriculture, land, and the environment in the area. After an all-encompassing analysis of different data collected in the study that was implemented in Lofa County, Liberia, a multifaceted report of the agricultural image together with farmers' perceptions have been developed. The study strictly demonstrates the compelling concurrence among the management of rural dairy, land, and socio-economic dynamics that contribute to the region's agricultural activities. The study brings a striking gender gap regarding the population sample between males and females representing a much bigger quantity. This demographic classification, therefore, implies probable variations in resource access, control of decision-making, and related agricultural activities between the two genders. What is more, the bulk of respondents are aged between 31 and 50 years which indicates that the farming population is of mature age, actively participating in different kinds of agricultural undertakings making it possible to have a passage of knowledge from one generation to the next and succession planning thus ensuring that the farming practices will be sustained.

Education levels among the surveyed population differ, which proves a very diverse educational environment in the study region. The fact that the majority of respondents who were asked are married depicts the fact that rural farming in this region is family-centric where farming activities are mostly a collective effort and there is a fair distribution of responsibility in families. As well, members of the farm community from different ethnicities can show one of the great factors of multiculturalism existing in Lofa County. Mainly for commercial farming, the region's agriculture practices are based. Farming is dominated by subsistence agriculture. The primordial culture of staple food crops like rice, together with cash crops credit includes cocoa, coffee, oil palm, and

rubber, represents the economic power and agricultural diversity within the region. The retention of natural forest habitats for farming purposes, especially those located in swamp and rainforest biomes, indicates the fine balance between agricultural activities and environmental conservation in the region. The responses of farmers to land-sparing solutions show that they are at different levels about being well-informed, having mixed feelings towards implementation, and having major problems of financial impediments and skills. Fewer than ten percent of the participants consider land-sparing methods but consensus is generally seen in the fact that the conversation of natural forest habitats could be beneficial. The remaining awareness-to-action gap is a strong indication of the critical need for capacity-building programs and policy interventions entailing sustainable land management practices. In terms of the current farming practices and crop cultivation approach the data exhibits a high diversity of industrial farming and rice cultivations with subsistence farming being also involved. Besides food crops, cash crops like cocoa, coffee, oil palm, and rubber which are grown for human consumption also make a considerable contribution to the local economy showing the wide range of agricultural livelihoods in this area.

The prevalence of traditional methods of farming such as slash and burn and rotation of crops implies the need for the increase in the implementation of modern, sustainable farming techniques to decrease environmental degradation and improve long-term productivity. Nevertheless, the slow implementation of new methods suggests that some obstacles are still in the way such as no resources, knowledge, and institutional support. The use of natural forest habitats for farming, particularly swamp and rainforest areas, stresses the fact that agriculture and the conservation of the environment in the area are two conjoined issues. Although farmers realize the necessity of forest conservation, problems like forest deterioration and dysfunctional monitoring systems are the main threats that affect the ecosystem and agricultural sustainability. The study outcomes brought about the understanding of how socio-economic issues influence agricultural methods and land use decisions in Lofa County, Liberia. The data show the distribution of education levels and marital statuses across respondents, and also it describes the ethnic diversity within the study area. Through this, the information becomes useful in illustrating the characteristics of local farming communities. In

general, the results of this study show that targeted measures for the development of sustainable agriculture, environment conservation, and livelihood enhancement among smallholder farmers in Lofa County, Liberia, have to be taken on an urgent basis. With the challenges reviewed and the opportunities exploited, policy-makers, implementers, and other stakeholders can form interdisciplinary teams and come up with well-grounded interventions that propel sustainable development and conservation initiatives in the area. In addition, this research also seeks to gain knowledge of farmers' perceptions and practices which can be used for designing and implementing approaches for effective policy development and interventions aimed at addressing the social and economic issues related to agriculture in Lofa County, Liberia.

Recommendations

Through the thorough analysis of the challenges and opportunities in this particular study, the following recommendations are made to address the problems and maximize the chances of strengthening agriculture and conservation in Lofa County, Liberia. These recommendations are categorized into two main areas: the ones flowing from the study and those designed to direct researchers in the future.

Recommendations Based on Findings:

1. ***Develop Targeted Awareness Campaigns and Capacity-Building Initiatives:***

The research unveils the knowledge gap in the practice, highlighting land-sparing principles of sustainable agriculture. These objectives could be fulfilled only when intensive target campaigns are undertaken to give training on sustainability management to farmers. This calls for the development of campaigns that are sensitive to the particular needs of the diverse Lofa community, which is a very interesting case. Capacity-building activities can be brought in conjunction with the promotion measures that drive farmers to learn more about skills, grades, and the inputs they need to produce everything sustainably. The farmers can be educated by having agricultural training programs on the latest innovations in agricultural technologies, conservation methods, and resource management. From this idea, the farmers can start practicing more

sustainable farming techniques that will improve both their productivity and their resilience.

2. Provide Financial Support and Technical Assistance:

The challenges of financial resources scarcity and insufficient technical expertise are the primary constraints faced by farmers from Lofa County in their way of practicing sustainable farming. These problems can be solved by covering farmers' incomes and providing them with technical assistance, for example, public bodies, NGOs, and international aid. Financial help can be the provision of a grant, loan, or subsidy that enables them to purchase necessary equipment, and input materials and at the same time access the market. Technical assistance programs with their provision of training, extension services, and advisory support give farmers more options for improving farming techniques, and hence higher agricultural productivity linked with environmental friendliness.

3. Strengthen Collaboration among Stakeholders:

The study highlights the need for joint actions envisaging cooperation between governmental and non-governmental entities aiming to promote forest protection and sustainable land management at the same time. It should be clear that stakeholders know their roles and responsibilities to make the collaboration successful and to guarantee that they work together to resolve common problems and realize the shared goals. The government could, for instance, engage the Forestry Development Agency (FDA) and the Ministry of Agriculture, Forestry, and Natural Resources to work hand-in-hand with village councils, non-governmental organizations (NGOs), and foreign partners concerning the designing and implementation of sustainable land use policies and programs. Through the forging links and mobilization of resources, the parties can build the capacity to contribute noticeably to the natural resource conservation and livelihood improvement of Lofa.

Recommendation for Further Study:

1. ***Conduct Further Research on Socio-Economic Factors:***

Although the outcome of this research is so useful in that it highlights farmers' perceptions and activities on cultivation more ideally other aspects including economic status have to be looked into to capture the perception of farmers regarding the selection of agricultural practices. To be specific, future research could particularly look at the effect of determinants like household income, access to markets, land rights, and cultural systems on farmers' shift towards sustainable agriculture. Through the knowledge of the deep-rooted socio-economics dimensions that drive reactions; developers and policymakers can, thereafter, design equitable development policies and targeted interventions that address the root causes of unequal land usage which in turn promotes sustainable development.

2. Investigate the Effectiveness of Educational Programs:

Through this study, it is emphasized that the successful implementation of educational programs and outreach initiatives can be very helpful in farmers' comprehension and adoption of environmentally friendly land management practices. Still, deeper studies of the programs will be necessary to assess their performance in other contexts. The coming research can apply comprehensive evaluation methods, for example, randomized controlled trials or quasi-experimental designs, to the effect of educational programs on behaviors, perceptions, and knowledge about agroecological farming among farmers. Taking research outcomes like the effectiveness of educational programs into consideration, researchers will use their evidence to design and implement more customized and evidence-based interventions which will then be used to promote local sustainable agriculture. Lastly, through the revealed problems and utilization of the obtained insights this study can contribute to the creation of more successful policies and campaigns that are engaged with the promotion of sustainable agriculture, protection of natural resources, and improvement of livelihoods in Lofa County. Through the implementation of the recommendations aforementioned and by granting attention to critical socio-economic aspects and targeted interventions, the stakeholders can cooperate to create a sustainable and resilient agricultural sector that benefits the present as well as the coming generations.

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APPENDICES

Appendix A
Ethical Committee Approval

NEAR EAST UNIVERSITY

SCIENTIFIC RESEARCH ETHICS COMMITTEE

25.04.2024

Dear Amos Gayflor Zaizay

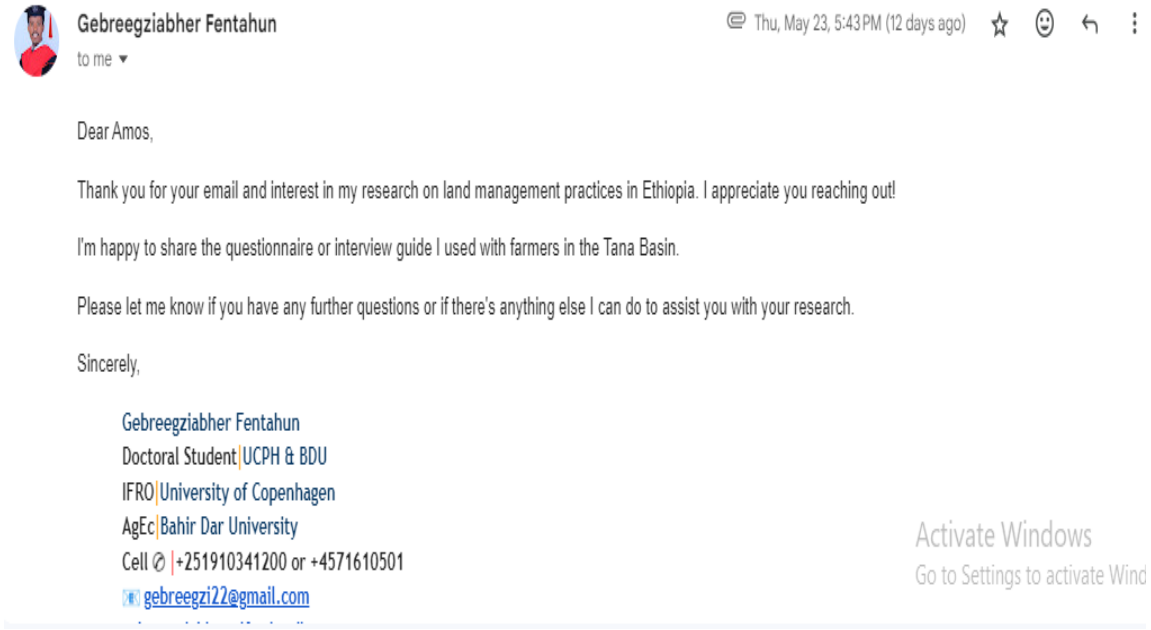
Your application titled **"Land Sparing As A Tool In Mitigating Agriculture Induced Deforestation In Liberia: Famers Perspective"** with the application number NEU/ES/2024/1107 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Prof. Dr. Aşkın KİRAZ

The Coordinator of the Scientific Research Ethics Committee

Appendix B

Permission Regarding the Use of Scales



Gebreegziabher Fentahun
to me

Thu, May 23, 5:43 PM (12 days ago)

Dear Amos,

Thank you for your email and interest in my research on land management practices in Ethiopia. I appreciate you reaching out!

I'm happy to share the questionnaire or interview guide I used with farmers in the Tana Basin.

Please let me know if you have any further questions or if there's anything else I can do to assist you with your research.

Sincerely,

Gebreegziabher Fentahun
Doctoral Student | UCPH & BDU
IFRO | University of Copenhagen
AgEc | Bahir Dar University
Cell | +251910341200 or +4571610501
gebreegzi22@gmail.com

Activate Windows
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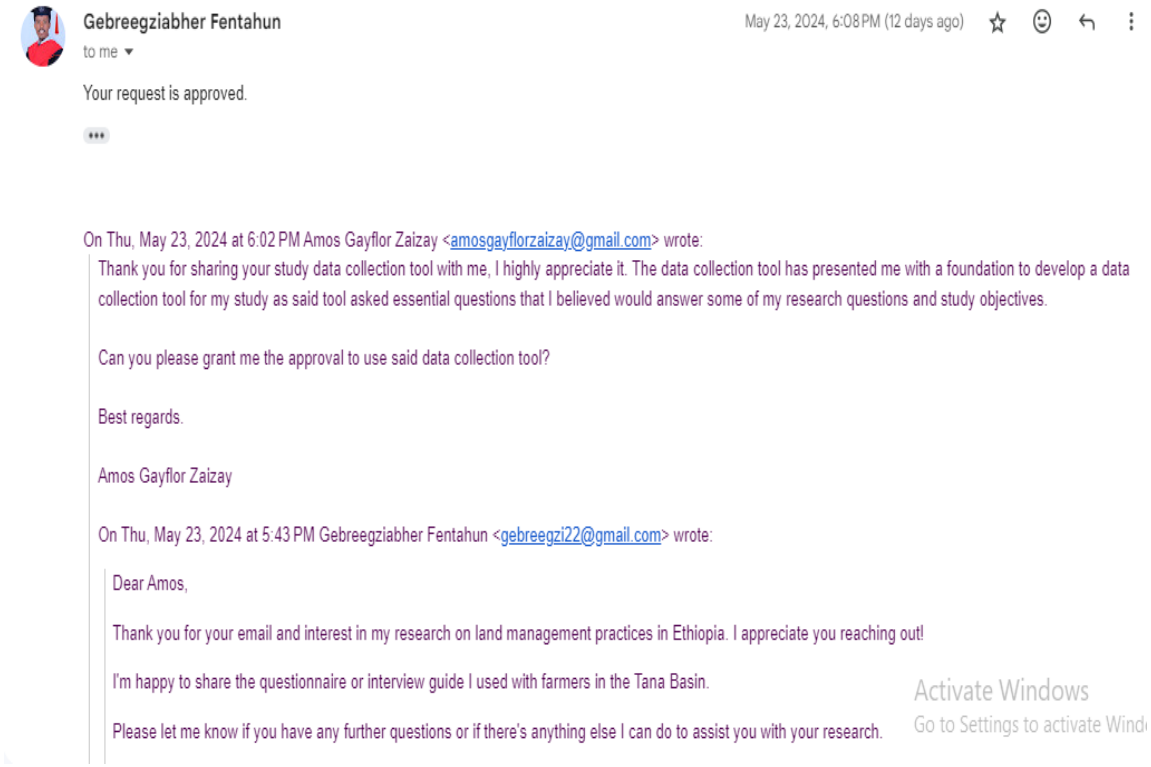

Gebreegziabher Fentahun
to me

May 23, 2024, 6:08 PM (12 days ago)

Your request is approved.

On Thu, May 23, 2024 at 6:02 PM Amos Gayflor Zaizay <amosgayflorzaizay@gmail.com> wrote:

> Thank you for sharing your study data collection tool with me, I highly appreciate it. The data collection tool has presented me with a foundation to develop a data collection tool for my study as said tool asked essential questions that I believed would answer some of my research questions and study objectives.
>
> Can you please grant me the approval to use said data collection tool?
>
> Best regards.
>
> Amos Gayflor Zaizay
>
> On Thu, May 23, 2024 at 5:43 PM Gebreegziabher Fentahun <gebreegzi22@gmail.com> wrote:
>
> > Dear Amos,
> >
> > Thank you for your email and interest in my research on land management practices in Ethiopia. I appreciate you reaching out!
> >
> > I'm happy to share the questionnaire or interview guide I used with farmers in the Tana Basin.
> >
> > Please let me know if you have any further questions or if there's anything else I can do to assist you with your research.

Activate Windows
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Appendix C

Demographic Data

Table 17.

Gender Distribution of Respondents in Lofa County, Liberia

Gender	**Frequency**	**Percentage**
Male	88	58.7
Female	62	41.3
Total	**150**	**100**

Figure 3.

Distribution of Respondents in Lofa County, Liberia

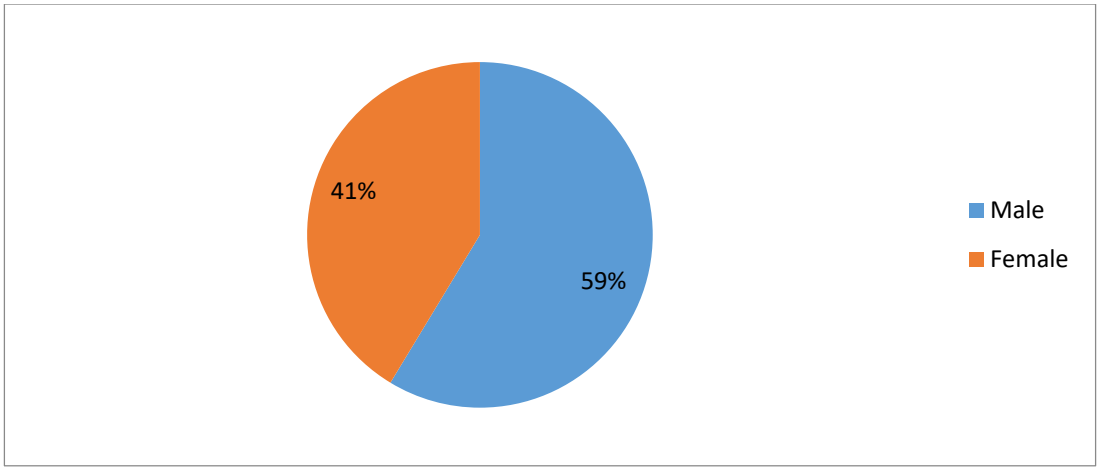


Table 18.

Age Distribution of Respondents in the Study Area

Age Range	**Frequency**	**Percentage**
1-10	0	0
11-20	10	6.7
21-30	38	25.3
31-40	34	22.7
41-50	58	38.7
51-60	7	4.7
61 & above	3	2
Total	**150**	**100**

Figure 4.

Age Distribution of Respondents in the Study Area

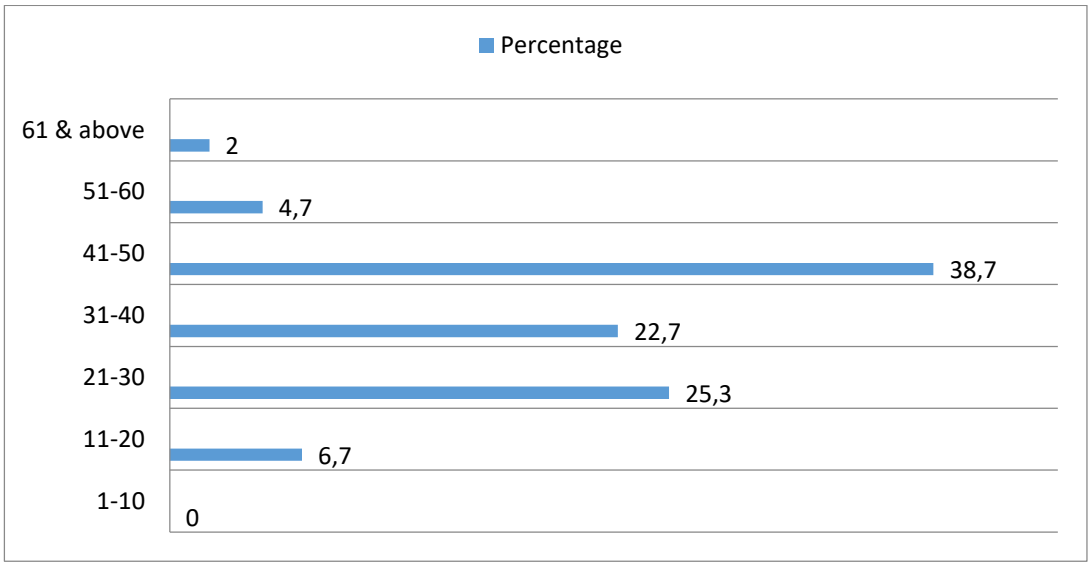


Table 19.

Education Level of Respondents in Study Area

Education Level	**Frequency**	**Percentage**
Did not Go to school	43	28.7
Elementary	47	31.3
Junior High	17	11.3
Senior High	19	12.7
Vocational	15	10
Associate Degree	6	4
Bachelor Degree	3	2
Total	**150**	**100**

Figure 5.

Education Level of Respondents in Study Area

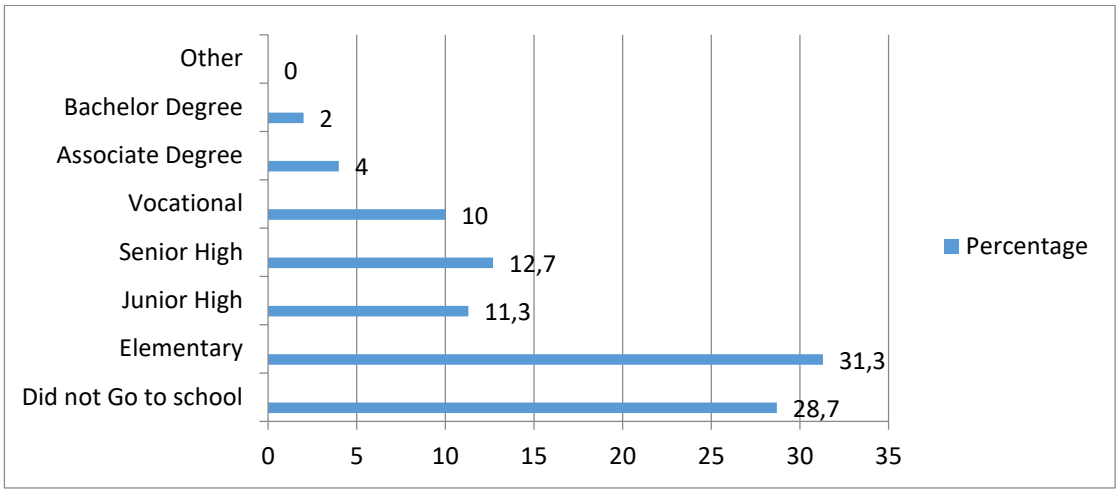


Table 20.

Marital Status of Respondents in Study Area (Lofa County, Liberia)

Marital Status	**Frequency**	**Percentage**
Married	88	58.7
Single	62	41.3
Total	**150**	**100**

Figure 6.

Marital Status of Respondents in Study Area (Lofa County, Liberia)

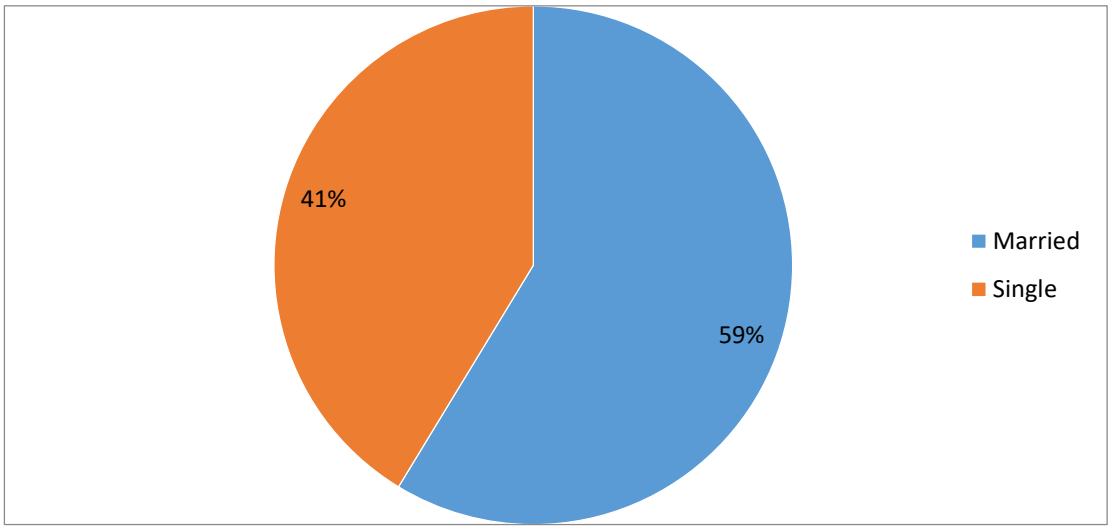


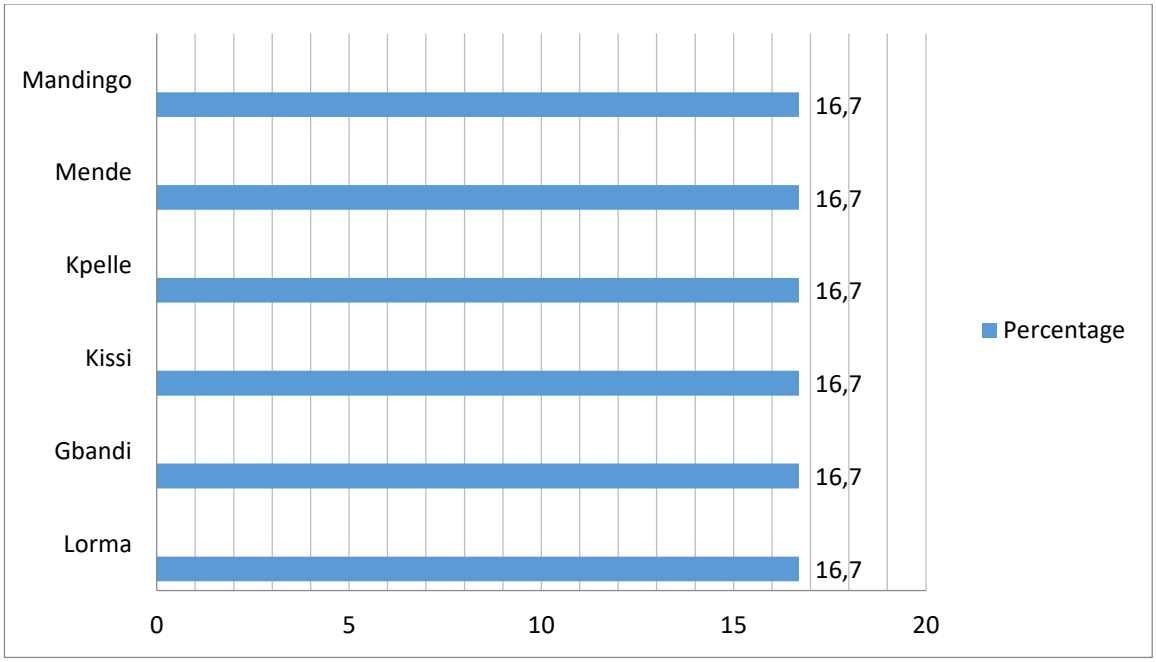
Table 21.

Ethnic Group of Respondents in Study Area (Lofa County, Liberia)

Ethnic Group	**Frequency**	**Percentage**
Lorma	25	16.7
Gbandi	25	16.7
Kissi	25	16.7
Kpelle	25	16.7
Mende	25	16.7
Mandingo	25	16.7
Total	**150**	**100**

Figure 7.

Ethnic Group of Respondents in Study Area (Lofa County, Liberia)



Appendix X

Turnitin Similarity Report

Amos Gayflor Zaizay Master THesis Turnitin Report

ORIGINALITY REPORT

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PRIMARY SOURCES

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