

**A SITUATIONAL ANALYSIS OF LIVESTOCK PRODUCTION
IN LIBERIA:
A CASE STUDY OF NIMBA, BONG AND MONTSERRADO
COUNTIES**

MASTER OF SCIENCE

BY

LEELIA ROSAMOND ANDREWS

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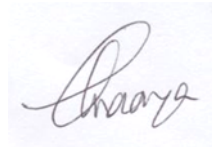
THE UNIVERSITY OF NAMIBIA

BY

LEELIA ROSAMOND ANDREWS

APRIL, 2012

Main Supervisor: Prof. Godwin P. Kaaya



Co Supervisor: Dr. Solomon Tefera Beyene



DECLARATION

I, Leelia R. Andrews, declare hereby that this study is a true reflection of my own research and that this work or part thereof has not been submitted for a degree in any other institution of higher education.

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DEDICATION

This Thesis is solely dedicated to the Almighty God for his Devine Favor upon my life from birth until this date and for the opportunity given me to reach thus far. Indeed your plans are to prosper me and give me a hope and a future.

Secondly, I dedicate this thesis manuscript to my father; Konah K. Andrews, Sr., and my mother Florence T. Andrews, for the academic foundation, religious and moral discipline and principles they laid in the success of my life.

And my son Paul for his patience, who sacrificed all his time being lonely without mom's love and benefits for my success. I owe my Life and all my Love to you.

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ABSTRACT

The main objective of the study was to analyze the situation of livestock production in Liberia. The specific objectives were to analyze the population of livestock in Liberia, to establish the factors limiting the production of livestock in Liberia, to analyze Liberia land use system of the livestock production sector and to analyze the economic impact of livestock production in Liberia. The study was a case study which surveyed three counties in Liberia: Nimba, Bong and Montserrado. Nimba and Bong are in the north and Montserrado in the south respectively. Descriptive analysis was conducted through the triangulation involving both qualitative and quantitative research methods and primary data, well- structured questionnaires, key informant interviews, focus group discussions, and meetings with the relevant stakeholders.

The study findings revealed that livestock production in Liberia is on the increase. However, livestock production in Liberia is limited by factors such as respondents' lack agriculture training, insufficient infrastructure, lack of veterinary services, insufficient finances, shortage of commercial feed supplements, inefficient and ineffective implementation of Government policies, lack of market and competition from imported livestock produce.

The study established that pasture land is largely communal and is continuously used for livestock production. The study found that there is a little extent of application of pastureland management practices. Most of the farmers produce livestock for immediate consumption and sustainable livelihoods and not for commercial purposes. The study recommended that livestock should be included in the Poverty Reduction Strategy Papers (PRSPs), the public sector should develop and enforce policy and regulatory frameworks for livestock, regulatory capacity of livestock authorities should be strengthened, collective action among smallholders should be

strengthened. Moreover, the government should encourage Private or Public-NGO partnerships to deliver livestock services to livestock farmers.

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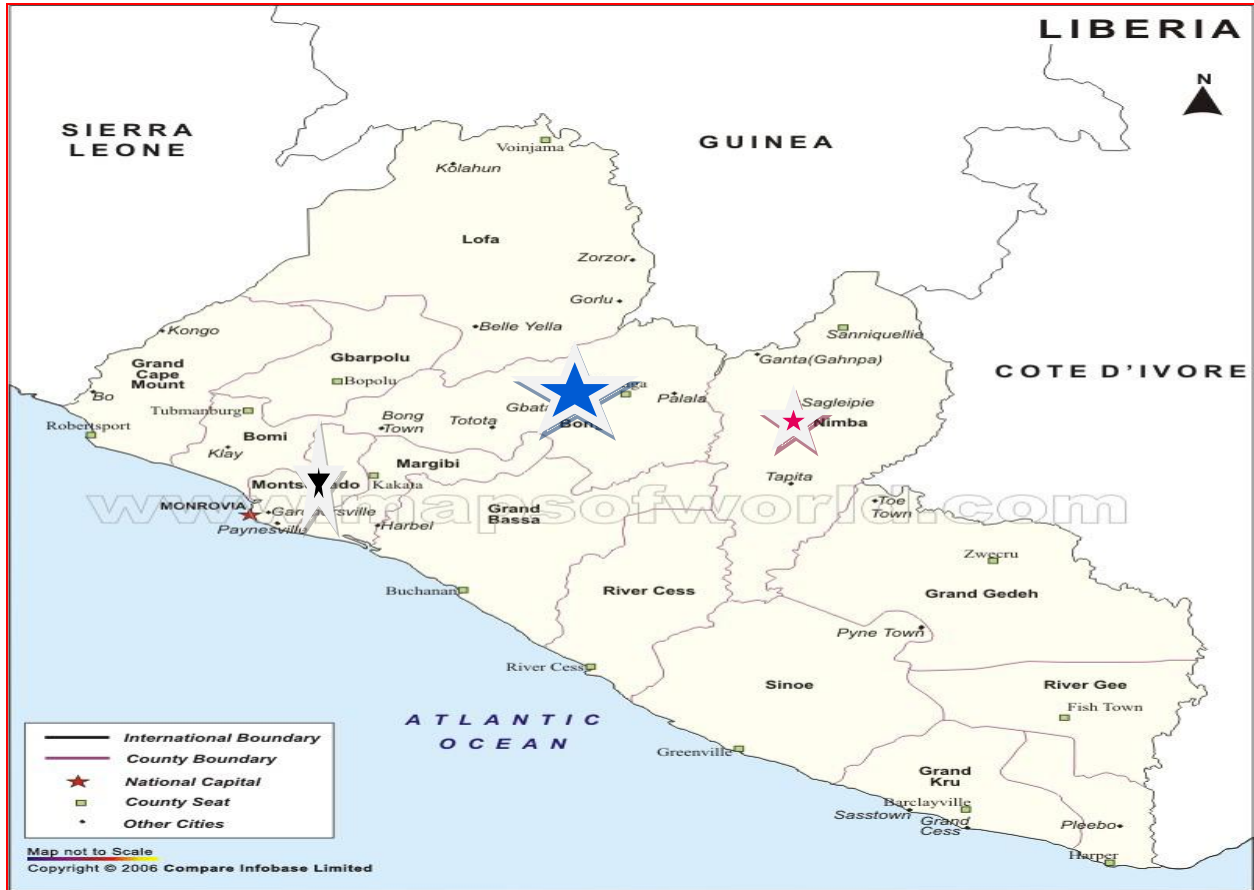
ABBREVIATIONS & ACRONYMS

CARI	-Central Agricultural Research Institute
CBAHW	- Community Based Animal Health Worker
CDA	-Cooperative Development Agency
FAO	-Food Agriculture Organization
FY	-Fiscal Year
GDP	-Gross Domestic Product
GoL	-Government of Liberia
ILRI	-International Livestock Research Institute
IMF	- International Monetary Fund
LASIP	-Liberia Agriculture Sector Investment Program
LISGIS	-Liberia Institute of Statistics and Geo- Information Services
MCI	-Ministry of Commerce & Industry
MDG's	-Millennium Development Goals
MoA	-Ministry of Agriculture
NGO	-Non Governmental Organization
NLB	- National Livestock Bureau
ODA	-Overseas Development Aid
PRSP	-Poverty Reduction Strategy Papers

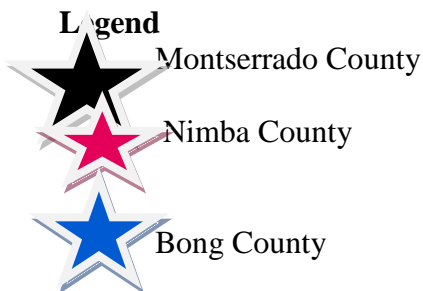
CHAPTER ONE: INTRODUCTION

1.1 Background Information of Liberia

Figure 1: Map of Liberia



SOURCE :(<http://www.google map of the world.com>)



Liberia is located on the west coast of Africa, and is bordered in the north by the Republic of Guinea, east by the Republic of Cote d'Ivoire, west by the Republic of Sierra Leone and the Atlantic Ocean in the south. Liberia has a tropical climate with average temperatures ranging from 70 degrees Fahrenheit (21 degrees Celsius). There are relatively small variations between day and night and between seasons, with temperatures never exceeding 37 degrees Celsius. (Olukoju, 2006).

There are two seasons in Liberia- the wet (rainy) season which runs from May to October and the dry season runs from November to April each year. The annual rain fall averages 170 inches (4.320 mm) inland. The average humidity on the coastal belt is 78% during the wet season, though the humidity sometimes drops to as low as 30% from December to March when the Harmattan winds blow from the Sahara.

Liberia has a geographical area of 111,370 square kilometres with a population of 3,476,608 inhabitants, (LISGIS, 2009). Liberia has a density of 31 persons per square kilometre ranging it among the lowest in the West African sub-region as compared to Sierra Leone and Cote d'Ivoire at 68 and 48 persons per square kilometres, respectively. The population is mostly made up of African sixteen indigenous ethnic groups which are as followed: the Kpelle, Bassa, Gio, Vai, Lorma, Kissi, Gola, Gbandi, Dei, Krahn, Belleh, Mende, Mandigo, Grebo and Kru. The Gola, Kpelle, Lorma, Gbandi, Mendi, and Mano are the oldest settlers of Liberia, dating back to 6,000 BC. (Olukoju, 2006).

1.1.1 Background information of Counties surveyed

1.1.1.1 Nimba County

Nimba County has an estimated population of 462,026 inhabitants. The population is mostly between the ages of 15 to 30 years because of the effects of the civil war. Gender distribution is fairly close: 46.37% female and 53.72% male. More than half of the Nimba County females are within the child bearing ages of 14 to 49 years, giving rise to high fertility rates in the County. Average rainfall in Nimba is recorded between 12.5 – 25 inches. (LISGIS, 2009)

There are three principal topographic areas. Prominent among the mountains is Mount Nimba. Nimba has four major rivers with St. John being the largest; there are three kinds of soil produced by different conditions of climate and vegetation in Nimba: lateritic soil or latosols or upland soil, clay or swamp soil, and sandy soil. Generally, lateritic soils cover about 75% of Liberia. According to Willie Schulze (*A New Geography of Liberia*), Lateritic soil are the most typical soils of the humid tropics, where there are alternating wet and dry seasons and are predominant. According to soil scientists, latosols have only 0.24% nitrogen (plant food) and are very acidic. Their continuous farming requires the constant use of fertilizers, an input that nearly all farming households are too poor to afford and this may explain the situation of annual bush fallowing by subsistence farmers in the County. Nevertheless, latosols are more productive than the other soil types and they provide valuable material for road building due to their hardness.

Nimba's natural vegetation is composed of tropical rainforest, specifically high forest, broken forest and low bush. As in the other northern parts of Liberia, the most prominent forest type is

moist semi-deciduous. Trees of this forest type are the *nesogordonia papaverifera*, *limba* (*terminalia superba*), and *obechi* (*triplochiton scleroxylon*). Low bush establishes itself in the areas of land rotation where trees are cut and burnt as a result of the shifting or bush fallowing method of farming. Typical trees of this vegetation type are the umbrella or corkwood tree (*mussanga cecropioides*) and the oil palm. Swamps are common in the County, and there is a small portion of the vegetation covered with scattered trees and dense elephant grass (*pennisetum purpureum*). There are, however no natural grass fields except those artificial pastures created by human activities through farming, habitation or the development of football fields. The original vegetation of the province would have consisted of tropical rainforest, which was cut down primarily for farming purposes and the cultivation of other cash crops such as cocoa, coffee, oil palm and rubber. The land abandoned after farming is occupied by elephant grass that slows the regeneration of forest trees.

1.1.1.2 Bong County

Bong County is located about 200 km NE of Monrovia with estimated total population of 333,481 habitants (LISGIS, 2009). The climate is tropical, hot and humid with temperature generally ranging from 65F to 85F. However, with the planet experiencing climate change, a slight fluctuation in the timing of the seasons has been noticed. Wind mileage is normally greatest in the rainy season, sometimes bringing violent storms capable of destroying houses and crops. It has a conventional type of rainfall of around 70 to 80 inches. Toward the interior, the rainfall decreases because the air loses moisture except for high areas where the air forces rise causing some relief rain. The region is well watered by six principal rivers and a number of small streams. The soils of Bong County are mostly latosols, which occurs on undulating and rolling

land and occupies about 18 percent of the total land area in Liberia. This soil is heavily leached with silica nutrients and humus is readily washed out.

The district is part of the high forest belt, which is divided into an evergreen rain forest zone and the moist semi-deciduous forest zone. The evergreen forest receives an annual rainfall of 80 inches and consists of plant species that do not have a marked period of leaf fall. The tallest trees reach 200 feet. The long dry season forces many species to drop their leaves during part of this period to minimize evaporation.

1.1.1.3 Montserrado County

Montserrado County is blessed with beautiful natural plains, fertile soils, lush natural vegetation, islands, ample rivers and gorgeous beaches. Montserrado has a tropical climate with two seasons, rainy and dry. The hot and dry wind “Harmattan” blows from the Sahara and causes marked fluctuations of temperature between day and night with a minimum of 10 degrees Celsius. The average temperature falls between 21 and 36 degrees Celsius. Annual average rainfall is about 75 inches. With the population of 1,118,241 habitants, the region’s topography consists of hills and valleys in the interior and lowlands along the Coast. Apart from direct access to the Atlantic Ocean, the district has many rivers and creeks. Montserrado soil consists mostly of alluvial clay. It is a home to Liberia’s capital, Monrovia. (LISGIS, 2009).

1.1.2 History of Livestock Production in Liberia

In Liberia, the majority of the people are involved in small scale farming activities, such as rearing chickens, sheep, goats, or pigs and cultivating small plots of land of less than three acres which provides poor women with the investment capital for their farming activities which can greatly increase their profits.

Liberia depended heavily on agriculture and livestock to feed her people and the sector was mainly destroyed by the civil war from 1990-2003. Agriculture is the largest sector of the Liberian economy and the most important source of income for women and especially main source of income for rural families especially which involve women and children in the rearing of livestock. The most important contributions before the war came especially from modern poultry (eggs productions for consumption and chicken). Beef and pig production were highly limited; goats and sheep were found at the level of the traditional economy. There were also chickens and guinea fowl in villages which ran freely. The number of cattle was low because of tsetse flies which transmit Trypanosomosis (FAO/AGA, 2005).The enclosure of livestock in pastures and barns are a relatively new development in the Liberian history of agriculture. When cattle are enclosed, the type of 'enclosure' may vary from a small crate or to a large fenced pasture. The type of feed may vary from natural growing grass to highly sophisticated processed feed. Animals are usually intentionally bred through artificial insemination or through supervised mating.

Indoor production systems are generally used only for pigs and poultry, as well as for veal cattle. Indoor animals are generally farmed intensively, as large space requirements would make indoor farming unprofitable and impossible. However, indoor farming systems are controversial due to: the waste they produce, odor problems, hygiene and sanitation, the potential for groundwater contamination and animal welfare concerns. Other livestock are farmed outside, although the size of enclosure and level of supervision may vary. In large open ranges animals may be only occasionally collected in "round-ups" or "musters". Since the advent of barbed wire (in the 1870s) and electric fence technology, fencing pastures has become much more feasible and pasture management simplified. Rotation of pasturage is a modern technique for improving

nutrition and health while avoiding environmental damage to the land. In some cases very large numbers of animals may be kept in indoor or outdoor feeding operations (on feedlots), where the animals' feed is processed, offsite or onsite, and stored onsite then fed to the animals.

Agriculture is the basis of the Liberian economy. In 2004, the agriculture and fisheries sector accounted for (51.9 %) of Liberia's gross domestic product. Rice and cassava are the dominant food production and in 2005 accounted for (18.8 %) and (22, 1 %) of total agricultural value added. (IMF, 2005).

Traditional farming, which is largely subsistence, provides livelihoods to the bulk of the rural dwellers. As in many developing countries, the use of modern technology is limited. Slash-and-burn method based extensive agriculture practices is the primary production techniques. Forest lands are cleared, burned and upland rice cropped together with other food crops. This method of cultivation causes rapid soil fertility loss and severe environmental degradation. Of recent, low land farming has been introduced.

Liberia livestock sector has never attracted potential investors. Prior to the civil war, Liberia was self-sufficient in eggs production made by Liberian Farmers (Baker's, Bight's and Shanghai's) poultry farms. Local beef and pork production were highly limited with goats and sheep at the levels of local farmers. With the exception of the rinderpest campaign funded by FAO in 1984, livestock vaccination was not the GoL's priority. FAO estimates (Shaw & Hoste, 1984) revealed animal population of 12,600 head of cattle, 110,000 pigs, 210,000 sheep; 200,000 goats, and 687,000 birds with an estimated annual production of 5,491 tons of meat. The cattle population was made up of N'Dama and short Horned (Muturu) breeds, all trypanotolerant breeds. There were importations in frozen meat and poultry in Liberia.



Figure 2: A young bull (Muturu) in the south-east Liberia. FAO, 1989

Live cattle (approximately 12,000 head of N'Dama and 14,000 head of Zebu breeds) were imported from Guinea and Mali respectively. Total average weight of the importation about 8,513 additionally there was a local meat production of 5,491 tons annually. Liberia's pasture areas have been estimated at 2,000,000 ha by (FAO, 1989). Before 1990 civil war, few hectares were improved and utilized by government and private farmers.

1.1.3 Land Use System in Liberia

Land tenure is a critical challenge in the livestock production system. Land is an important factor that unites families or tribe members together. However, there are three types of land ownership in Liberia: State or Public Land, Individual Proprietorship, and Common/tribal or common/collective ownership rights based on customs. Customary ownership is the dominant form of land tenure.

Concession, commercial and traditional farms are the three types of farms from agricultural outputs. Concession farms, which include rubber and palm oil are largely owned and operated by foreign firms for example the Firestone Rubber Plantation in Liberia. The commercial farms are mainly owned and operated by Liberians engaged in the production of fruits, vegetables, coffee, oil palm, poultry and cocoa.

According to customary ownership, the tribal chives are the custodians of the land and these chives are responsible to manage and maintain the land fertility ensuring a sustainable ecosystem. The modern land tenure system is a mixture of customary land ownership and modern western property ownership. The customary land use system and the customary land policy existed without any real conflict, not until settlers or freed slaves from America introduced alien concepts of buying, selling and making of new and written laws on full private ownership as understood by westerners.

1.2 Statement of the Problem

Livestock production in Liberia has had a severe setback for several decades. It has been the least prioritized department or bureau within the Ministry of Agriculture, considering the various components of agriculture. About 95% of rural dwellers are involved in animal production; however, the husbandry techniques or practices used are still rudimentary with extremely limited use of modern inputs. Consequently, there is a low productivity of animals and animal products, and of very poor quality. Also due to the inadequacy of such low outputs, animals reared are largely consumed by household members to meet the high demand for meat and other animal

products. Of the Liberian populace, significantly high importation of these products is done annually which involve high foreign exchange rate.

Because of the high cost attached to imported meat and other animal products on the local market, in most cases the rural dwellers cannot regularly afford the cost. Thus the intake of animal protein is inadequate, hence posing nutritional problems. In order to satisfy the high urge for meat and other animal products, the farmers regularly hunt wild animals (pouching) in the forest. Others obtain protein through marine and fresh water fishing.

Prior to the civil war in Liberia, information on livestock production was accessible and available to local farmers, researchers, stakeholders and the country as a whole. After the war, the sector was totally damaged and distorted which led to unavailability of important information in the livestock sector. Yet, the Livestock Development Policy clearly states that a baseline data base on livestock production has to be available.

It is against this background that the survey was conducted to analyze and develop a baseline database and to recommend appropriate policies for the Liberia National Livestock Sector and to use this information as a basis for helping policy makers and implementers of the restocking program, identify strategies for reducing poverty, food insecurity and promoting income generation activities and moreover make these information available and accessible to local farmers, policy makers, researchers and the country as a whole.

1.3 General objectives:

To analyze the situation of livestock production in Liberia.

1.4 Specific Objectives

- i. To analyze the population of livestock in Liberia
- ii. To analyze the factors limiting the production of livestock in Liberia
- iii. To analyze the land use system in the livestock production sector in Liberia
- iv. To analyze the economic impact of livestock production in Liberia

1.5 Hypotheses

The study will be guided by the following null hypotheses:

H_i : The population of livestock in Liberia is not on the increase

H_{ii} : Livestock production is not limited by factors such as diseases, insufficient grazing and foraging capacities and shortage of feed supplements

H_{iii} : Land is not properly used in the livestock production sector in Liberia

H_{iv} : Livestock production has no impact on the economy of Liberia

1.6 Limitations/Delimitations of the Study:

Due to financial constraint (Research funding) and time constraints, the study was concentrated on the Situational Analysis of Livestock Production in three counties (Bong, Nimba and Montserrado) in Liberia. This is because these counties are the main producers of livestock and

livestock products in the country and are densely populated and their vegetation offers a healthy environment for livestock farming. Furthermore, the study is delimited to livestock farming in the three counties. Findings from the study can be used as basics to determine livestock analysis for the other thirteen counties in Liberia.

Other problems encountered by the researcher were:

Poor road infrastructures- Because of the civil war from 1990- 2003, most of the roads were damaged and destroyed but the present Government of Liberia is trying to reconstruct and rebuild those roads. Therefore, a four wheel drive vehicle was used in accessing the farms.

Hiring of interpreters- one field assistant who could clearly speak the vernacular, and interact with traditional farmers was hired for each county in order to enhance the efficiency and effectiveness of the data collection process.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This Chapter looks at Literature reviews from previous studies, local and international articles, books, journals, as well as the internet containing information related to the topic'' A Situational Analysis of Livestock Production in Liberia(A Case study of Nimba, Bong and Montserrado counties)", so as to guide the researcher in understanding the topic and identifying most appropriate strategies to follow. Literature reviews are secondary sources, and as such, do not report any new or original experimental work.

It is most often associated with academic-oriented literature, such as a thesis, a literature review usually precedes a research proposal and results section. Its ultimate goal is to bring the reader up to date with current literature on a topic and forms the basis for another goal, such as future research that may be needed in the area. The purpose of a Literature is to provide the reader with an up to date account and discussion of the research findings in a particular topic.

2.2 Livestock as source of employment

Increased production of livestock implies higher employment. Dairying is labor intensive at farm level of women and children are more active in production while men take the role of marketing. Labor typically amounts to over 40 % of total costs in smallholder systems. In Liberia, goats, sheep, poultry and rabbits, especially from backyard production systems, are important sources of part-time work, particularly for landless women and children. The processing sector has also

been identified as a focus for generating employment and limiting rural depopulation. The meat sector also provides employment for slaughter, marketing and processing (Chamblee et al., 2002).

Livestock farmers in Liberia have not identified the importance of Dairy Productions due to many factors but most importantly the Dairy industry has not yet been established.

Jobs created on farm by livestock include activities such as the cleaning of manure and feed refusal from barns, as well as the collection of feed. Information on the labor involved in Livestock industries provide employment for particular groups, but specific details on wages paid, the hours of work involved are usually lacking. The cut and carry system is a common feature of the livestock industries of many developing countries. It involves laborers collecting grasses from common property areas for large ruminants, usually kept by small farmers. The availability of this form of employment to rural workers with few alternative employment opportunities is important since it is a disincentive for them moving to urban areas, helping at least to stem the urbanization process and the social problems associated with outmigration from rural areas.

2.3 Livestock as a source of Nutrients, fertilizer and soil conditioner

If food security is defined as access to enough food for an active healthy life, then livestock can make a major contribution. An adequate quantity of balanced and nutritious food is a primary indicator of quality of life, human welfare and development (Winrock, 1992, De Boer et. al., 1994). Animals are an important source of food, particularly of high quality protein, minerals, vitamins and micronutrients. The value of dietary animal protein is in excess of its proportion in diets because it contains essential amino acids that are deficient in cereals. Eating even a small

amount of animal products corrects amino acid deficiencies in cereal-based human diets, permitting more of the total protein to be utilized because animal proteins are more digestible and metabolized more efficiently than plant proteins (Winrock, 1992), (De Boer et al., 1994). "Quality foods ... derived from animal sources have major importance for optimizing human performance in chronically mild to moderately malnourished populations (Diaz-Briquets et al., 1992). This is especially important for young children.

Nutrient recycling is an essential part of any strategy for sustainable agriculture. Integration of livestock and crops allow for efficient recycling through use of crop residues and by-products as animal feeds and for animal manure as crop fertilizer. Cattle dung contains about 8 kg of nitrogen, 4 kg of phosphate and 16 kg of potash per ton of dry matter (Chamblee et al., 2002). In addition, manure returns organic matter to the soil, helping to maintain its structure as well as its water retention and drainage capacities. The value of manure is so well-recognized that some farmers keep livestock primarily for this purpose. The cultivation of legumes, fodders and trees, for example, in alley farming systems, also contributes to the enrichment of soils through nitrogen fixation. Soybeans in the humid tropics can supply 40 kg of nitrogen per hectare, although this contribution varies considerably with the species. Systems using sugar cane as livestock feed has demonstrated that the recycling of dead leaves into the soil (instead of burning them) favors the fixation of nitrogen by bacteria and reduces the bacteria weed growth and water evaporation, thus increasing the yield of the subsequent harvest (Chamblee et al., 2002).

(Sanders et al., 1995) observed that throughout Africa, manure is the primary source of plant nutrients for traditional rain fed crops. Chemical fertilizers are expensive and applied mainly to high yielding varieties especially in irrigated conditions. A massive currency devaluation in the

West and Central African Francophone countries in 1993 increased prices of fertilizers so much that farmers responded by applying more manure by making compost in a systematic manner and by developing a market for manure.

In areas where crop-livestock mixed farming is emerging, manure is an important link. Manure is of paramount importance in these areas because most soils are fragile and of low inherent fertility (Rivera et. al., 1994). Only a small fraction of crop land receives adequate manure, however, and availability in a given year depends on the livestock population and its species composition, location at maturing time, feed supply from range and crop land and efficiency of manure collection. Though crop and livestock production are not yet integrated on a wide scale, there is considerable loss of nutrients in the process of transfer from range-based livestock to crop fields (Fernandez- McIntire et al., 1994). Nutrient flow is further affected by drought-induced changes in livestock populations, species composition and animal mobility. For these reasons, it has been estimated that, in present production systems, animal manure is not adequate to sustain the current level of crop production in the semiarid areas because it requires a very high pasture area per unit of crop area. (Williams et al., 1994).

According to (Brouwer & Powell, 1998) loss of manure will then be minimized as it becomes critical for sustaining soil productivity. It has also been suggested that efficiency of manure use can be increased by joint application of manure and fertilizer and manipulation of the relative amounts and times of application of manure. Improved feeding, such as using urea-treated straw, improves manure quality which in turn gives higher crop yields. It is recognized, however, that achieving higher productivity in agriculture will require increased use of chemical fertilizers. As components of mixed crop livestock farming systems, livestock play a critical role in the

development of sustainable and environmentally sound agricultural production systems. The use of livestock fosters intensification; an alternative to expanded cultivation of marginally productive lands that may be vulnerable to degradation (Brouwer & Powell, 1998). Manure is the most important contributions that livestock make to intensification and sustainability. Although it cannot replace all of the soil minerals removed by harvested crops, it recycles a significant proportion and adds organic matter that contributes to the tilt and water-holding capacity of soils. Manure is often the only fertilizer available to farmers in the developing world and contributes as much as 35% of soil organic matter in some areas (ILRI, 1997).

Livestock also transfer nutrients from renewable sources, such as rangelands, to croplands, replacing those removed by crops. In Nepal, farm-level research on resource flow linkages between crop and livestock subsystems reveal that 21–29% of the total value of livestock products can be traced directly to inputs from crop production (i.e. crop residues and crop by-products). Similarly the manure and animal traction that contribute to crop output amount to 10–15 % of the total value of crop production. These figures indicate how closely crop and livestock enterprises are often interrelated in smallholder farming systems. The soil is easier to till following the legumes, making life easier for the farmer. The soil is under plant cover for most of the year, protecting it from wind and rain erosion, and livestock productivity is increased.

Forage legumes tend to remain on the land for longer periods and develop greater ground cover than other crops, so they provide more protection for the soil over longer periods (ILRI, 1997). They are planted at higher densities than food legumes and this, coupled with their generally more extensive rooting system, increases the contribution of their roots to building up soil organic matter and improving soil structure. Another benefit of forage legumes to the soil is that

they are usually grazed where they grow. The nutrients in the animals' manure and urine return to the soil where the plants grew, replacing the nutrients extracted by the plants. This, together with their ability to fix atmosphere nitrogen in association with *Rhizobium* bacteria, brings more nutrients into the farming system and boosts soil fertility. Forage legumes are not an end in themselves—farmers will only grow them if there is a use for them, and that means livestock. The impetus for farmers to grow forage legumes may lie in the greater yields they get from their crops, but the resulting increase in livestock production also benefits the human population (ILRI, 1997).

2.4 Livestock and food supply

Livestock production is a major component of the agricultural economy of Africa and goes well beyond direct food production. Sales of livestock and their products provide direct cash income to farmers. Livestock are the living bank for many farmers and have a critical role in the agricultural intensification process through provision of draught power and manure for fertilizer and fuel. They are also closely linked to the social and cultural lives of millions of resource-poor farmers for whom animal ownership ensures varying degrees of sustainable farming and economic stability. Moreover, livestock produce food for humans and create saleable products from resources that would otherwise go to waste—straw and household wastes, as well as from land that cannot, or should not, be ploughed, such as hill slopes and thin soils prone to erosion. (FAO, 1985).

(Reuntlinger, 1985), (World Bank, 1986), (FAO, 1989) reported that Food Security at regional and national levels is equated with national or regional balances, between availability and need based on assumed per capital need. Food security at household level is equated with sufficiency

of household entitlements of food production resources, income available for purchases, and gift or assistance sufficient to meet the aggregate needs of all household members. The meaning of food security has evolved since the first World Food Conference of 1974. It is now accepted that it relates to access by all people at all times to enough food for an active healthy life but the concept is used differently at different levels.

At regional and national level it is equated with national or regional balances, that is between availability and need based on assumed per capital need. At household level, food security is equated with sufficiency of household entitlements. Achieving food security in this case is largely determined by an assumption of minimum nutritional need. Food Security at the level of the individual is rarely, if ever, considered (Chen & Kates, 1994). Irrespective of the reference level, food balance is now considered an inadequate criterion for food security because availability may not guarantee access due to poor distribution or lack of purchasing power. There are many examples of coexistence of aggregate food self-sufficiency and widespread malnutrition and hunger (Chen & Kates, 1994).

Food security is defined with reference to food grains. This is especially misleading for societies where roots and tubers are major sources of food and income and for mainly pastoral or livestock-based societies where livestock products are important sources of food and income (Jabbar, et. al., 2002). For example, foods other than cereals supply 40 % of total food energy for half of the sub-Saharan African population with the highest risk of food insecurity (FAO, 1993). The potential contribution of livestock to food security and economic development is assessed in relation to other functions. Exclusion of livestock is inappropriate because individual and household food security depends on access to assets, work and assured income. Livestock can

contribute to food security through increased output of livestock and non-livestock products and by employment and income generation that may assure access to food (FAO, 1993).

2.5 The Role of Gender in Livestock Production

It is important to make a distinction among the types of responsibility that women have over livestock: ownership, control over decision-making, use rights and provision of labor in most systems. Women provide labor for the various tasks related to livestock but may or may not control the process of decision-making, particularly over the disposal of animals and animal products. Similarly, women may be involved in production, but may or may not own the means of production: livestock, land, water, etc. It has been argued that women do not have much greater social and economic autonomy. For example in countries where Islam is a determining factor, women are segregated and have lower status, and are controlled and dominated by men showing a wide variation depending on ethnicity, religion, etc. (FAO, 1993).

The role and status of women in livestock production also depends on their ethnicity. In Liberia, women are more independent than their other counterparts within the farming system. Despite their considerable involvement and contribution, Liberian women's role in livestock production has often been underestimated. As a result, it is very difficult to obtain information on the role of women in livestock production from existing research and project reports. In Liberia, women were responsible for crops and men for livestock. But now, the table has changed. Both women and men are somehow equally into livestock production. It is useful to note that women work longer in the farming system, especially in the livestock sector than men. Ndagala contends that

the participation of women in the labor force lasts until age fails them: Men enter ‘elder hood’ at the age of about 38, while women become elders at the age of 60 (Ndagala, 1991).

2.6 Livestock and the Millennium Development Goals (MDGs)

Fighting poverty has become the overriding priority in the new millennium. By adopting the Millennium Declaration 4, the Member States of the United Nations committed themselves to address poverty. This resulted in the formulation of the MDGs in 2000. Since then, these goals have become important objectives for governments, as well as bi- and multilateral development cooperation. UN Member States are assessing their achievements against the targets set, and development organizations and aid agencies are reflecting on their contributions. However, the MDGs should be seen as the least common denominators in fighting poverty around the globe. Defining the role for livestock therefore remains a challenge for policy makers (FAO, 1993).

Box 1 Millennium Development Goals (MDGs)

Goal 1 Eradicate extreme poverty and hunger

Goal 2 Achieve universal primary education

Goal 3 Promote gender equality and empower women

Goal 4 Reduce child mortality

Goal 5 Improve maternal health

Goal 6 Combat HIV/AIDS, malaria, and other diseases

Goal 7 Ensure environmental sustainability

Goal 8 Develop a global partnership for development

The role of agriculture in general and of livestock production in particular in the fight against poverty is a long debate. Starting in the 1990s policy makers, including donor communities, lost interest in the agriculture sector (FAO, 1993). The low prices on the world market for agricultural commodities did not encourage investments or funding of projects in the sector. After a decade of neglect, interest in the agricultural sector has reappeared on the agenda, as there is an increasing understanding that economic growth will only contribute to reducing poverty, if the unequal distribution of income is not neglected (FAO, 1993). It is in this context that policy makers recognize agricultural development and natural resource management as a central tool to reach the MDGs 5. The livestock sector is not static. It is subject to changes brought about by increase in the human population, urbanization, and economic growth and market transformations. In livelihood programmes, it can help to alleviate poverty and promote sustainable development.

The growing demand for livestock products, due to the increased purchasing power of large numbers of people in urban and semi-urban centers, offers a potential for the livestock sector. However, quality standards set by the supermarkets threaten the participation of poor livestock keepers, and there is a genuine fear that they will not be able to benefit from these developments. Conducive policies (global trade reforms to make livestock production more profitable for developing countries), together with focused interventions (investment in pro poor infrastructure and technologies) are required to ensure that the development of the livestock sector becomes a priority. Poverty is not only about lack of income, it is also about vulnerability. Livestock provide particularly poor households with the potential to 'bank' their savings, which enhances their 'capacities' to cope with shocks and reduces their economic vulnerability. A major way that

livestock enterprises contribute to meeting the MDGs is by generating household income by reducing by half the proportion of people whose income is less than one US dollar per day (FAO, 1993).

2.7 Livestock and climate change considerations

Livestock production is associated with carbon dioxide, methane and nitrous oxide emission, water depletion and soil erosion (Fernandez-Rivera et al., 1994). The climate change impact on livestock production showed at 18 % of the total global greenhouse gas emission is from human sources particularly those associated with rapid industrial expectation of livestock operation. (Stanfield et al., 2006). Yet in smallholder crop-livestock and agro-pastoral livestock systems, livestock is one of the limited numbers of broad-based options to increase incomes and sustain the livelihood of an estimated billion people who have a limited environmental footprint. Livestock are particularly important for increasing the resilience of vulnerable people, subject to climatic conditions, market and disease shock through diversifying risk and increasing assets. Human activity is associated with Green House Gas (GHG) emissions. Those from livestock in this system are relatively modest compared to the contributions that livestock can make to the livelihood of huge number of people. The demands of energy supply through bio fuels are yet another factor that will put increasing pressure on the natural resource base and the balance between different natural resource uses especially in the crop-livestock systems (Rivera et. al., 1994).

In relation to climate change, livestock have a role in both mitigation and adaptation. Livestock mitigation measures include technical and management options to reduce GHG emissions from livestock as well as the integration of livestock into broader environmental service approaches

(IPCC, 2007). The impact of climate change on livestock systems and the opportunity for livestock is a tool for helping the poor to adapt to the effects of climate change. The livestock aspects include the impacts on the natural resource base supporting livestock production (largely feed and water); livestock genetic resource, breeding and management, and livestock health. Climate change is likely to have major impacts on poor livestock keepers and on the ecosystems goods and services upon which they depend. These impacts will include changes in the productivity of rain-fed crops and forage, reduce water availability and more widespread water shortages and changing severity and distribution of important human, livestock and crop diseases. Other major changes can be anticipated in livestock system, related to livestock species mixes, crops grown, feed resources and feeding strategies (IPCC, 2007).

2.8 Livestock, Feeds and Water

Water scarcity has become globally significant and it's an accelerating condition 1.2 billion people worldwide (MEA, 2005). Population growth, economic development and climate change impacts is likely to have a substantial effect on global water availability in the future. The impact of climate change on water supply changes the livestock system. The key contribution of ground water to extensive grazing systems will probably become even more important in the future in respect to climate change.

Feed resource is another most evident and important effects on livestock production. Though the effects may be indirect, but feed resource can have a significant impact on livestock productivity, the carrying capacity of rangelands, the buffering capacity of the ecosystem and their sustainability, prices of stovers and grains, trade in feeds, changes in feeding options, greenhouse gas emissions and grazing management (MEA, 2005) .

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

This part of the survey described several aspects of the research such as research design, population, sampling procedures, research instruments, data collecting procedures and data analysis. It also highlighted some aspects of ethical concerns that were taken into considerations when the survey was conducted.

3.2. Research Design

The survey was interpretive in nature using both qualitative and quantitative methods. The qualitative research method was used predominantly to elicit the views, perceptions and experiences of respondents on the Situational Analysis of Livestock Production in Liberia. (Lewis, 2000) has defined the qualitative method as a loosely defined category of research design which is field focused and deals with subjective data in descriptive form like note, recording or other descriptions. It is sometimes referred to as interpretative, naturalistic and descriptive research, involving small groups of data.

According to (Maree, 2007) a research design is a plan or strategy which moves from the underlying philosophical assumptions to specifying the selection of respondents, the data gathering techniques to be used and the data analysis to be done. The choice of research design was based on the researcher's assumptions, research skills and research practices that influenced the way in which the researcher collected the data.

The survey was undertaken in the Nimba, Montserrado and Bong counties in Monrovia. These regions were chosen because these three regions are presently into Livestock production in Liberia and the researcher resided in those regions during the time of study. Therefore, the researcher had access to most of the livestock farmers in the counties.

Qualitative method was used to show similarities and differences on the response provided by the livestock farmers. Qualitative data was gathered through the use of closed-ended questions which made provision for the collection of quantifiable information.

3.3. Population

A target population is a group of people in which the researcher is interested in. Such a group shares a given set of characteristics, about which the researcher is able to draw conclusions, (Cardwell et. al., 1996). The study population in the research was livestock farmers residing in Nimba, Montserrado and Bong counties. It consisted of some residents and livestock farmers that were into both involved into intensive and extensive methods of farming.

3.4. Sample and Sampling

Sampling is the process of selecting units from a population of interest so that by studying the sample, one may fairly generalize the results back to the population from which they were chosen (William, 2006).

Usually, the population is too large for the researcher to attempt to survey all of its members. A small, but carefully chosen sample can be used to represent the population. The sample reflects the characteristics of the population from which it is drawn (StatPac, 2009).

Convenience sampling was used in this study. This is a non-probability sampling method, which is more convenient and economical as the sample is selected from the population in some non-random manner. In this study 90 persons were considered, where 10 persons were chosen to participate in the focus group discussions. These people were chosen based on the shared characteristics.

3.5. Research Instruments

The survey keenly took into considerations the use of a questionnaire, structured interviews and observation. The choice of using questionnaire is mainly because large number of respondents was used in order to get qualitative information from the sample. Structured interviews were used to get detailed information from the residents. Observations were also used to get information in order to analyze the situation of livestock production in Liberia.

It was part of the researcher task to interview group members by asking them questions which was selected and phrased in advance. Note books were used to capture statements from the discussions. (Lewis, 2000) states that, the researcher must start with general questions, move to specific questions and then back to general questions. The funnel approach (from general to specific) is one way of engaging the interest of participants quickly. Very specific questions about the topic towards the beginning may set the discussion on a track that is too focused and narrow.

Questionnaire:

The structured questionnaire for residents of Nimba, Montserrado and Bong counties in Liberia was designed and it was divided into three main sections. Section A was related to the

respondents' demographic data and it consisted mainly of closed-ended questions about the respondents' demography and the subject under survey. This section enabled researcher to gather quantitative data.

Section B and C elicited respondents' views on the Situational Analysis of Livestock Production in Liberia. This section consisted mainly of both the open-ended and closed-ended questions that allowed respondents to provide their personal views, opinions, perceptions and experiences on the issue under study. This part enabled researcher to collect reliable qualitative data. (Patton, 2000).

Interview Schedules:

Structured interviews were conducted with residents that formed part of the sample. Structured interviews were administered together with the questionnaire so that residents could give their views and opinions about the situation of livestock production in Liberia. (Swart, 2003) regards interviews as a helpful tool for data collection because it provides an opportunity for the researcher to find out more about people's views on the subject being investigated.

3.6. Reliability and Validity of the Instruments

According to (Maree, 2007) reliability of an instrument means that if the same instrument is used at different times or administered to different subjects from the same population, the findings should be the same. In other words, reliability is the extent to which a measuring instrument is repeatable and consistent.

In this research an internal reliability was used, where in the researcher was able to see to it that the questions prepared for the focus group discussions correlated with each other. This type of

reliability is also called internal consistency. When a number of items are formulated to measure a certain construct, there should be a high degree of similarity among them since they are supposed to measure one common construct. A measure of this degree of similarity is an indication of the internal consistency of the instrument (Maree, 2007).

The research consisted of the facilitator (researcher), a note-taker and an observer. All these three instruments compared notes to ensure that there were similarities in the findings and thereafter comprehensive notes were written.

Validity of an instrument refers to the extent to which it measures and what is supposed to measure, (Maree, 2007). Draft questions were submitted to experts in the field of study and to supervisors for comments before finalizing the questions. (Maree, 2007) refers to this kind of validity as content validity. This refers to the extent to which the instrument covers complete content of the particular construct that it is set to measure.

3.7. Data Collection

The researcher along with the observer attempted to make notes, whereas the note-taker was responsible to capture the exact phrases and statements made by the participants. At the end of each session the researcher was able to summarize the session's findings in order to facilitate data analysis.

3.8. Data Analysis

According to (Lewis, 2000) information collected from a focus group discussion is raw data. The researchers' task is to prepare a statement regarding the collected information. The first step was

to transcribe the entire interview. This provided a complete record of the discussion and facilitated analysis of the data. The next step is to analyze the content of the discussion.

The third step was to interpret and summarize the information. In this step the researcher looked at the range of views expressed. It is important to make sure all opinions or views are represented in the summary. The fourth step was to explain the information. This is where the information was discussed lengthily and shared with relevant stakeholders.

The responses were manually transcribed and the Qualitative Content analysis was used to analyze the quantitative methods. Descriptive Statistics was used whereby data was displayed using frequency tables and Qualitative data was to be coded first and then analyzed using identified themes.

Tables were used to illustrate how many respondents support or do not support a particular view. This was used to compare whether there exist any significant differences or similarities between the views held by values such as age, gender.

3.9. Research Ethics

It is important to highlight the ethical considerations in regard to the research. An essential ethical aspect is the issue of the confidentiality of the results and findings of the study and the protection of the participants' identity. This could include obtaining permission to be interviewed, undertaking to destroy audiotapes and note books. It is also important for one to familiarize themselves with the ethics policy of the relevant institutions (Maree, 2007).

The following research ethics were observed during the survey:

- **Informed consent**

The researcher obtained consent from prospective participants as to whether they were willing to participate in the discussions. This meant, informing them about what the study is all about in order for them to be able to make a rational decision whether to participate in the survey or not.

- **Permission from authorities**

Permission was obtained from the appropriate relevant authorities before conducting the survey; Town Superintendent, Town Chives, Elders, and Zoes.

- **Confidentiality**

Information was obtained from the participants during the study and it remained confidential and could only be shared with others if prior agreement was made with respondents. According to (Bless & Higson-Smith, 1988) the researcher must assure the participants that data will only be used for the stated purpose of the research and that no other person will have access to the information. It is of importance that the researcher must accept responsibility of protecting the participants.

- **No intimidation**

The participants who were involved in the survey will do so, on a voluntary basis. This meant consent was sort before the survey was conducted.

- **No plagiarism of data or information.**

Information from other researchers and authors were acknowledged and proper citations and references were done.

All respondents were assured that the information collected was to be treated with strong confidentiality and no information that might lead to the identification of the Respondents' identity was divulged. Respondents were kept at ease and they were informed of their rights to remain unanimous if they wish.

In addition, the researcher clearly outlined the instructions on how to complete the questionnaires and interview procedures were explained to all respondents so that they were kept at ease and confusion was reduced to a minimal point. Importantly, the researcher informed the respondents that the collected information was used only for the purpose of the survey and not for any other purposes.



(Meeting with appropriate authorities before commencing survey)

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents data analysis, interpretation and presentation. Data has been presented in form of tables and figures and pie charts. A pilot study was carried out to determine reliability of the questionnaire and Spearman rank order correlation (r) was used to compute the correlation coefficient to establish the degree to which there was consistency in eliciting similar response every time the questionnaire was administered. Spearman rank order correlation (r) was 0.6 which was within the acceptable range of reliability (0.6-0.9) indicating that questionnaires used were reliable. The study targeted 90 respondents who were livestock farmers residing in Nimba, Montserrado and Bong counties. However, 80 respondents participated in the study resulting in a response rate of 89%. (Mugenda & Mugenda, 1999) recommended a response rate of 50% and above as for data analysis. Descriptive statistics (frequencies and percentages) weighted mean and standard deviation were computed during data analysis. Chi Square Test was used to test the hypotheses. The study findings were presented in tables and pie-charts and bar graphs while explanations were done in prose.

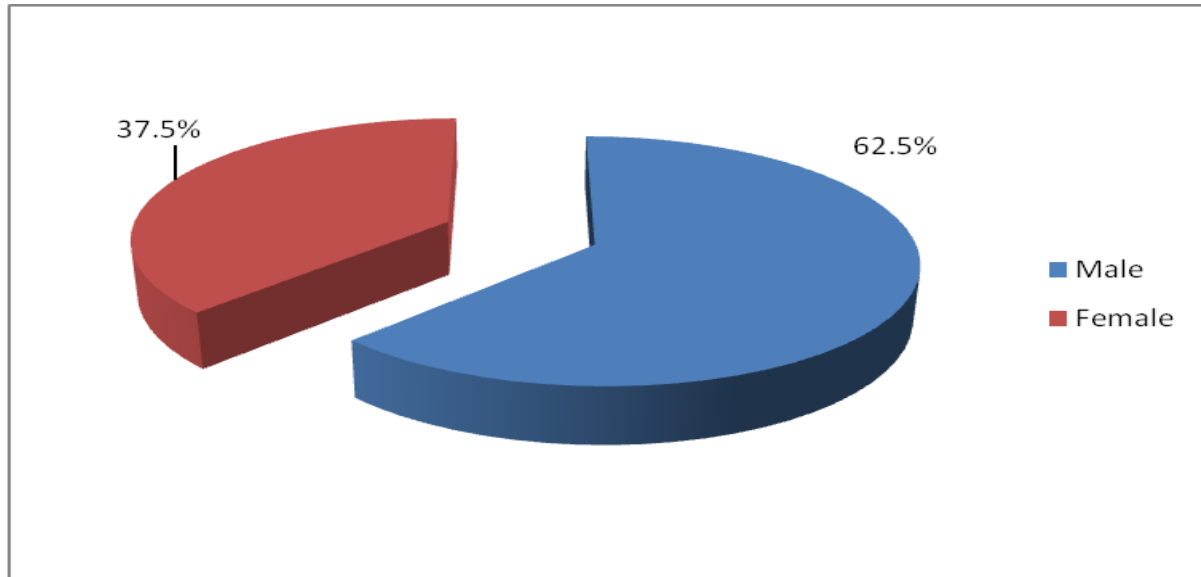
4.2 Respondents demographic information

The study established the demographic information on respondents with respect to gender and age. The study findings are discussed in the following sub sections.

4.2.1 Distribution of Respondents by Gender

The respondents were asked to indicate their gender. The study findings are illustrated in the figure below.

Figure 3: Distribution of Respondents by Gender



From figure, 62.5% of the respondents were males while 37.5% were females. The findings therefore indicate that majority of livestock farmers in Nimba, Montserrado and Bong counties in Liberia are male.

4.2.2 Distribution of respondents by age

The respondents were asked to indicate their ages. The study findings are illustrated in the figure below.

Figure 4: Distribution of respondents by age

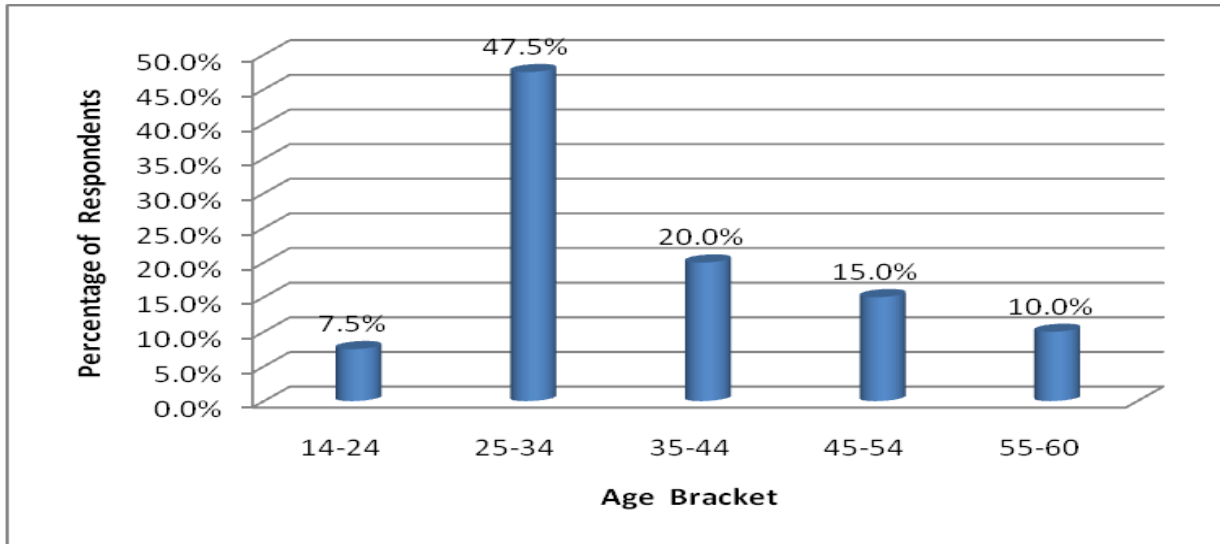
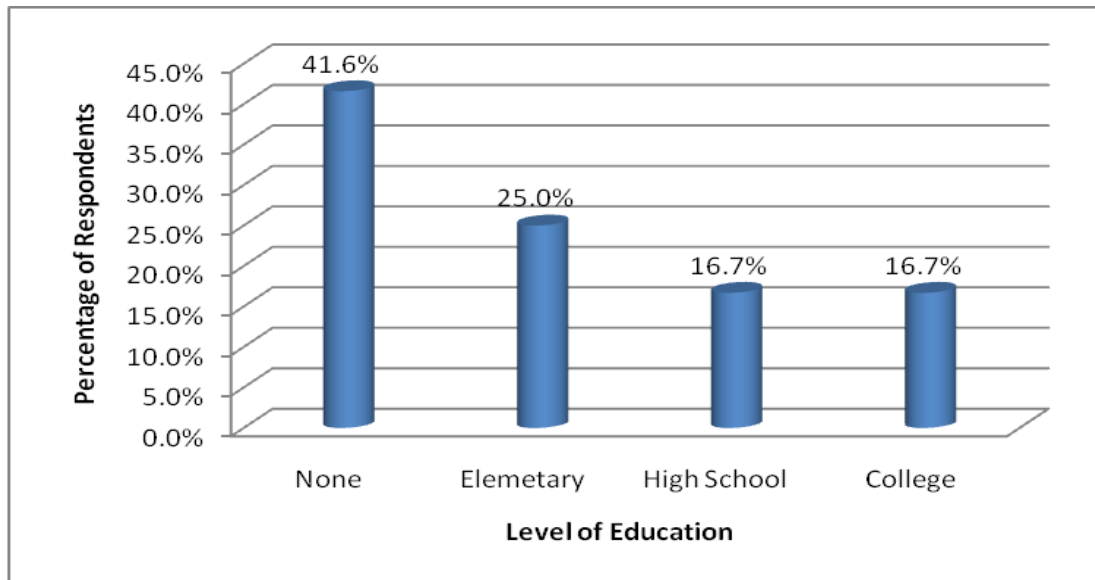


Figure above indicate that majority (47.5%) of the respondents were aged between 25 and 34 years. The study findings reveal that majority of of livestock farmers in Nimba, Montserrado and Bong counties in Liberia are in the active age for labor productivity 25 and 34 years.

4.2.3 Level of Education

Figure below illustrates level of education of the respondents.

Figure 5: Level of Education



From the study findings in figure above majority (41.6%) of the respondents have no formal education while 25.0% of the have elementary education, 16.7% have high school education and another 16.7% have college education. The findings reveal that majority of farmers are basically illiterate and few just had basic education. The war in Liberia was a contributing factor for lack of education of most of the respondents and this led to most of the respondents resolving to do poultry farming.

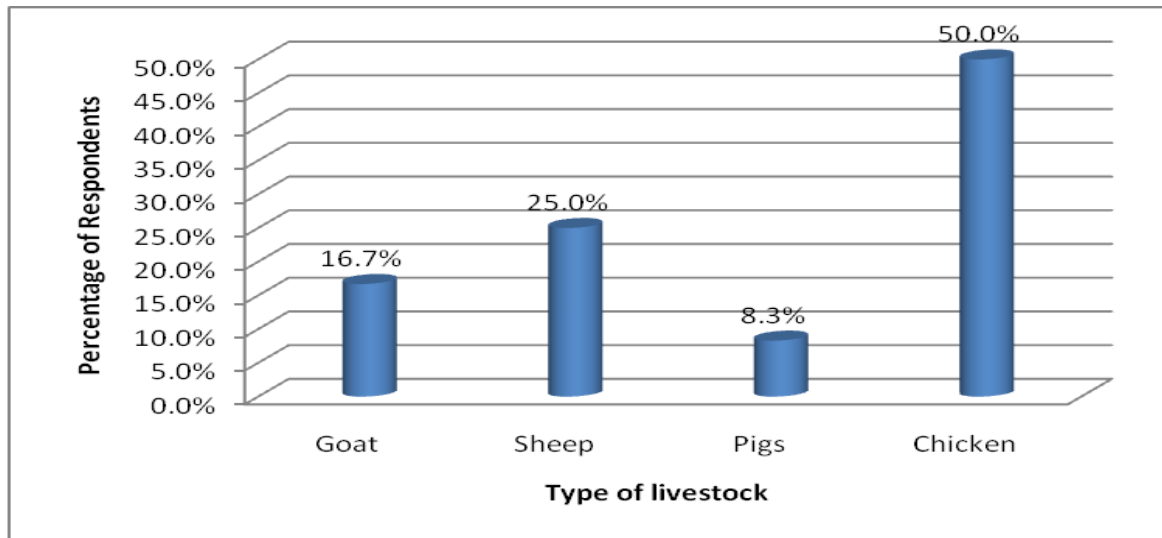
4.3 The extent to which farmers practice livestock production in Liberia

The study sought to establish the extent to which farmers practice livestock production in Liberia. The findings are presented in the following subsections.

4.3.1 Types of livestock

The finding in figure below presents the study findings

Figure 6: Types of livestock

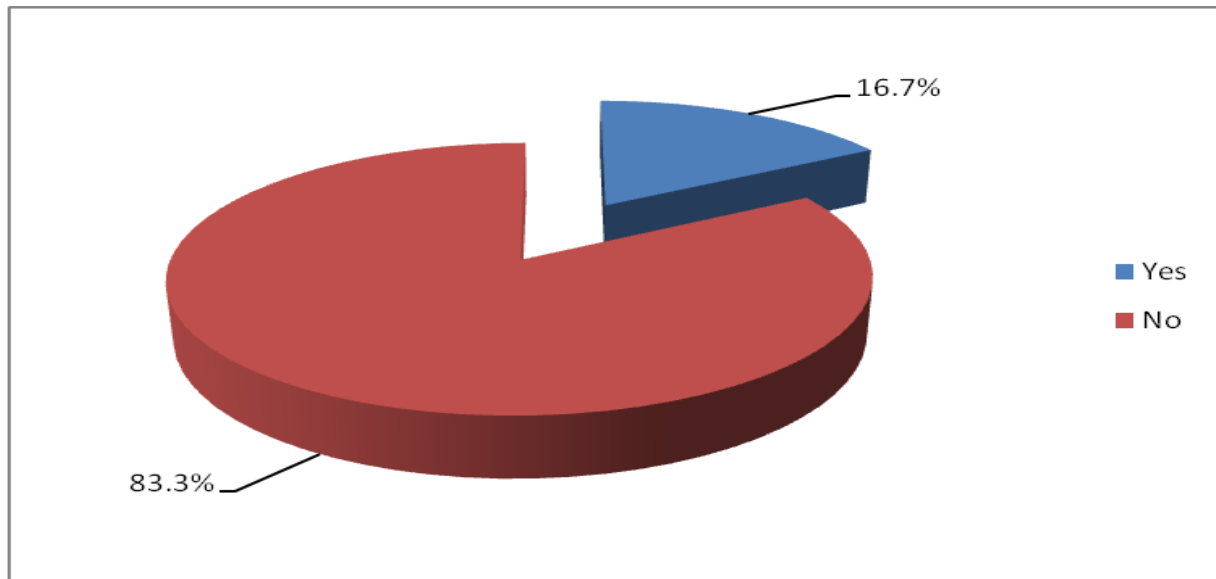


The study findings in figure above revealed that majority of the respondents (50.0%) keep chicken, sheep (25.0%), goat (16.7%) and pigs (8.3%). The study findings revealed majority of livestock farmers in Nimba, Montserrado and Bong counties in Liberia keep chicken followed by goat, then sheep, pigs and scanty number of cattle. Though, most of the respondents said that they mostly rear chicken, sheep, goats and pigs because they are less expensive rear, though it is tedious to rear and have access to these livestock easily than cattle. According to the respondents to rear cattle is very expensive and sourcing it is difficult. Moreover, they said supplementing their feed is very expensive since they are small scale farmers. Most of the farmers who rear cattle indicated that they were imported from Mali, Nigeria and other far west of West African region. Though the reason behind this is because of the civil war that erupted in Liberia and neighboring country Sierra-Leone. Most of the livestock were killed, looted and eaten during war because there was no food. So after the war, one of the consequences was that the rebuilding of the nation made many people to lose interest in livestock. And the fear of the unknown made many people to lose hope in livestock rearing.

4.3.2 Keeping records of livestock

The study sought to establish whether livestock farmers keep records of livestock. The study findings are illustrated in the figure below.

Figure 7: Keeping records of livestock



From the figure above, majority (83.3%) of the respondents do not keep proper records of their livestock, while 16.7% of the respondents keep record of their livestock. From the finding, it shows that most of the farmers do not know the essence of keeping records of their livestock and probably because they are not involved in commercial farming so they do not know the need to keep records. Moreover most of the respondents are illiterate. Most of the livestock farmers who rear few animals can take down records unlike those who don't have time. So keeping records have become unusual because there is no need to do that. They find it unlikable to keep record, though they know how many they have and how many are sold at a time.

4.3.3 Farmers perception on the progress of livestock production in Liberia

The respondents were requested to indicate their level of agreement to the following statements on livestock production in Liberia. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree. The mean and standard deviations were generated from SPSS and are as illustrated in table below.

Table 1: Farmers perception on the progress of livestock production in Liberia

Statement	Mean	Std. Deviation
Majority of farmers in Liberia practice livestock farming	2.293	0.8751
Livestock keeping has not been on the increase	2.036	0.9222
Livestock farmers receive sufficient support from Ministry of Agriculture	2.364	0.8812
Livestock farmers have access to sufficient farm inputs	2.129	0.2902
Majority of livestock farmers are happy with the current state of livestock production in Liberia	2.043	0.3483
There is a need for review of government policies in order to improve the current state of livestock production	4.245	0.2654

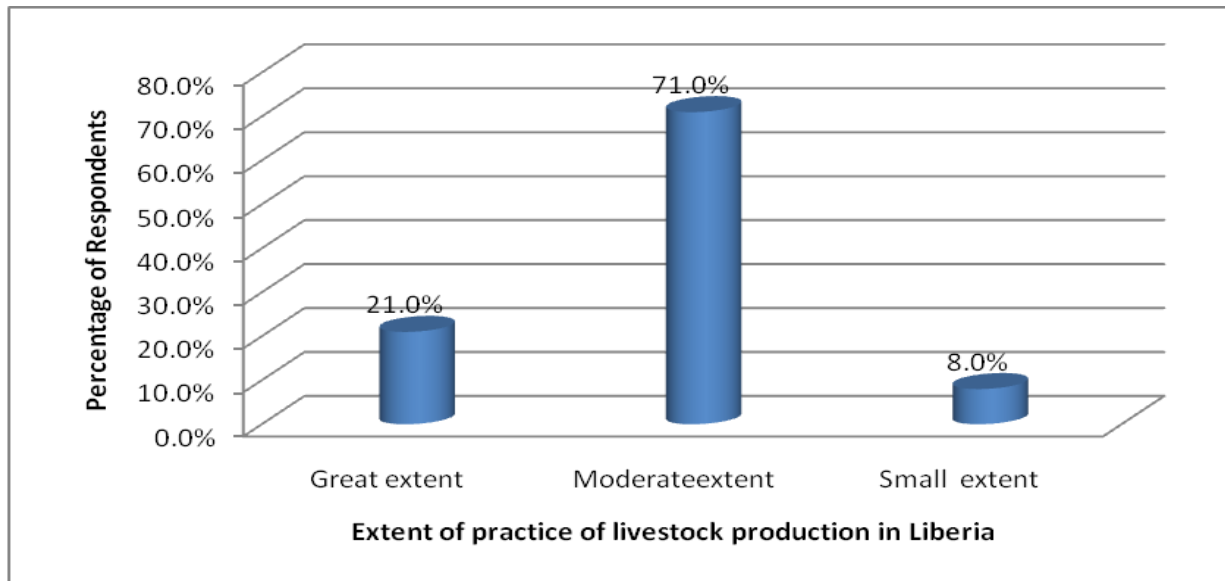
Statements with mean close to 1 were rated as strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree. From the study findings in table 4.3 above, majority of the respondents agreed that there is a need for review of government policies in order to improve the current state

of livestock production (M=4.245). However majority of the respondents disagreed to the statements that Majority of livestock farmers are happy with the current state of livestock production in Liberia (M=2.043), livestock keeping has not been on the increase (2.036), livestock farmers have access to sufficient farm inputs (M=2.129), majority of farmers in Liberia practice livestock farming (M=2.293) and livestock farmers receive sufficient support from the Ministry of Agriculture (M=2.364).

4.3.4 The extent of livestock production in Liberia

The respondents were requested to rate the extent to which farmers practice livestock production in Liberia. The findings are presented in the figure below.

Figure 8: The extent of livestock production in Liberia



From the study findings in figure, majority of the respondents (71.0%) indicated that livestock production is moderately practiced in Liberia. The study findings revealed that livestock production is not widely practiced in Liberia.

4.3.5 Hypothesis H_i : The population of livestock in Liberia is not on the increase

Chi-Square Test was done using SPSS to test the null hypothesis. P values less than the significant level of 0.05 lead to rejection of null hypotheses. P values more than the significance level of 0.05 led to acceptance of null hypothesis. A chi-Square test result is illustrated below.

Table 2: Chi-Square Tests for H_i

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.395 ^a	3	0.024

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.14.

From the Chi-Square Tests in table the p value ($P=0.024$) is less than the significance level at 0.05. Therefore, the study rejects the null hypothesis that population of livestock in Liberia is not on the increase. The study concludes that population of livestock in Liberia is on the increase.

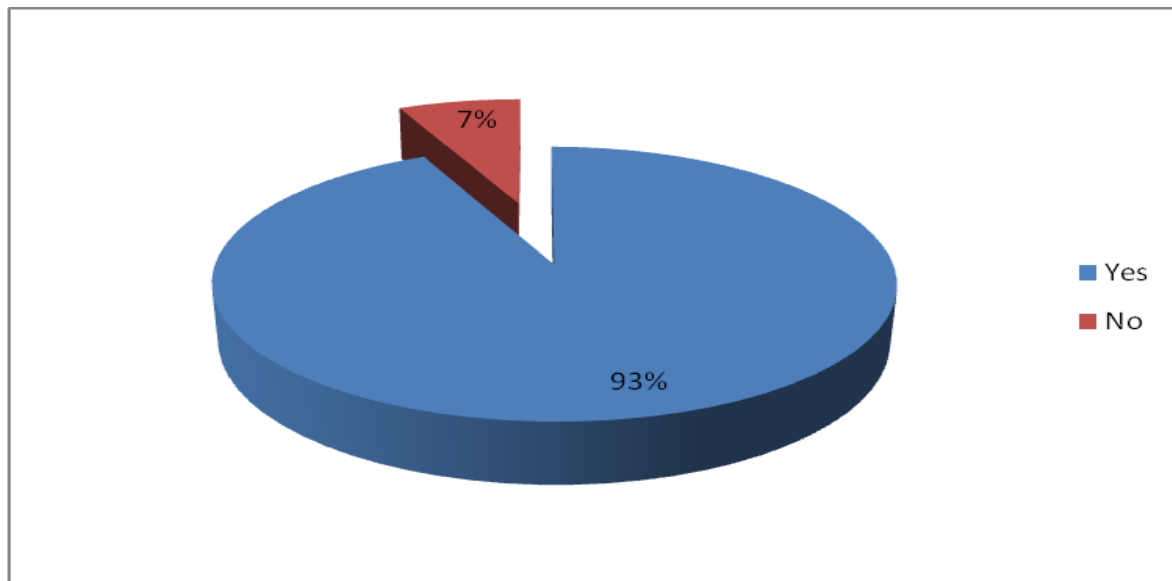
4.4 Factors limiting the production of livestock in Liberia

This subsection presents study findings on factors that limit livestock production in Liberia.

4.4.1 Availability of agricultural training

The respondents were requested to indicate whether they have training in agriculture. The findings are presented in the figure below.

Figure 9: Availability of agricultural training

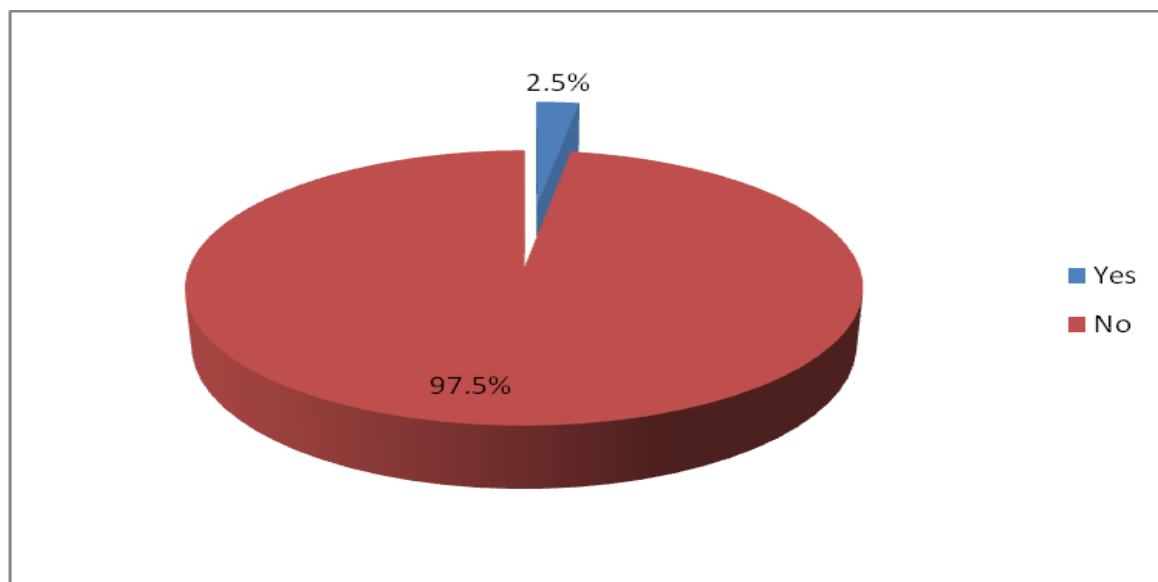


From the figure, the majority (93.0%) of the respondents said that they do not have any agricultural training and 7% of respondents have agricultural training. From the findings, it shows that most of the respondents lack agricultural training and this really contributed to most of them not being able to produce livestock products in commercial quantity. The war devastated many things in Liberia and many facilities in Liberia are not adequately provided for training.

4.4.2 Availability infrastructure

The respondents were asked whether there was sufficient infrastructure for livestock production in Liberia. The figure below illustrates the study findings.

Figure 10: Availability infrastructure



From the study findings in figure 4.8 above, majority of the respondents (97.5%) said that there was no sufficient infrastructure for livestock production in Liberia. The finding indicates that availability infrastructure is a limiting factor in livestock production in Liberia.

The respondents were further requested to indicate the available means of transport for livestock and livestock produce. Table below shows the study findings.

Table 3: Available means of transport for livestock and livestock produce.

Means of transport	Frequency	Percentage
Car	10	12.5
Truck	4	5.0
Bicycle	45	56.2

Trekking	21	26.3
Total	80	100.0

From Table 8, majority of the respondent (56.2%) use bicycle to transport their livestock, 26.3% of the respondents trek to transport their livestock, 12.5% of the respondents use car and the remaining 5.0% of the respondents use truck to transport their livestock and livestock produce. The means of transport system, which is the farm to market road, is in a deplorable condition (for communities surveyed). Though the common means of transport like car, bicycle are all used in the community. Though, because of the war many of the road outlets are very bad and they are not regularly maintained basically because of the damage done by the civil war. So many people use the bicycle or they trek to go and sell their livestock. Some of them have to go very early in the morning so that they can meet up with the buyers who might buy the livestock at a very good price. But some of the people get to the market very late and don't even get to the market place on time and sometime they don't sell their livestock. They sometime sell it at a giveaway price or they take it back home and this causes a lot of inconveniences to the seller. So the transport means have to be done effectively for this seller to be able to get to the market on time.

4.4.3 Availability of veterinary services

All the respondents said that the available veterinary services were not sufficient for efficient livestock production. The respondents were further requested to name the available veterinary practices in their regions. Table below shows the study findings.

Table 4: Availability of veterinary services

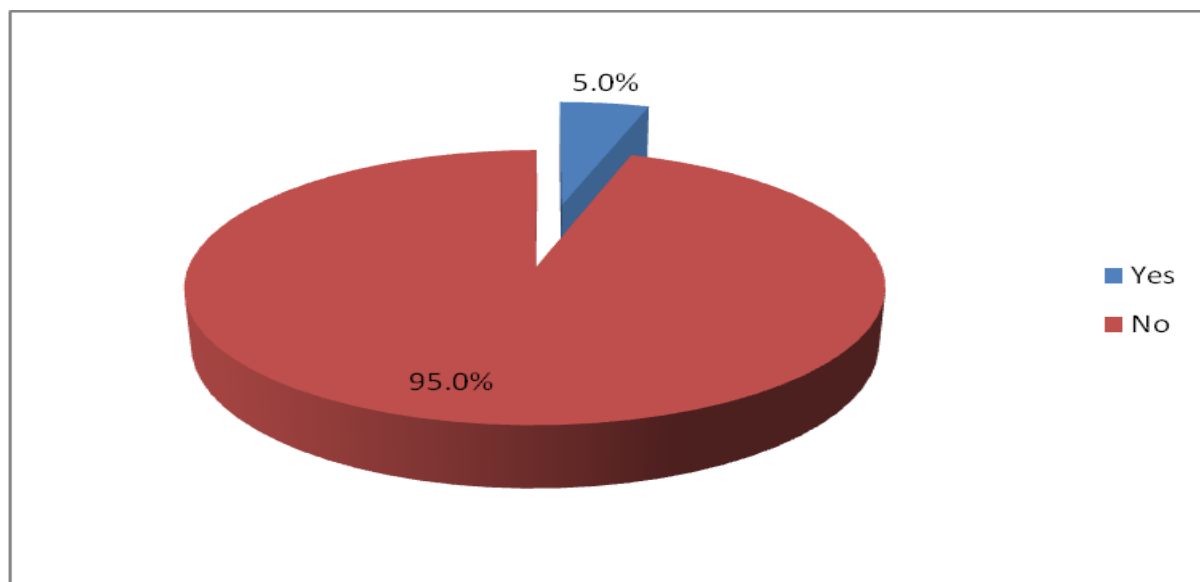
Veterinary Services	Frequency	Percentage
Dipping (dropping)	26	32.5
Castration	12	20.0
Vaccination (immunization)	8	10.0
De-worming	10	12.5
Ear-tagging (grouping)	24	30.0
Total	80	100.0

From table above, majority (32.5%) of the respondents each indicated dipping, 30.0% indicated ear-tagging, 20.0% indicated castration, and 12.5% of the respondents each indicated de-worming and 10.0 % indicated vaccination. From the finding, majority of the respondents access dipping and ear-tagging services from veterinary officers. Fewer livestock farmers access veterinary services such as castration, vaccination and de-worming.

4.4.4 Availability of finances

The respondents were asked whether there was sufficient finance for livestock production in Liberia. Figure below illustrates the study findings.

Figure 11: Availability of finances



From the study findings in figure above, majority of the respondents (95.0%) said that there was insufficient finance for livestock production in Liberia. The findings reveal that insufficiency of finances is a major challenge for livestock farmers in Liberian livestock industry.

4.4.5 Availability of commercial feed supplements

Table below shows the study findings on availability of commercial feed supplements.

Table 5: Availability of commercial feed supplements

Veterinary Services	Respondents	Percentage
Yes	25	31.3
No	55	68.7
Total	80	100.0

From the study findings in table, majority of the respondents (68.7%) said that commercial feed supplements were not available. The study findings reveal that majority of livestock farmers do not access commercial feed supplements. Most of the people feed their livestock with grasses, and maize. In fact most of the people don't have access to genetically modified food for their livestock and they only gather food for their livestock by buying maize and blend it for consumption of their livestock. So most of the farmers don't know anything like supplement and this has really affected the production of livestock.

The respondents that use feed supplement indicated that they use cassava leaf, potato leaves, avocado, rice dust, coconut and maize meal supplement. The supplement that most of them are aware of is maize and coconut supplement. They blend maize with coconut and add scent leaf which has a medicinal value. This helps in keeping the livestock healthy, though it is not really proper and adequate for the proper growth of the livestock. Some of the feeds are traditionally made with grasses which they gather from the bush. Sometimes, during the time of dry season it becomes practically impossible for these farmers to get enough grasses to feed their animals and these animals lose weight. Therefore, most people don't sell their product during this time.

4.4.6 The extent to which various factors affect livestock production in

Liberia.

The respondents were requested to state which the following factors affect livestock production in Liberia. The responses were rated on a five point Likert scale where: 1 – Very great extent 2 – Great extent, 3 – Moderate extent 4- Little extent and 5- No extent at all. The mean and standard deviations were generated from SPSS and are as illustrated in table below.

Table 6: Factors affecting livestock production

Factors affecting livestock production	Mean	Std. Deviation
Availability of finances	4.234	0.1245
Availability infrastructure	4.221	0.1641
Availability of veterinary services	4.154	0.1893
Agricultural training	4.129	0.2138
Government policies	4.042	0.2458
Availability of market	4.016	0.2652
Competition from imported livestock produce	4.014	0.3245

The statements with mean close to 1 were rated as very great extent 2 – great extent, 3 – moderate extent 4- little extent and 5- no extent at all. From the study findings in table above, majority of the respondents indicated that livestock production in Liberia is affected by competition from imported livestock produce (4.014), availability infrastructure (4.221), availability of veterinary services (4.154), agricultural training (4.129), government policies (4.042), availability of market (4.016) and availability of finances (4.234).

4.4.7 Hypothesis H_{ii} : Livestock production is not limited by several factors

Chi-Square Test was done using SPSS to test the null hypothesis. P values less than the significant level of 0.05 lead to rejection of null hypotheses. P values more than the significance level of 0.05 led to acceptance of null hypothesis. Chi-Square test results are illustrated below.

Table 7 Chi-Square Tests for H_{ii}

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.215 ^a	3	0.036

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 25.4.

From the Chi-Square Tests in table the p value (P=0.036) is less than the significance level at 0.05. Therefore, the study rejects the null hypothesis Livestock production is not limited by factors such as diseases, insufficient grazing and foraging capacities and shortage of feed supplements. The study concludes that Livestock production is limited by factors such as insufficient grazing and foraging capacities and shortage of feed supplements.

4.5 Analysis of land use system in the livestock production sector in Liberia

One of the objectives was to establish the effectiveness of land use system in the livestock production sector in Liberia. The following are the study findings.

4.5.1 Type of ownership for pasture land used in livestock production

The respondents were asked to indicate the type of ownership for pastureland used in livestock production. The study findings are presented below.

Table 8 : Type of ownership for pasture land

Type of ownership for pasture land	Respondents	Percentage
Land holding through customary law /communal land	44	55.0
State own land	20	25.0
Land holding through title deed	16	20.0
Total	80	100.0

The study finding in table indicate majority of the respondents (55.0%) own pasture land through customary laws while 25.0% of the respondents use pasture land that is state owned and 16.0 % of the respondents are held through title deeds. The findings reveal that pasture land for livestock production in Liberia is largely communal.

4.5.2 Types of grazing systems

The respondents were asked to indicate which of the following types of grazing systems they apply in livestock production.

Table 9: Types of grazing systems

Types of grazing systems	Respondents	Percentage
Continuous stocking in which pastures rarely receive a spell from grazing	47	58.7
Rotational grazing in which a period of grazing is followed by a period of rest	22	27.5
Time controlled or cell grazing where many relatively small paddocks enable a short graze period with heavy stocking rates followed by a long recovery period	11	13.8

Total	80	100.0
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The study findings in table indicate that majority of the respondents (58.7%) have adopted continuous stocking in which pastures rarely receive a spell from grazing, 27.5% of the respondents practice cell grazing where many relatively small paddocks enable a short graze period with heavy stocking rates followed by a long recovery period and 13.8% of the respondents who use rotational grazing in which a period of grazing is followed by a period of rest. The study findings reveal that majority of livestock farmers continuously use the pasture land for livestock production.

4.5.3 Management options for pasture land

The respondents were requested to indicate the extent to which the following management options for pasture land are applied in livestock production in Liberia. The responses were rated on a five point Likert scale where: 1 – Very great extent 2 – Great extent, 3 – Moderate extent 4- Little extent and 5- No extent at all. The mean and standard deviations were generated from SPSS and are as illustrated in table below.

Table 10: Management options for pasture land

Management options for pasture land	Mean	Std. Deviation
Management of total grazing pressure	2.435	0.4687
Use of appropriate utilization rates	2.236	0.3548
Implementation of appropriately timed spelling and herd management strategies	2.012	0.4781

Monitoring of pasture composition	2.582	0.6924
Use of hay, supplements, fodder trees and shrubs in a strategic manner	2.398	0.8934
Management of the tree/grass balance to avoid woodland thickening	2.473	0.7245
Implementation of forage budgeting strategies	2.066	0.6783
Use of climate and seasonal forecasting resources	2.126	0.3894
Maintenance of native grassland free of encroachment from woody vegetation	2.423	0.2654
Use of appropriate fire management practices	1.865	0.4362
Fencing pasture land according to land types	1.675	0.2486
Proper management of the distance stock have to travel to water and pasture	2.277	0.2981

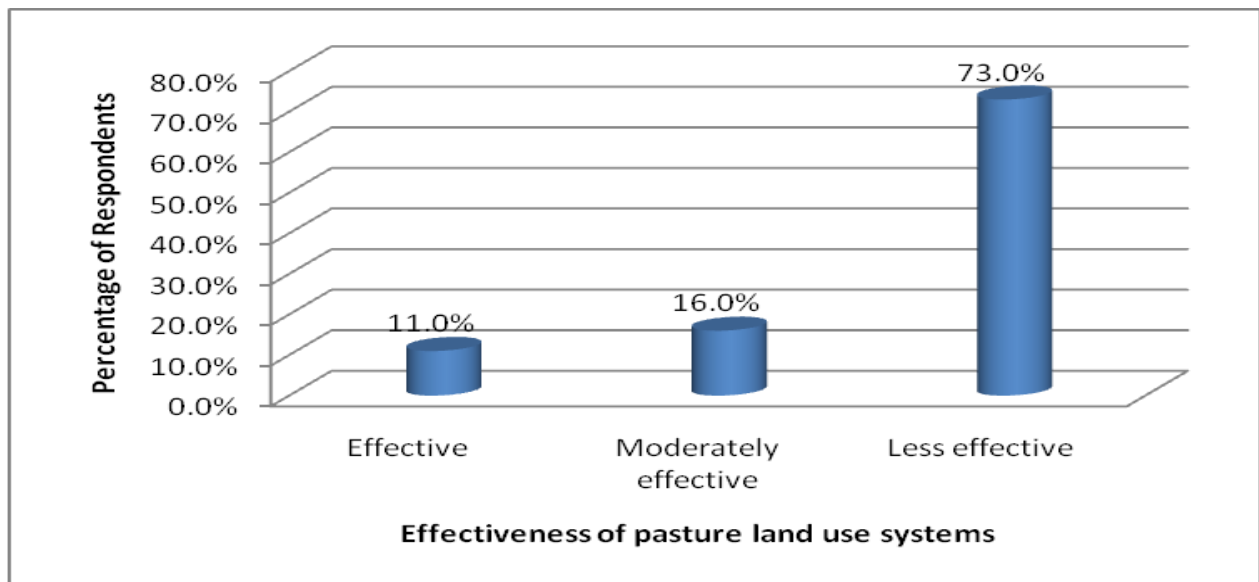
From the study finding majority of the respondents indicated that there is a little extent of application of pasture land management practices such as management of total grazing pressure (M=2.435), use of appropriate utilization rates (M=2.236), implementation of appropriately timed spelling and herd management strategies (M=2.012) monitoring of pasture composition (M=2.582), management of the tree/grass balance to avoid woodland thickening (M=2.473) and maintenance of native grassland free of encroachment from woody vegetation (M=2.423). There is little use of hay, supplements, fodder trees and shrubs in a strategic manner (2.398), implementation of forage budgeting strategies (M=2.066), use of climate and seasonal forecasting resources (M=2.126), proper management of the distance stock have to travel to

water and pasture (M=2.277), use of appropriate fire management practices (M=1.865) and fencing pasture land according to land types (M=1.675).

4.5.4 Effectiveness of land use system in the livestock production sector in Liberia

The respondent were requested to rate the effectiveness of land use system in the livestock production sector in Liberia. Figure below illustrates the findings.

Figure 12: Effectiveness of land use system in the livestock production sector in Liberia



From the study findings in figure above, majority of the respondent (73.0%) indicated that land use system in the livestock production sector in Liberia is not effective. The findings reveal the there is inefficiency in the use of pasture land for livestock production in Liberia.

4.5.6 Hypothesis H_{iii} : Land is not properly used in the livestock production sector in Liberia

Chi-Square Test was done using SPSS to test the null hypothesis. P values less than the significant level of 0.05 lead to rejection of null hypotheses. P values more than the significance level of 0.05 led to acceptance of null hypothesis. Chi-Square test results are illustrated below.

Table 11: Chi-Square Tests for H_{iii}

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.467 ^a	3	0.112

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.6.

From the Chi-Square Tests in table the p value (P=0.112) is more than the significance level at 0.05. Therefore, the study accepts the null hypothesis that Land is not properly used in the livestock production sector in Liberia.

4.6 The economic impact of livestock production in Liberia

One of the objectives of the study was to establish the economic impact of livestock production in Liberia. The study findings are presented in the following subsections.

4.6.1 Type of livestock farms

The following table illustrates the types of firm in Nimba, Montserrado and Bong counties in Liberia.

Table 12: Type of livestock farms

Type of livestock farms	Frequency	Percentage
Private farm	25	31.3
Commercial farm	15	18.7
Communal farm	40	50.0
Total	80	100.0

From table above, majority of the respondents (50.0%) of the respondents are engaged in communal farming, followed by 31.3% of the respondents who engaged in private farming and the remaining 18.7% of the respondents who engaged in commercial farming. From the analysis it shows that most of the farmers produce livestock for immediate consumption and not for commercial purposes. Hence, it indicates that most of the farmers are involved in intensive system of livestock production which does not really generate income to the government neither to themselves.

4.6.2 Aim of animal rearing

The following table illustrates the aim of rearing animals in Nimba, Montserrado and Bong counties in Liberia.

Table 13: Aim of animal rearing

Aim	Frequency	Percentage
Selling	26	32.5
Own consumption	47	58.7
Donation	3	3.8
Hobby	4	5.0

Total	80	100.0
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The study findings in table shows that majority of the respondents (58.7%) rear animal for own consumption, 32.5% of the respondents keep livestock for selling, while few respondents (5.0% and 3.8%) keep livestock for hobby and donation respectively. From the findings, most of the livestock farmers in Nimba, Montserrado and Bong counties in Liberia rear the animal for own consumption which shows that most people use it as supportive nutrients. While the remaining ones use as a source of income. Many of the respondents derive pleasure in animal rearing which generates income for most of the respondents. Liberia has suffered a lot of s economic and social set-backs and most of the people resolve in making alternative plan of generating income by rearing livestock. This has been the ultimate goal of most of the Liberians. The country was jeopardized by the war, most of the industries were destroyed and many people lost their lives and most of the people that survive lost hope of living because they don't know where to begin. The only alternative of generating income is by relying on their ability and the only ability is to be self employed. So most of the respondents start a little intensive subsistence farming by rearing animals. Most of the livestock are bought from the market, though donor agency (Samaritan Purse) also provides assistance through the restocking program by donating some livestock. Though concerted communal effort is also used in rearing animals in which the income generated is used to sustain the livelihood of the people in the community.

4.6.3 Number of livestock sold

All the respondents said that they sell a minimum of 5 livestock yearly. This shows that most of the farmers generate income to sustain their livelihood from the sales of the livestock. Though the sale of livestock depends mostly on people in the community. If the population is few then

there is tendency that the sales will not be enough. The country has a lost a whole lot because of the civil war, lives were lost, properties were destroyed and this affected the population. Many people that survived ran for safety of their live to other countries as refugees. Therefore the people indirectly affect the sale. Most people sell an average of five chickens yearly because of the less number of people living in the community.

The respondents were requested to indicate where the livestock is sold. The study findings are presented in table below.

Table 14: Places where livestock is sold

Places where livestock is sold	Frequency	Percentage
Open market	48	60.0
Farm gate	12	15.0
At home	20	25.0
Total	80	100.0

From the table above, majority of the respondents (60.0%) sell their livestock at the market, 25.0% of the respondents sell their livestock at home while 15.0% of the respondents sell their livestock at the farm. From all indication it shows that most of the participants sell at the market because they make more money, it is more competitive and there is standard for sales of livestock. Most of the people go to the open market to sell their livestock. All the communities have open markets where livestock are sold and there is no discrimination for sales at the market. Both the rich and poor go to the open market to buy and sell their product. So there is no

limitation in selling livestock by the people. The value of each livestock is decided by the owner and the owner can sell the product at any price he/she wishes.

The respondents were further requested to indicate whether they experience problems in marketing the animals. All the respondents indicated that they do not experience any problem in the sale of the animals. This is because most of the animals are not quarantined or examined before sale. So everyone sell his/her animals anytime at the open market, home or at the farms. Animals in Liberia are quarantined on lower basics because of poor infrastructures within the Quarantine Bureau. Presently there is one effective Abattoir within the country. The new one will soon be completed. The two that is within the country is located within Monrovia, Montserrado County. So many people just take their livestock to the market at their own pace. So checking a livestock if it is healthy is out of point in Liberia, anyone can make his/her way to the market to sell his/her livestock. This has been the pattern after the civil war in Liberia. But for a proper and hygienic meat to be sold there is need to have an institution that will help quarantining the livestock. This can reduce some of the disease mentioned in the literature.

4.6.4 Economic impact of livestock production in Liberia

In order to establish economic impact of livestock production in Liberia, the study obtained data on Liberian economy from Liberia Agriculture Sector Investment Program (LASIP) report prepared by the government of Liberia in the year 2010. The report covered projections for a five year program from 2011–2015.

Economic expansion is underway in Liberia; real growth rates of 7.8% and 9.5% were experienced in 2006 and 2007, respectively, but the global financial crisis and delays in the resumption of full-scale mining and forestry operations (traditional drivers of growth) limited

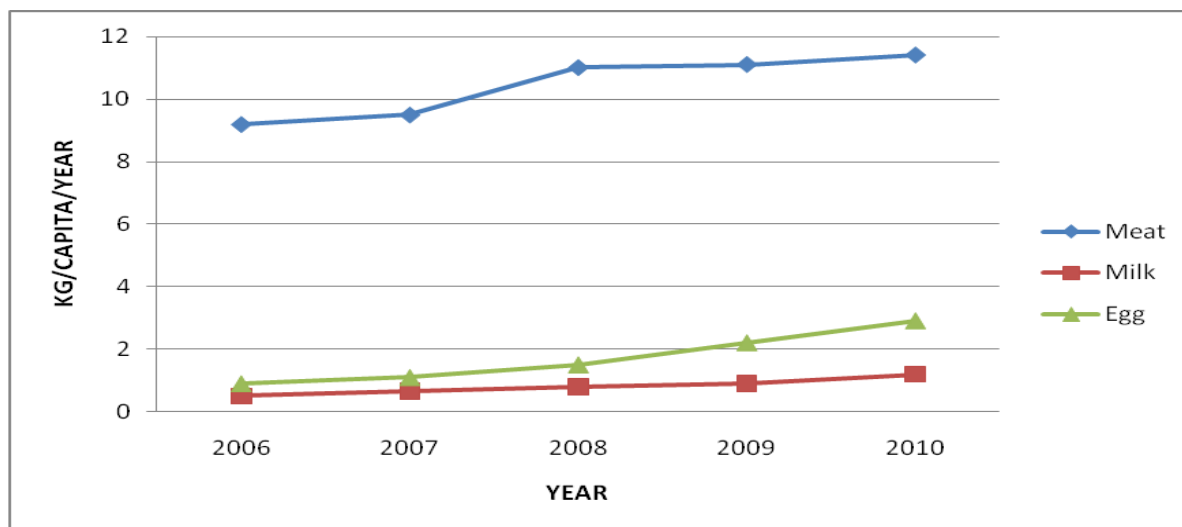
economic growth to 7.1% in 2008 and 4.5% in 2009. Performance would have been worse were it not for the agriculture and services sectors that accounted for 42.2% and 25.8% of real gross domestic product (GDP), respectively. In summary, the average growth for the last four years was 7.2%. Along with the expansion has become an increase in employment and inflation. The rate of inflation also increased from 11.4% to 17.5% over the same period, driven mainly by price increases in the international market for food and fuel. Economic growth has improved public finances and related indicators. The cash-based budget increased from US\$80 million during Fiscal Year (FY) 2005/06 to US\$327 million in FY 2009/2010 and US\$347 million for the draft budget in FY 2010/2011.

Although Liberia has an estimated 2 million ha of pastureland, the livestock sector accounts for only 14% of agricultural GDP. Estimates suggest there is slow growth in aggregate livestock numbers comprising mainly cattle, poultry, and swine. Traditional livestock farmers dominate, as was the case before the war., Traditional systems accounted for 100% of the holdings of cattle, goats, and sheep; 58% of pigs; and 100% of guinea fowl. A few modern peri-urban livestock farmers produced rabbits, guinea pigs, poultry, and ducks. According to information from the Ministry of Commerce and Industry (MCI, 2011), there is imports of livestock and produce from neighboring countries.

4.6.5 Trends in annual per capita production of meat, milk and egg

The data obtained from (FOA, 2011) indicate that there has been upward trend in annual per capita production of meat, milk and egg in the previous years from 2006-2010. Table below shows Trends in annual per capita production of meat, milk and egg.

Figure 13: Trends in annual per capita production of meat, milk and egg



Source: (FOA, 2011)

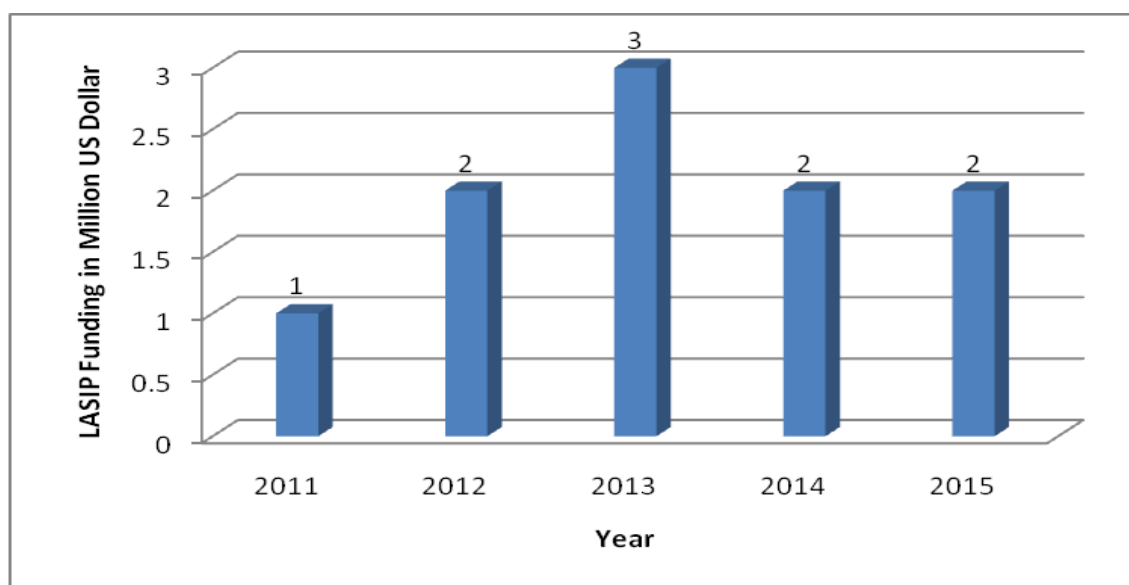
The Government of Liberia (GoL) has put in place measure to increase annual per capita production of livestock produce. The government of Liberia has come up with Liberia Agriculture Sector Investment Program (LASIP) to promote livestock development. Table show total cost of LASIP in US\$ Millions, amount for already funded and the funding gap in livestock development and promotion.

Table 15: Funding of Livestock Development and Promotion

	Total Cost of LASIP (US\$ Millions)	Already Funded (US\$ Millions)	Funding Gap (US\$ Millions)
Funding of Livestock Development and Promotion	11.1	1.1	10

The Liberia Agriculture Sector Investment Program (LASIP) projects to promote economic impact of livestock production. The funding in the five year period will be as shown in figure below.

Figure 14: Finding of livestock development for the period 2011 to 2015



The GoL projects to enhance economic viability in five year period (2011-2015) by increasing the number of livestock and carcass weight of livestock as illustrated in table below

Table 16: Projected Animal Population in the period 2011 to 2015

Year	Projected Animal Population				
	2011	2012	2013	2014	2015
No. of heads of cattle	45,600	55,000	66,000	79,200	95,000
No. of heads of sheep	276,000	300,000	360,000	400,000	480,000
No. of heads of goats	300,000	360,000	414,000	450,000	550,000
No. of heads of pigs	144,000	165,000	198,000	235,000	282,000

No. of heads of poultry	6,512,000	7,100,000	7,800,000	8,500,000	1,000,000
Carcass weight of cattle in Kg	105	110	115	120	130
Carcass weight of sheep and goats in Kg	12	13	15	15	15
Carcass weight of pigs in Kg	30	35	40	45	45
Carcass weight of poultry in Kg	1.3	1.5	2	2.2	2.2

4.6.6 Hypothesis H_{iv} : Livestock production has no impact on the economy of Liberia

Chi-Square Test was done using SPSS to test the null hypothesis. P values less than the significant level of 0.05 lead to rejection of null hypotheses. P values more than the significance level of 0.05 led to acceptance of null hypothesis. Chi-Square test results are illustrated below.

Table 17: Chi-Square Tests for H_{iv}

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.281 ^a	3	0.104

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.281 ^a	3	0.104

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 26.2.

From the Chi-Square Tests in table the p value ($P=0.104$) is more than the significance level at 0.05. Therefore, the study accepts the null hypothesis that livestock production has no impact on the economy of Liberia.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

This chapter presents the summary of the study finding, conclusion and recommendation. The chapter is presented with regard to the study objectives which analyzed the population of livestock in Liberia, to establish the factors limiting the production of livestock in Liberia, to analyze the land use system in the livestock production sector in Liberia and to analyze the economic impact of livestock production in Liberia.

5.1 Summary

With regard to the extent to which farmers practice livestock production in Liberia the study found that population of livestock in Liberia is on the increase. The study findings revealed that majority of livestock farmers in Nimba, Montserrado and Bong counties in Liberia keep chicken goat, sheep, pigs and scanty number of cattle. However majority of the farmers do not know the essence of keeping records of their livestock and probably because they are not doing commercial farming so they do not know the need to keep records. The study established that there is a need for review of government policies in order to improve the current state of livestock production. Besides majority of livestock farmers are not happy with the current state of livestock production in Liberia, do not have access to sufficient farm inputs and do not receive sufficient support from the MoA.

In respect to factors limiting the production of livestock in Liberia the study found that livestock production is limited by factors such as respondents' lack agriculture training, there is insufficient infrastructure, lack of veterinary services, insufficient finances, shortage of commercial feed supplements, Government policies, lack of market and competition from imported livestock produce.

Analysis of land use system in the livestock production sector in Liberia revealed that pasture land for livestock production in Liberia is largely communal. Majority of livestock farmers continuously use the pasture land for livestock production. From the study finding majority of the respondents indicated that there is a little extent of application of pasture land management practices such as management of total grazing pressure, use of appropriate utilization rates, implementation of appropriately timed spelling and herd management strategies, monitoring of pasture composition, management of the tree/grass balance to avoid woodland thickening and maintenance of native grassland free of encroachment from woody vegetation. There is little use of hay, supplements, fodder trees and shrubs in a strategic manner, implementation of forage budgeting strategies use of climate and seasonal forecasting resources, proper management of the distance stock have to travel to water and pasture, use of appropriate fire management practices and fencing pasture land according to land types. The findings also reveal the there is inefficiency in the use of pastureland for livestock production in Liberia.

The study finding on the economic impact of livestock production in Liberia indicates that livestock production has no impact on the economy of Liberia. From the analysis it is shown that most of the farmers produce livestock for immediate consumption and not for commercial purposes. Most of the livestock farmers in Nimba, Montserrado and Bong counties in Liberia rear the animal for supportive nutrients. Those who trade in livestock produce sell them at an open market. Although Liberia has an estimated 2 million ha of pastureland, the livestock sector accounts for only 14% of agricultural GDP. Estimates suggest there is slow growth in aggregate livestock numbers comprising mainly cattle, poultry, and swine. Traditional livestock farmers dominate, as was the case before the war. However, the government Liberia has put in place measure to increase annual per capita production of livestock produce. The government of

Liberia has come up with Liberia Agriculture Sector Investment Program (LASIP) to promote livestock development.

5.2 Conclusion

The study concludes that livestock production in Liberia is on the increase. Majority of livestock farmers in Liberia keep chicken, goat, sheep, cattle and scanty number of pigs. However livestock farmers in Liberia do not keep proper records of their livestock. Besides, there is a need for review of government policies in order to improve the current state of livestock production. The study also conclude that majority of livestock farmers are not happy with the current state of livestock production in Liberia and do not have access to sufficient farm inputs and sufficient support from the Ministry of Agriculture.

The study conclude that livestock production of in Liberia is limited by factors such as respondents' lack agriculture training, insufficient infrastructure, lack of veterinary services, insufficient finances, shortage of commercial feed supplements, inefficient implementation of Government policies, lack of market and competition from imported livestock produce.

With regard to land use system in the livestock production sector in Liberia the study concludes that pasture land is largely communal and is continuously used for livestock production. The study concludes that there is a little extent of application of pasture land management practices such as management of total grazing pressure, use of appropriate utilization rates, implementation of appropriately timed spelling and herd management strategies, monitoring of pasture composition, management of the tree/grass balance to avoid woodland thickening and maintenance of native grassland free of encroachment from woody vegetation. Besides, there is

little use of hay, supplements, fodder trees and shrubs in a strategic manner, implementation of forage budgeting strategies use of climate and seasonal forecasting resources, proper management of the distance stock have to travel to water and pasture, use of appropriate fire management practices and fencing pasture land according to land types. Pastureland in Liberia is not used efficiently.

The study concludes that livestock production does not have significant impact on the economy of Liberia. Most of the farmers just rear livestock for immediate consumption and livelihood sustainability and not for commercial purposes. However, the government Liberia has put in place measure to increase annual per capita production of livestock products. The Government aims at improving the economic gain from livestock production through LASIP.

5.3 Recommendations

Based upon the findings, the study recommends the following:

Prioritize actions: Livestock should be included in the Poverty Reduction Strategy Papers (PRSPs). The GoL agencies that produce these documents are generally not familiar with the critical role livestock can play in poverty alleviation. Explicit inclusion of appropriate instruments to enhance livestock development is critical to attract both domestic and Overseas Development Aid (ODA) resources to ensure livestock is utilized to its full potential to reduce poverty.

Understand the value chain from producers to consumers and identify key entry points to enhance overall efficiency and opportunities for increasing profitability to smallholder livestock

producers. Animal feed availability, particularly through local production, should be prioritized to support increased local livestock production.

Enhance capacity: The public sector should develop and enforce policy and regulatory frameworks for livestock. Many countries have policy frameworks inherited from colonial times or taken from Western countries without adaptation to local conditions. Many policies regarding handling of public slaughterhouses also require reform. Government staff trained in livestock policy analysis is needed to promote the appropriate reforms. Expand the options for service delivery to poor livestock farmers. Agricultural extension and related services have declined over the last decades in Africa. Regarding veterinary services, important experience has been gained in the use of community animal health workers and similar institutional arrangements. However, the regulatory framework has frequently inhibited these developments.

The Grameen Bank in Bangladesh, which provides credit to the poor, who often use it for livestock purchases, shows that the provision of credit can make a significant difference in reducing poverty. Farmers in Liberia should benefit from in-kind credit that enables them to increase food and feed production, raising levels of small ruminant productivity and manure. Many NGOs should provide livestock credits in cash or in kind and create a micro-finance credit opportunities, through banking institutions in order to make funds available and accessible to livestock farmers. With MoA serving as collateral, attention should be given and support provided for capacity development, particularly training of Veterinary Doctors, livestock technicians, and provision of adequate animal health service delivery facilities, and training facilities in and out of the country. Improved breeding stock should be sourced and made available to livestock farmers. Moreover, the National Legislature should re-enact into law a clearly defined policy on livestock in the country.

Strengthen actors: Strengthen the regulatory capacity of livestock authorities. To increase livestock productivity we must reduce risks such as livestock diseases. Regulations must be enforced to reduce perceptions, both domestically and of trade partners, of such risks. This would enhance trading options and prices, hence providing incentives to the livestock farmers for increasing productivity. All agricultural related involved in livestock production should place high emphasis on disease surveillance and subsequence treatment thereby enhancing the productivity of the livestock farmers.

Strengthen collective action among smallholders: Economies of scale in production, processing, and marketing give commercial livestock producers advantage over small-scale livestock producers. The success of dairy development in India shows one pathway to achieving smallholder competitiveness. Vertical integration in the poultry and pig industry presents another private-sector approach to increasing smallholder competitiveness. Community-based management of common property, such as rangelands, water-points and dipping facilities can be a successful solution to the government. With MoA being a focal point, an avenue should be created for importation of substitution and rehabilitating with smallholder livestock farmers operating in consonance with the Cooperative Development Agency (CDA) in consultation with Central Agricultural Research Institute (CARI)

Facilitate partnerships: Government should encourage Private or Public-NGO partnerships to deliver livestock services. Delivery of cost-effective services to smallholder livestock keepers is a major challenge. Innovative institutional arrangements combining elements of public service regulation and quality control, private-sector provision of inputs and use of NGOs and CBOs to

deliver livestock services are required. Significant experimentation is presently taking place in this field.

Demand-driven agricultural research should be embedded in an effective innovation system.

The evolving context for livestock production increasingly requires adaptation in production technology to increase productivity. This requires knowledge in the hands of those managing the production system and the related support services. Much of this knowledge exists but is neither available where needed nor in the appropriate form. Other knowledge needs to be created through research. A close partnership between farmers, government agencies, input suppliers, marketing agents, postharvest processors, consumers and researchers is required to cost-effectively meet these knowledge needs. Regional cooperation in policy design research should give the public good nature of research. Most knowledge needs are met through research partnerships. Similarly, given regional trade patterns and ecosystems, many policy issues require regional coordination. Control of diseases such as foot-and-mouth is an example of such need for regional partnerships.

Government officials, NGOs, agribusinesses, and farmers who understand the complexity of livestock issues need to work together to raise Liberia's livestock production levels. Research has a central role to play in enhancing the learning process needed for such coordinated actions.

To conclude, the National Livestock Bureau (NLB) should review its legal and policy framework to enhance delivery of animal health services, improve disease control measures, and promote trade of livestock, wildlife, and their products. Some of the key components that Liberia must address during this review include developing effective national disease surveillance and reporting system to identify and address animal health constraints as required by World Animal Health Codes. Support for epidemiological surveillance should be provided. The ultimate goal

should control major diseases and allow Liberia to regain access to local markets for its live animals and animal products.

The NLB should remain an integral component of the disease sero-surveillance strategy, with a focus on pre-identified groups of key species in areas of importance. Because Livestock are not vaccinated in Liberia, there should be valuable sentinels for the monitoring and control of disease, as has been shown with rinderpest. Livestock surveillance should provide a feasible and valuable source of information for monitoring disease occurrence. To improve the delivery of animal health services in the rangelands, the government needs to consider increasing public expenditure for veterinary services in these areas and to devolve some services from the central government to private, public, and community sectors. Community-based animal health workers should provide low-cost services to pastoralists in remote areas.

Opportunities for substantial progress exist: in the improvement of grazing lands, health control, animal management practices, and marketing and institutional infrastructure. However, there is still a need to assess these adaptation options in relation to reducing vulnerability of humans and ecosystems, particularly options associated with livestock, with the object of maintaining or increasing food security, incomes and resilience while maintaining key ecosystem functions. Livestock movement control should ensure stock inspection at markets, auction yards, stock routes, and entry points into Liberia to limit disease transmission across borders. Given the complexity of livestock (and in most cases crop-livestock system) a mix of technological, policy and institutional innovations are required. On the technology side, improvements should be linked to a combination of feed and nutrition, genetics and breeding, health and environmental management options, with different combinations appropriate to different systems.

Clinical disease and serological investigations should be ensured at key points along these routes and at slaughterhouses. Services for local markets should focus on improving productivity and reducing transmission risks for epidemic and zoonotic diseases, without the strict sanitary measures required for local markets. Disease-free zones should be established in designated areas where strict veterinary controls are applied to allow livestock for export to be maintained. Major production areas should be supported by building slaughterhouses that have cooling facilities. Strategic vaccination, vector-control programmes, and effective management of quarantine are required to reduce infection and prevent transmission of disease in livestock. The restraint and capture of livestock, diagnostic ability in the field, follow-up investigations in the laboratory, and interpretation of epidemiological data should be strongly encouraged

The national undergraduate and postgraduate curricula need to be reviewed as to ensure they provide sound knowledge on livestock and wildlife disease management. To succeed in controlling trans-boundary diseases, Government needs to collaborate with other African community states to review and harmonize regional policies, laws, and regulations governing disease surveillance and control. However, overgrazing, overstocking and feeding of crop residues to livestock without returning manure to the land causes environmental degradation. Positive effects of livestock, such as the utilization of grasslands and crop residues of low opportunity cost, and the beneficial effects that grasslands have on the environment, such as carbon sequestration, nutrient cycling (including water) and arresting soil erosion. There is a poor response of the government to environmental conservation due to lack of awareness of livestock-related environmental issues. There should be some emerging trends such as the creation of government environmental bodies, environmental NGOs and the inclusion of environmental concerns in policy formulation. However, there should be scientific data to inform

policy makers, compounded by the lack of effective interaction between the NLB and policy makers.

Policy is another important factor determining the impact of livestock on the environment, especially in fragile environments under collective management. Collaboration on policies options for sustainable land management should be accessible in providing an understanding of the conditions under which livestock farmers degrade or improve their land. Policy makers should be informed on the impacts of livestock under different policy options. Research on property rights, risks and policies for managing grazing and feed resources will help identify policy options that can be used to reduce environmental degradation.

Technologies and management schemes that can enhance productivity need to be developed. At the same time, ways need to be found to preserve the natural resource base. It should consist of a range of resource-saving practices that aim to achieve acceptable profits and high and sustained production levels, while minimizing the negative effects of intensive farming and preserving the environment. Solutions need to try not only to protect the environment, but also to encourage more lucrative ways of managing livestock. In contrast, livestock-related environmental problems can be solved by tougher enforceable legislation that makes livestock producers pay for the costs of environmental protection.

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APPENDIX I: QUESTIONNAIRE

Dear Sir/Madam,

My name is Leelia R. Andrews. I am pursuing degree of master of science of the University of Namibia and currently undertaking a project entitled “*A Situational Analysis of Livestock Production in Liberia: A Case Study of Nimba, Bong And Montserrado Counties*”. I kindly request for your participation in the study. The information provided will be treated with high level of confidentiality and will be used for academic purposes only. Your response is highly appreciated.

SECTION 1: BACKGROUND INFORMATION (Tick where appropriate)

- a) Gender: Male Female
- b) Age: 14-24years
- 25 – 34 years
- 35 – 44 years
- 45- 54 years
- 55-60 years
- Above 60 years
- c) Academic qualification: College High School Elementary School None

SECTION 2: THE EXTENT TO WHICH FARMERS PRACTICE LIVESTOCK PRODUCTION IN LIBERIA

- 1. list the types of livestock that you keep
 - (i).....
 - (ii)
 - (iii)
 - (iv)
 - (iv)

2. Do you keep records of livestock?

Yes [] No []

3. Indicate your level of agreement to the following statements on livestock production in Liberia. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree.

	1	2	3	4	5
Majority of farmers in Liberia practice live stock keeping					
Livestock keeping has not been on the increase					
Livestock farmers receive sufficient support from Ministry of Agriculture					
Livestock farmers have access to sufficient farm inputs					
Majority of livestock farmers are happy with the current state of livestock production in Liberia					
There is a need for review of government policies in order to improve the current state of livestock production					

4. Kindly rate the extent to which farmers practice livestock production in Liberia.

Very great extent []

Great extent []

Moderate extent []

Little extent []

No extent at all []

SECTION 3: FACTORS LIMITING THE PRODUCTION OF LIVESTOCK IN LIBERIA

5. Do the following factors limit the production of livestock in Liberia

Factors affecting livestock production	Yes	No
Availability of finances		
Availability infrastructure		
Availability of veterinary services		
Agricultural training		
Government policies		
Availability of market		
Availability of commercial feed supplements		
Competition from imported livestock produce		

6. To which extent do the following factors affect livestock production in Liberia. The responses were rated on a five point Likert scale where: 1 – Very great extent 2 – Great extent, 3 – Moderate extent 4- Little extent and 5- No extent at all.

Factors affecting livestock production	1	2	3	4	5
Availability of finances					
Availability infrastructure					
Availability of veterinary services					
Agricultural training					
Government policies					
Availability of market					

Availability of commercial feed supplements					
Competition from imported livestock produce					

SECTION 4: ANALYSIS OF LAND USE SYSTEM IN THE LIVESTOCK PRODUCTION SECTOR IN LIBERIA

7. Which of the following types of ownership for pasture land do you use in livestock production?

Type of ownership for pasture land	
Land holding through customary law /communal land	
State own land	
Land holding through title deed	

8. Which of the following types of grazing systems do you apply in livestock production.

Types of grazing systems	
Continuous stocking in which pastures rarely receive a spell from grazing	
Rotational grazing in which a period of grazing is followed by a period of rest	
Time controlled or cell grazing where many relatively small paddocks enable a short graze period with heavy stocking rates followed by a long recovery period	

9. Please indicate the extent to which the following management options for pasture land are applied in livestock production in Liberia. The responses were rated on a five point Likert scale where: 1 – Very great extent 2 – Great extent, 3 – Moderate extent 4- Little extent and 5- No extent at all.

Factors affecting livestock production	1	2	3	4	5
Management of total grazing pressure					
Use of appropriate utilization rates					
Implementation of appropriately timed spelling and herd management strategies					
Monitoring of pasture composition					
Use of hay, supplements, fodder trees and shrubs in a strategic manner					
Management of the tree/grass balance to avoid woodland thickening					
Implementation of forage budgeting strategies					
Use of climate and seasonal forecasting resources					
Maintenance of native grassland free of encroachment from woody vegetation					
Use of appropriate fire management practices					
Fencing pasture land according to land types					
Proper management of the distance stock have to travel to water and pasture					

10. Rate the effectiveness of land use system in the livestock production sector in Liberia.

Very effective []

Effective []

- Moderately effective []
 Less effective []
 Not effective at all []

SECTION 5: THE ECONOMIC IMPACT OF LIVESTOCK PRODUCTION IN LIBERIA

11. Indicate the type of your livestock farms

Type of livestock farms	
Private farm	
Commercial farm	
Communal farm	

12. What is the aim of your animal rearing

Aim	
Selling	
Own consumption	
Donation	
Hobby	

13. What is the number of livestock that you sell?

14. Indicate where is the livestock sold

Places where livestock is sold	
Open market	
Farm gate	
At home	
Any other place (mention)	