INFLUENCE OF OIL AND GAS EXPLOITATION ON AGRICULTURAL PRODUCTION AND COPING MECHANISMS REQUIRED BY FARMERS FOR SUSTAINABLE AGRICULTURE IN BAYELSA STATE

BY

ZIMOGHEN, JULIE

PG/MED/12/64074

DEPARTMENT OF VOCATIONAL TEACHER EDUCATION

(AGRICULTURAL EDUCATION)

UNIVERSITY OF NIGERIA,NSUKKA.

SUPERVISOR: PROF. E.C. OSINEM

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APPROVAL PAGE

THIS PROJECT HAS BEEN APPROVED FOR THE DEPARTMENT OF VOCATIONAL TEACHER EDUCATION, UNIVERSITY OF NIGERIA, NSUKKA.

By

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Prof. E.C. Osinem
Supervisor
Internal Examiner

é é é é é é é é é é é é .. é é é é é é é é é é é é é ...
External Examiner
Prof. C.A. Igbo
Head of Department

é é é é é é é é é é é é é é é é ..
Prof. U.C Umoh
Dean, Faculty of Education

CERTIFICATION

Zimoghen Julie, a postgraduate student in the Department of Vocational Teacher Education (VTE) with Registration Number PG/M.ED/12/64074, has satisfactorily completed the requirements for the award of the degree of Masterin Education (M.Ed) in Agricultural Education. The work embodied in this project is original and has not been submitted in part or full for any diploma or degree of this or any other university.

_____	_____
PROF. E.C. OSINEM	**ZIMOGHEN, JULIE**
(Supervisor)	(Candidate)

DEDICATION

To

Sharon .T. Williams and Mr/MrsZimoghen .A. Zimoghen.

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Abstract

The study was aimed at determining the influence of oil and gas exploitation on agricultural production and coping mechanisms required by farmers for sustainable agriculture in Bayelsa State. The study specifically determined the activities of oil and gas exploitation, influence of oil and gas exploitation on crop and aquacultural production as well as the influence on farmers and also explored the coping mechanisms to curtail problems of oil and gas exploitation. Five research questions and four hypotheses guided the study. The study adopted descriptive survey research design. The population of the study was 67,551registered farmers of the federal ministry of agriculture and rural development in the state. Proportionate stratified random sampling technique was used to select 1% of the farmers according to their LGAs (strata) bringing the sample to 674 respondents. A 75-items structured questionnaire was used to collect data. The items on the questionnaire were assigned four response options of High Influence/Strongly Agree (HI/SA= 4), Moderate Influence/Agree (MI/A=3), Slight Influence/Disagree (SI/D=2) and No Influence/Strongly Disagree (NI/SD=1). The instrument was face validated by three experts: all from the Department of Vocational Teacher Education, University of Nigeria, Nsukka. The reliability of the questionnaire was established using Cronbach Alpha method and a coefficient of 0.78 was obtained. Out of the 674 copies of the instrument administered, 650 copies of the questionnaire were retrieved and utilized for analysis representing 96% retrieval. The data were analyzed using mean and standard deviation to answer the research questions and t-test statistics was used to test the null hypotheses at 0.05 level of significance at the appropriate degrees of freedom. The findings of the study revealed that the influence of oil and gas exploitation on crop, aquacultural production as well as on farmers in Bayelsa state is moderate. Findings further revealed that Oil and gas exploitation has resulted to reduction of crop yield, retarded growth rate in crops and has led to reduction in total land for crop production activities as well as led to high displacement of farmers from their original settlements and has resulted to loss of farmland for agricultural activities as indicated by farmers in Bayelsa State. Recommendations made included continuous training of extension workers on current information about curtailing problems of oil and gas exploitation so as to enable them enlighten farmers, the encouragement of farmers by Ministry of Agriculture and Rural Development and other well-meaning non-governmental organization in the providing incentives and subsidizing inputs for the farmers in Bayelsa State.

CHAPTER ONE

INTRODUCTION

Background of the Study

The method and technological know-how adopted in the maximum exploitation of environment as a society has various beneficial and deleterious implications on the environment. The determining factor of positive or negative implications is dependent on the pattern of exploitation of the natural resources in the society. Societies are known to have distinguished themselves by the way and degree in which they have succeeded in increasing agricultural production for human and industrial use (Food and Agriculture Organization, 2004). The common and extensive growth in agriculture in Nigeria has been to increase the area of land for agricultural purposes as a response to improving food production and raising its contribution to GDP in the nation. In 2009, agricultureôs contribution to GDP in Nigeria rose to 42%, but later declined to 40.19% in 2011 and further decreased to 39.12% by the end of 2012(National Bureau of Statistics, 2013). Due to the significance of agriculture to man and industries in nation building, there is therefore the need for sustainable agriculture.

Sustainable agriculture is the production of food, fibre, or other plant or animal products using farming techniques that protect the environment, public health, human communities, and animal welfare. Sustainable agriculture enables individuals to produce healthful food without compromising future generations (Grace Communicationsô Foundation, 2013). It can be viewed as a

complex interaction among soil, water, plants, animals, climate, and people. Therefore sustainable agriculture concentrates on long-term solutions to problems instead of short-term treatment of symptoms (Sullivan, 2003). Also, sustainable agriculture refers to a range of strategies for addressing many problems that affect agriculture. Such problems include loss of soil productivity from excessive soil erosion and associated plant nutrient losses, surface and ground water pollution from pesticides and oil spillages, fertilizers and sediments, impending shortages of non- renewable resources, and low farm income from depressed commodity prices and high production costs. Therefore, sustainable agriculture depends on a whole-system approach which includes components of agricultural production to be operated in a sustainable manner so as to achieve the overall goal of continuing health of the land and people even as they involve in agriculture.

Agriculture is the rearing of animals and the production of crops for food, fibre, biofuel, drugs and other products used to sustain and enhance human life (International Labour Organization, ILO, 1999). It is the production of crops and rearing of livestock for manôs benefit (Tatathi, Naik&Jalgaonkar, 2011). In this study, agriculture means the act or process of raising crops, and raising of livestock for human and industrial use. Agriculture is divided into two types; subsistence and commercial agriculture. Subsistence agriculture is the type of farming which is usually operated on a small piece of land. That is, farming on a small scale. It is concerned with the provision of the basic needs of the

farming family. The total yield from the farm is usually low while there is little or no surplus for sale or capital investment. Commercial agriculture is the type of farming which involves the cultivation of large hectares of land. That is, farming in large scale. Most of its operations are usually mechanised and yield is very high. Production is principally for commercial purposes (Omoruyi, Orhue, Akerobo&Aghimien, 1999). The significance of agriculture is numerous and varied such as serving individual and industrial needs as well as contributing to the economic growth of many countries. Agriculture is a major sector of Nigeriaôs economy, engaging over 70% of the labour force and contributing about 40% to the Gross Domestic product (GDP) (Federal Ministry of Agriculture and Rural Development, FMARD, 2000). Agriculture generates revenue for the government at the local, state and federal levels. It serves as a means of livelihood by providing employment to farmers, marketers and processors of agricultural products. It provides food to the teeming population, feed for animals and raw materials for various industries and it enhances development of rural areas (Omoruyi et al, 1999). Agriculture is of great importance to man and as a result people engage in its production.

Production is the act of creating goods or services as output that has value and utility for manôs use (Kotler, Armstrong, Brown & Adams, 2006). The authors further stated that any effort directed towards the realization of a desired product or service is a óproductive effortô, and the performance of such act is production. Agriculture produces goods and services which are utilized by man

and industries directly or indirectly. Therefore, agricultural production is the process of utilizing resources such as land, labour, capital and entrepreneurial skills to create goods for man and industries. Crop production is a branch of agricultural production which involves the cultivation of crops to meet manôs needs. Crops both annual and perennial are the main source of food for animals and human survival and also boost the nationôs economy particularly farmers (Nicholas, 1992). Sustainable crop production is a way of growing or raising food in an ecologically and ethically responsible manner. This includes adhering to agricultural and food production practices that do not harm the environment (Grace Communicationsô Foundation, 2013). Crop production if not practiced sustainably could lead to poor production of food which will subsequently lead to unavailability of locally produced food.

Agricultural production includes a component named aquacultural production. Aquaculture is the rearing of fish and other aquatic organisms in man-made ponds, reservoirs, cages or other enclosures in lake and coastal waters (Omoruyi et al, 1999). Aquaculture involves the organised production of aquatic organisms (particularly fish) in a properly partitioned aquatic medium, under complete or partially controlled environmental conditions for the direct or indirect promotion of human welfare (Ayinla and Tobor, 1997). Water is the necessary aquatic environment for aquacultural production. Water is an essential environmental resource because it is one of the basic natural elements and often regarded as the liquid of life due to its numerous uses and life

sustaining qualities. Water as an agricultural resource is a liquid without colour, smell or taste that falls as rain, or found in lakes, rivers, streams, springs, seas and oceans; and is used for drinking, irrigation, production (Hornby, 2001). Water bodies such as lakes, rivers, seas and ocean among others are filled with abundant aquatic organisms. Water form an essential element for the development of manôs economic activities such as fishing by farmers. Farmers are in charge of the utilization of resources such as soil, water among others. Farmers are engaged in the cultivation of crops and rearing of animals for the production of food and raw materials to meet man and industrial needs. Sustainable agricultural farmers focus on ensuring that their farming practices irrespective of the type of farming and the environment can be sustained over time and do not cause undue damage to the environment. The livelihood of farmers is heavily depend on their natural environment as they utilize scarce resources to produce goods and services that are useful to man and industry and agricultural production contributes to the economic growth of many countries though many factors still influence itôs production.

Influence is the effect of something on a person, thing or event (Encarta, 2009). The explosion of dynamite in aquatic environment produces narcotic effect and mortality of fish and other aquatic organisms. The overall influences of oil and gas exploitation are enormous. Oil and gas exploitation is the development and utilization of oil and gas for maximum benefit. Some activities in the study area that have influence in the environment are crude oil

and gas exploitation. Crude oil is a natural substance with complex mixture of a wide range of hydrocarbons with some sulphur, oxygen and nitrogen compounds, coupled with straight and short-branched alkanes, cycloalkanes, aromatic hydrocarbons (PAHs), heterocyclic, benzene, foluene, xylene and polycyclic compounds/or chemicals. It is found underground and below sea beds. It is formed from decayed plants and animals millions of years ago (Ikein, 1991). Gas is a state of matter consisting of particles that have neither a defined volume nor defined shape (Helmenstine, 2003). Virtually all aspects of oil and gas exploration and exploitation have deleterious influence on the environment, crops, animals, and aquatic lives among others (Olusola and Okoroigwe, 2007). One of the causes of environmental degradation associated with oil and gas exploitation is gas flaring. Gas flaring raises temperatures which affect crop growth and render large areas uninhabitable because of immense heat from flare (Agbola and Olurin, 2003). Acid rain is caused by the flaring of gas and it increases soil acidity which affects the growth of crops (Uyigue and Agho, 2007).

Bayelsa State is a lowland maritime area that is largely occupied by water bodies. It has almost the largest supply of crude oil which is the main stay of the Nigerian economy, hence the heavy presence of oil exploration and exploitation companies such as Shell Petroleum Development Company (SPDC), Nigerian Agip Oil Company (NAOC), Chevron and Mobile, among others. Besides these, there are a number of servicing companies such as Willbros, Saipem,

Panalpina, among others (Jebbach, 2000). In 1956, oil was struck at Oloibiri (in present Bayelsa State) in commercial quantity. Though, it was not until 1958 that actual production started with an output of about 5,100 barrels per day. This rose to a peak of about 2.3 million barrels per day at the height of the oil boom (1979-1983). In 1993 alone, a total of about 750,099,708 million barrels were produced (Ibaba, 2001). Oil and gas resource from the Niger Delta of which Bayelsa is inclusive accounts to over 98% of the Nigeriaôs export earnings and 83% of the governmentôs total revenue (Bayode, Adewunmi and Odunwole, 2011).

Oil spill has continually degraded the environment of Bayelsa State. Seismic blasts and discharge of untreated effluents directly into water bodies, some of which serve as the only source of water for the people are common in the region. Rivers are heavily polluted and also farmlands are under oil spills. Oil canals and network of pipelines is making it impossible and dangerous for people to undertake economic activities on it. It is estimated that between 1976 and 1996 a total of 2,369,470.40 barrels of crude oil were spilled into the rivers and lands of the Niger Delta region of which Bayelsa is inclusive (Uyigue and Agho, 2007).

Oil interferes with the functioning of various organs and systems of plants and animals. It creates environmental conditions unfavourable for life. For example, oil on the water surface forms a layer which prevents oxygen from dissolving in water. Water bodies polluted with oil affects the amount of

dissolved oxygen in the water, which consequently impacts the lives of aquatic plants and animals. Oil spreads over the water surface preventing contact with atmospheric oxygen (Legborsi, 2007). Crude oil contains toxic components, which caused out right mortality of plants and animals as well as other sub lethal impacts (Olusola and Okoroigwe, 2007).

The influence of oil and gas exploitation on socio-economic lives is that oil spills caused communities to evacuate their homesteads either due to direct damage posed or the consequences of the pollution problem caused by the spill. The natural environment is often degraded without adequate compensation from the multinational companies. The demand for compensation for damaged resources and other properties have been putting individuals or communities on a collision course (Okoko, 2002).There is correlation between exposure to oil pollution and the development of health problems. The diseases traceable to oil pollution include respiratory problems, cancer, skin ailments such as rash and dermatitis, eye problems, gastro-intestinal disorders, water borne diseases and nutritional problems associated with poor diet (Legborsi, 2007). Oil and gas exploitation could lead to the destruction of traditional means of livelihood and causing the youths to engage in morally unacceptable practices. Pipeline vandalization is another possible source of environmental degradation. It could be caused by youth restiveness resulting from the economic hardship in the Niger Delta. Several cases of pipeline vandalization have been reported. In 1993, seven cases were reported, in 1996, 33 cases were reported and in 1998,

57 cases were reported. The number of cases of pipeline vandalization rose astronomically to 497 in 1999 and over 600 cases in 2000. The dramatic increase in pipeline vandalization from the 1990s to 2000 is suggestive that the more the people are deprived of their means of livelihood, the more restive they become (Uyigue and Agho, 2007). Youths in the Niger Delta involve in the vandalization of pipeline to express their grievances over the destruction of their environment by multinational oil companies without adequate compensation from them. The influence of oil and gas exploitation will not just extinct as long as exploitation activities still continue because of its benefits, hence, it is important that farmers adopt appropriate coping mechanisms.

Mechanism is the method or means of doing something while coping is to deal effectively with a difficult problem or situation (Encarta, 2009). In this study, coping mechanisms are strategies or measures adopted by farmers in dealing and minimizing the influence of environmental problems associated with oil and gas exploitation. Farmers coping mechanisms such as use of fast-maturing varieties, use of mulching materials for all seedlings at the germination period and tree planting system by the side of the fish ponds to reduce the scorching effect of the sun are important in the reduction of the diverse influence of oil and gas exploitation in Niger Delta region which Bayelsa State is inclusive (Uyigue and Agho, 2007). However, the activities of oil and gas exploitation have led to environmental problems which are threatening agricultural production and farmers. In this light, there is need to

identify the influence of oil and gas exploitation on agricultural production in Bayelsa State.

Statement of the Problem

The discovery and exploitation of oil in commercial quantities at Oloibiri (Bayelsa State) in 1956 have continued till date with increases in related activities in the state. Divers oil and gas exploration and exploitation activities in Bayelsa State have constituted source of environmental degradation, ecological destruction, drastic changes in the traditional socio-economic life of the people and deprivation of traditional occupation of fishing and farming.

Gas flaring in the state, for instance, has caused climatic upheaval in rainfall pattern which has affected farm planning, culminating to delay in planting season, late harvesting and low harvest. Similarly, one observes frequent crop wilting, defoliation, wrinkling and stunted growth caused by increased temperature from gas flaring. Gas released during flaring (methane, carbon dioxide, sulphur, nitrogen oxides, organic acids, hydro carbons) cause acidification of rainwater and increases soil acidity which reduces soil fertility resulting to crop growth retardation. The poisonous gas emissions have deleteriously affected the health of farmers, as cases of respiratory, blood circulatory and reproductory problems abound in Bayelsa state health centres. Besides, there is high incidence of crop pests which gather from the forest to enjoy the warmth and light of gas flared at night.

Bayelsa state is a lowland maritime area that is largely covered by water bodies with abundant organisms but oil pollution from spills and effluent have killed several mangrove vegetation, fishes, crabs, molluscs and periwinkles in the contaminated waters. The oil films on water surfaces have prevented natural aeration as well tainted fishing gears, hence low catchability. Intensive oil exploration and exploitation activities in the riverine communities are responsible for the increasing rate of coastal recession that has led to incessant displacement of some of the fishermenôs settlement from their original locations while others are thrown out of fishing jobs that have affected fishing business in the state.

The premature death of marine lives and human beings in the study area had been partially attributed to oil prospective activities due to the consumption of polluted water. Worse still, several clashes amongst farmers have resulted over claims of ownership of portions of land where exploration activities are carried out which has led to loss of several lives and properties. In view of the associated problems of oil and gas activities, it is important to critically examine the influence of oil and gas exploitation on sustainable agricultural production and farmers coping mechanisms, hence this study.

Purpose of the Study

The major purpose of the study was to determine the influence of oil and gas exploitation on sustainable agricultural production and farmers coping mechanisms in Bayelsa State. Specifically, the study sought to:

1. Identify the various activities of oil and gas exploitation that affect agricultural production in Bayelsa State;
2. identify the influence of oil and gas exploitation on crop production in Bayelsa State;
3. Identify the influence of oil and gas exploitation on aquacultural production in Bayelsa State.
4. identify the influence of oil and gas exploitation on farmers in Bayelsa State;
5. Ascertain farmers coping mechanisms to curtail the problems of oil and gas exploitation in Bayelsa State.

Significance of the Study

The following category of persons will benefit from the study. They include oil companies, agricultural extension agents, farmers, researchers. Specifically, the findings will provide useful information to the oil companies operating in Bayelsa State in alleviating the problems of farming. This will serve as a guide to oil companies in detecting operational areas to be adjusted for harmonious operation the state.

The study will provide information to agricultural extension agents on farmers coping mechanisms which they could teach to other farmers to cope with oil and gas related environmental problems. This information would also serve as a body of knowledge for agricultural extension agent who teaches the farmers on improved farming practices. It will also provide information on the influence of oil and gas on crop, soil, water and farmers. This information can guide extension agents in teaching farmers.

The findings of the study will provide farmers with coping mechanism to reduce the influence of oil and gas exploitation on agricultural production as it will suggest to farmers suitable coping mechanisms with the influence of oil and gas exploitation on agriculture.

The study will be used as a resource material on oil and gas exploitation and its influence on agricultural production for researchers who may be interested in researching on related topics. The research will be equipped by the findings on the influence of oil and gas exploitation on crops, soil, water, socio-economic life and health of farmers as well as coping mechanisms and measures for enhancing production activities to beef up literature in their studies. The study will contribute to the world of literature which will be useful to researchers.

Research Questions

This study was guided by the following research questions:

1. What are various activities of oil and gas exploitation that affect agricultural production in Bayelsa State?
2. What are the influences of oil and gas exploitation on crop production in Bayelsa State?
3. What are the influences of oil and gas exploitation on aquacultural production in Bayelsa State?
4. What are the influences of oil and gas exploitation on farmers in Bayelsa State?
5. What are farmers coping mechanisms to curtail the problems of oil and gas exploitation in Bayelsa State?

Hypotheses

The study was guided by the following hypotheses, which will be tested at 0.05 level of significance.

1. There is no significant difference in the mean responses of subsistence and commercial farmers on the influence of oil and gas activities on crop production in Bayelsa State.
2. There is no significant difference in the mean responses of subsistence and commercial farmers on the influence of oil and gas activities on aquacultural production in Bayelsa State.

3. There is no significant difference in the mean responses of subsistence and commercial farmers on the influence of oil and gas activities on farmers in Bayelsa State.
4. There is no significant difference in the mean responses of subsistence and commercial farmers on coping mechanism to curtail the problems of oil and gas exploitation in Bayelsa State.

Scope of the Study

This study focused on the influence of oil and gas exploitation on agricultural production and coping mechanisms required by farmers for sustainable agriculture in Bayelsa State as perceived by farmers. The scope of the study were on the activities of oil and gas that occur during each project phase such as exploration, drilling/development, production and decommissioning/ reclamation that affects agricultural production, influence of such activities on crop and aquacultural production and health of farmers. Farmers coping mechanisms such as use of fast-maturing varieties, use of mulching materials for all seedlings at the germination period and tree planting system by the side of the ponds by fish farmers among others are also the focus of this research work.

Livestock production is outside the scope of this study because livestock is more resistance to degraded environment than crops because of its mobility

and access to feed. Therefore the influence of oil and gas exploitation on livestock was not covered in this study.

The study covered the original eight (8) local government area of Bayelsa State, thus Yenagoa, Kolokuma/Opokuma, Sagbama, Ekeremor, Southern Ijaw, Ogbia, Brass and Nembe. It involved registered farmers with Ministry of Agriculture and Rural Development (Bayelsa State branch).

CHAPTER TWO

LITERATURE REVIEW

Related literatures to this study were reviewed under the following sub headings:

- **Conceptual framework**
  - ❖ Concept of exploration and exploitation
  - ❖ The activities of oil and gas exploration and exploitation that affect agricultural production
  - ❖ Influence of oil and gas exploitation on agricultural production
  - ❖ Environmental impact assessment (EIA)
  - ❖ Farmers coping mechanisms to curtail problems of oil and gas exploitation
- **Theoretical framework**
  - ❖ Ecological Systems Theory
- **Related empirical studies**
- **Summary of literature reviewed**

Concept of Exploration and Exploitation

Exploration is the testing of a number of places for natural resources, e.g. drilling or boring for samples that will be examined for possible mineral

deposits. Exploration refers to the searchfor mineral resources from the land and sea using technological know-how (Bayode, Adewunmi and Odunwole, 2011). According to Nigerian Environmental study/Action Team (1991) as highlighted by Mba (1995), there are three (3) categories of mineral resources namely fuel mineral, metallic mineral and industrial minerals and their exploration processes differ. Fuel mineral exploration activities involve exploration, extraction, processing and transportation as well as storage and consumption of petroleum, natural gas, coal, lignite and uranium. Similar activities which involve iron, gold, columbite, cassiterite and tantalite is referred to as metallic exploration while those that involve limestone, marble, feldspars, gypsum, gravel and sand among others come under industrial exploration. Fuel exploration is done basically for harnessing energy that is latent in the minerals, metallic exploration is carried out for the purpose of industrial and economic undertakings while industrial exploration is for the use of the minerals in construction.

Exploitation is the development of natural resources for benefit. It is the use or development of natural resources in order to gain a benefit. The exploration and exploitation of the environment dates back to the existence of man on earth (Ekundayo, 1988). This exploration and exploitation activities continue to reveal complex implications in spite of improvement in the technology adopted in carrying out these activities. Oil exploration and

exploitation are few of such activities which started at different times in different parts of the world.

Nigeria joined the league of oil producing nations on August 3rd, 1956 when oil was discovered in commercial quantities (Jonathan, 2004). Oil exploration and exploitation in Nigeria have evolved through a long history. However, they have left trail of woes in their path with so much damage to the ecosystem and problems to human life in the exploration region. All of Nigeriaôs oil and gas come from its Niger Delta region which sustains the largest wetland in Africa and one of the largest wetlands in the world (Ledum, 2012).

The Activities of Oil and Gas Exploration and Exploitation

Oil and gas production can result from activities that occur during each project phase: exploration, drilling/development, production, decommissioning and reclamation. Ibaba (2001) pointed out that, the major activities that occur during the exploration phase include: seismic surveys and exploratory well drilling. Field activities that occur during exploration include:

- Surveying and mapping surface and subsurface geologic features to identify areas where oil and gas may have accumulated;
- Collecting seismic data to evaluate a geologic formation's potential for containing economically producible quantities of oil and gas and

identifying the best location to drill an exploratory well to test the formation;

- Drilling exploration and delineation wells to determine where oil and gas are present and to measure the area and thickness of the oil- and/or gas-bearing reservoir;
- Logging and coring wells to measure permeability, porosity, and other properties of the geologic formation(s) encountered; and
- Completing wells deemed capable of producing commercial quantities of hydrocarbons (well completion is sometimes considered the first stage of the drilling/development phase).
- In the case of shale gas wells, perform hydraulic fracturing which involves pumping quantities of water (1-4 million gallons/wells) and proprietary chemicals into horizontal wells in order to increase the permeability of the rock hosting the gas resources.

To identify potential production areas both remote sensing (e.g., photography, radar, infrared images, and microwave frequency receivers) and geophysical exploration (e.g., seismic tests) are used. Seismic exploration (the most important tool for discovering oil and gas reserves) involves exploding dynamite in a hole drilled several hundred feet in the ground, dropping a heavy object from a truck onto a hard surface such as a paved road, or shaking the ground with a mechanism known as a vibrasizer. Seismic waves from these

procedures travel downward and outward and then bounce back from subsurface features (e.g., faults, formation boundaries) at different rates and strengths depending on what underground substances the waves pass through. These waves are analysed to determine the location of oil and gas deposits. Coal seems must be at least 20 feet thick to produce economically viable coal bed methane. (Tribal Energy and Environmental Information Clearing House TEEIC, 2009).

This stage includes building roads for access to the drilling area; clearing vegetation and levelling the drilling area; constructing a drill pad and pits to hold water and drilling wastes; and installing the drill rig and associated engines, pumps and equipment. Conventional oil and gas wells generally range from 3,500 to 10,000 feet deep, whereas shale gas and coal bed methane wells are generally 1,000 to 4,000 feet deep. Drilling continues in stages: drill, run and cement new casings, then drill again. The final well depth is indicated when the rock cuttings reveal oil sand from the reservoir rock. At this stage, the drilling apparatus is removed from the hole and several tests are performed to confirm this finding (Tari, 2003).

Wells are completed for production if the value of the recoverable hydrocarbons is greater than the cost of drilling, producing, and delivery to market. If not, the exploratory well would be plugged, all drilling equipment and materials would be removed from the drill site, and the site would be

restored as near as possible to its original condition. If enough hydrocarbons are present to possibly warrant commercial production, additional exploratory wells would be drilled to test the production conditions and further delineate the boundaries of the reservoir (Jebbach, 2000).

Activities of Drilling/Development Phase

During the drilling/development phase, full field development occurs. This involves the construction of well pads, access roads, gathering pipelines, and other ancillary facilities (e.g., wellhead compressors, separators, dehydrators, storage tanks, reserve pits, flare pits, and so forth) and the drilling and completion of wells (Nwadiaro, 1993). As the well bore is drilled, casing is placed in the well to stabilize the hole and to isolate water bearing and hydrocarbon bearing zones.

The general drilling sequence for coal bed methane wells involves drilling an 8.75 in. hole that is drilled to a minimum depth of 160 ft, where a 7 in. steel casing is run and cemented into place. A 6-7/8 in. hole is subsequently drilled to a depth of 2,000 to 7,500 ft, depending upon the basin, and a 5.5 in. Production casing is run between the bottom of the wellbore and the surface. A pump jack or pumping unit is then installed to pump water from the coal bed to the surface. Conventional wells are drilled vertically using sections of rigid pipe to form the drill string. Conventional vertical oil or gas well takes 3 to 10 days to drill, but directional drilling could extend this time to a month or more. Coal

bed methane wells may only take a few days to drill and a few more to complete (TEEIC, 2009).

Activities of Production Phase

The primary activity conducted during the production phase is pumping hydrocarbons to the surface. During this phase, additional wells may be drilled within the development area to enhance hydrocarbon recovery. Once the fluid starts flowing, it must be separated into its components (oil, gas, and water). Other activities that occur during production phase include production enhancement, well servicing (routine maintenance such as replacing worn or malfunctioning equipment), and well work over (a more extensive equipment repair). The production phase may last for a number of decades. During this phase, wells and associated facilities are routinely monitored. Flaring is done at wells that produce only a small amount of natural gas and that have no on-site use for the gas or no pipelines nearby to transport the gas to market (Smart, 1998).

Activities of Decommissioning/ Reclamation Phase

TEEIC (2009) identified decommissioning/reclamation activities would include:

- Closure of production and injection wells;

- Removal of production equipment and debris;
- Removal or treatment of any remaining production waste or contamination from spills or releases;
- Closure and remediation of pits and contaminated soils;
- Correcting subsistence by adding additional topsoil;
- Closing access roads to plugged and abandoned wells and associated facilities;
- Regrading and recontouring the well site and access roads;
- Removal of gathering pipelines and other ancillary facilities; and
- Performing compaction, removal, restoration, and revegetation on well sites and access roads.

At the well site, the casing would be filled with cement and wellhead, pump jacks, tanks, pipes, facilities, and other equipment would be removed. The wellbore is plugged to prevent underground fluids from getting into groundwater.

Ibaba (2001) concluded that, the casing is cut off below the surface and capped with a steel plate welded to the casing. Surface reclamation should then be undertaken to restore the natural soil consistency and plant cover. Waste-handling pits, if present, are properly closed. All areas disturbed by the project would be restored to preproject conditions and/or to conditions acceptable to regulatory agencies, landowners, or other stakeholders. Where the soil has been

contaminated with hydrocarbons, the soils would be transported to a licensed landfill or they could be restored using bioremediation with microorganisms that digest the hydrocarbons. Rather than being plugged, some wells that may be converted for use as either for disposal of the produced water from other wells or as part of oil enhancement operations in the production field.

Influence of Oil and Gas Exploitation on Agricultural Production

Human activities have damage the environment, as a result soil erodes, cropland and forests disappear, species die out, pollution spreads and millions of people suffer (Olusola and Okoroigwe, 2007). Oil and gas operations are activities of humans that have deleterious influence on various components of the agriculture, such components include:

Influence on crop production

Crops are the main source of food for animals and human survival and also boost the nationôs economy particularly farmers. During oil spill, the process of photosynthesis which enhances plant diversity is impaired since the process is reduced due to the fact that spilled crude have a high absorbance property so when the crude spreads on to the surface of leaves, the latter find it difficult to photosynthesize and thus die (Legborsi 2007). The toxic crude also affects underground herbs and shrubs, while microbial organisms which form important groups in food web, are also destroyed.Oil and gas exploration and

exploitation activities have led to the death and poisoning of crops (Antony, 2003).

Authorities such as Okezie and Okeke, (1987) and Salau (1993) revealed that there was about 100% loss in yield in all crops cultivated about 200 metres away from the Izombe station, 45% loss of those about 600 metres away and about 10% loss in yield for crops about one kilometer away from the flare. Equally, Ibaba (2001) observed that, plantains around gas flaring areas ripe faster than usual; thereby compounding storage problems. Also, economic trees such as oil palm, cotton tree among others have been withered away by flared gas.Okoko (2002) identified that, gas flaring has been the most constant causes of environmental pollution because in many places it has been going on 24 hours a day for over 35 years. He added that another great damage caused to crop communities is oil spill (see Appendix E).

Oil spill incidence has affected crop production and where it occurs with fire out-breaks, more crops species are damaged. An instance in Brass-Ogada-Rumuekpe pipeline at Odua with 10 hectares of rice and flouring vegetation consumed by fire. The same thing occurred at Okorogba in Bayelsa state. In addition, decaying of dead crops and animals will eventually cause fouling of surrounding environment thereby polluting agricultural environment including soil. The production of crops is heavily dependent soil.When the farming soil is been polluted by the oil activities, the soil fertility will be destroyed. A gradual

or total reduction in organic matter levels in the soil, especially in the intensively cultivated or oil operated arable areas, has been accompanied by deterioration in soil structure leaving the soil more prone to compact and erosion and finally zeros productiveness. From serious observation, some soils are now suffering from dangerously low organic matter level and could not be expected to sustain the farming systems which have been imposed on them (Nicholas 1992). The biological activity of the soil has been destroyed because of oil and gas exploration and exploitation activities.

Antony (2003) asserted that, farmlands have been rendered infertile with gross implication on the right to adequate food. Oil and gas exploration and exploitation activities have led to the death and poisoning of farm lands. Since crude oil is virtually insoluble in water, it floats on the surface and spreads out into a thin file covering a large area known as a slick. This causes suffocation and death of many soil organisms and as these dead organisms decay, the degree of pollution in the affected areas increases.Legborsi (2007) noted that, oil spills involve the release of dangerous hydrocarbons such as benzene and Polynuclear Aromatic Hydrocarbons into the soil and water sources. These spillages affect vast stretches of land and waterways thus polluting not only crops but also marine life and the sources of water for domestic uses. Mangrove forests are particularly vulnerable to oil spills because the soils soak up the oil like sponges and re-release it every rainy season. As the spill occurs, it spreads onto farmlands and water bodies. The toxic crude seeps into the grounds and is

taken up by the roots of crops. Oil spills lower soil fertility and cause poor growth of crops.

Influence onaquacultural production

Aquaculture is the farming of ocean and freshwater plants and animals for human consumption (Encarta, 2009), Aquaculture involves the organised production of aquatic organisms (particularly fish) in a properly partitioned aquatic medium, under complete or partially controlled environmental conditions for the direct or indirect promotion of human welfare (Ayinla and Tobor, 1997). Water is a mandatory resource for aquacultural production. Water is an essential agricultural and environmental resource. It is often regarded as the liquid of life due to its numerous uses and life sustaining qualities. Unfortunately, water like other environmental resources has been subject to pollution. Oil on surface water is a serious threat posed by oil-related pollution in its effect on the groundwater, which is a source of drinking water in Bayelsa state. It is worthy of note that, groundwater pollution resulting from oil spills cannot be totally cleaned up. The only real solution lies in preventing groundwater to be polluted (Jebbah, 2000).Furthermore, when oil spills or when there is an effluent discharge, it seeps into the ground and becomes mixed in the underground water system. It has been found that polluted underground water take many years before it can be remedied. Yet this underground water moves into streams and wells which are the only sources of local water supply in the

community which results in the rise of water borne diseases. This has affected the traditional relationship of the people with water. There is a palpable fear that rather than being the source of life, these water systems have become sources of misery, disease and death.

Oil and gas exploration and exploitation have led to the death and poisoning of aquatic lives.Bayode et al (2011) observed that, water pollution has been caused by oil spillages and chemical discharges which has led to the destruction of aquatic life and ill health among residents. This has resulted from increased Chemical and Biochemical Oxygen Demand (COD and BOD) in the case of death of aquatic life while diseases such as hyperactivity and risk of high blood pressure, heart attack and stroke coupled with kidney problems has been recorded. Gas flaring causes light pollution. Light pollution subjects the living organism around the vicinity of the flare to 24-hour daylight. This affects the reproduction of fish as well as sending fish to deep sea areas. Some species of fish are no longer available. The entire ponds, rivers, creeks and swamps are now covered with water hyacinth (Legborsi, 2007).

Ibaba (2001) asserted that the oil on the water surface will reduce the inter-phase between atmosphere and the surface of the water, resulting in less oxygen that has to dissolve in water. The low oxygen in water will induce physiological strengthening on the organisms which on human consumption, may eventually lead to death, because the oil contains many toxic chemical

including benzene, foluene, xylene, and polycyclic aromatic hydrocarbons (PAHs). These are very toxic and fish and other aquatic store mercury in their brain, without metabolizing it. Oil on the surface of water bodies is harmful to many forms of aquatic life because it contains thousands of different chemical compounds.

Influence on farmers

Smart (1998) observed that the chemical compounds from industrial polluted areas causes respiratory and chromosome damage in women and also causes still births and cancer in women. This is because women use the polluted water for washing and laundry activities and other economic activities within the vicinity of polluted areas. Chindah (1998) revealed that oil and gas exploitation involves a lot of activities which impact directly on the ecology of the host communities and consequently on the occupations and lives of host communities.

Legborsi (2007) examined that, one of the increasing socio-economic costs to most host communities resulting from oil pollution, is the rapidity of which zinc roofs are easily corroded. Houses with zinc roofs that are close to the location of the flare stacks do not last for two years before they become corroded. This is different from other areas where zinc roofs last for at least ten years because of the low presence of gas flaring. It is acid rain oxidizes zinc through the process of oxidation to form zinc oxides. This oxidation process is

responsible for the corrosion. Another implication of oil pollution is that having destroyed biodiversity, it has also rendered the agricultural sector, which is the largest employer of labour in the Bayelsa State, unprofitable. Hence, most people have become jobless since their local economic support system of fishing and farming is no longer sustainable (Legborsi, 2007).

One of the influences of oil pollution is the destruction of the traditional local economic support system of fishing and farming. The combination of the effects of oil spill and acid rain resulting from gas flaring (see Appendix D& E) has been soil degradation which affects crop yield and harvest. Fish are driven away from in-shore or shallow waters into deep-sea as a result of flaring. The ultimate result of this is the poor crop yield as the soil has been rendered infertile and poor fish catch, as most fish has been driven into deep waters. The whole impact of this is food shortage and which has affected the ability of most farming families to feed themselves (Legborsi, 2007). Oil pollution has resulted in the destruction of agricultural environment. This in turn has led to the unsustainability of land for the traditional economic livelihood patterns that once thrived in the area. As a result, there are many people who are emigratingout of the area into cities where they have become environmental refugees (Legborsi, 2007).

Environmental Impact Assessment (EIA)

Impact refers to the difference made in an outcome (Championing Volunteering and Civic Society, CVCS, 2013). It strictly refers to observed deviation from usual or normal outputs. Some use the term as a way of summing up all the benefits or changes occurring after an event. Impact can also be understood as a combination of all the effects an event has on the other and may be intended as well as unintended effects, negative as well as positive changes, long-term and short-term or interim outcome (CVCS, 2013). Impacts are usually resultants of external factors/intervention enforcing a change from the conventional proceedings or natural outcomes causing a new pathway of actions as shown below:

Figure 1

Impact Diagram

In the figure 1 above, natural outcome proceeded from point A to B, with the external intervention at point C, a change occurred causing the observed altered outcome at point D or E. Slope CBD or CBE reflects the amount of change in the observed outcome, this is referred to as the impact and the direction of change, D or E, determines the nature of change; positive or negative impact respectively. Measuring impact involves assessment or evaluation of the degree of observes changes over time after the causative effect (Grossmann, 2005).

An impact study is a research done on a certain situation to determine if a specific action would, or is, having an effect on its environment or other related issues (Ken & Bronwyn, 2013). Impact studies pull data from various sources and often look at many different aspects of the issue. In an environmental impact study, for example, extensive research may be done before building a

road in a certain area. One of the steps may include determining how water runoff may be affected and if there are any vulnerable streams around. Another aspect could be a survey of plant and animal species in the area (Ken & Bronwyn, 2013). Any found to be in danger could affect the project. This demonstrates how thorough some of these studies can be. In some cases, a project may still continue despite what an impact study finds. In cases where the negative impact can be mitigated by positive implications, there may be a net gain to the area. In other cases, the impact study may indicate ways the negative effects can be minimized. Although, often not part of an impact study, an action plan may be developed based on its findings. This plan will seek to clear up any issues the study found (Ken & Bronwyn, 2013).

The different steps and potential methodologies of conducting impact assessments or study include: appraisal of the expected effects (inherent to the study logic), formulation of impact strategy ï what is going to be measured, formulation of impact methodology ï how are the effects measured/assessed and modalities of carrying out the impact assessment (Grossmann, 2005). The author further explains each stage below;

Crucial for the execution of an impact study is to appraise the expected effects and effects that the intervention has on the target group. Such an appraisal is based on the inherent intervention logic as formulated during the design of the study. Normally, each study has a set of expectations and

objectives, which should be causally linked to the various intervention activities. The appraisal involves a thorough review of the objectives and expectations and how they should be met. It is important to conduct such an appraisal for each region/country, as the same effect can have various expectations and objectives in different contexts. The information can be compiled in a short matrix that lists the expected objectives, activities and expected outcomes. The second step in the impact assessment process is to identify the purpose and strategy of the study. The core question is: what should be measured? This step is closely linked to the appraisal, which indicates the areas where the study is supposed to have impacts. Accordingly, the impact measures should reflect the objectives of the study and also help to indicate whether they have been met or not (evaluation). A number of methodologies exist to conduct impact studies. The central concern of these approaches is the issue of attributing study activities to observed impacts. These methodologies refer to the ñhardò impacts as such and not necessarily to other assessment purpose (e.g. cost-effectiveness assessment or evaluations). In general, four different methodologies can be identified for the attribution of impacts Experiments, Quasi-experiments, Non-experiments and Qualitative approaches (such as field survey). The final step is to design and carry out the impact study. First of all, it involves the strategic question whether the assessment/study should be carried out on a continuous basis, on a regular basis or only once. Conducting pure impact assessments are rather likely to be carried out on a

regular basis or once. Impact assessments based on before-after comparisons are easier to conduct on a continuous basis, especially for interventions that have an initial screening process in place.

Impact study is an assessment that prepares evidence for decision-makers on the advantages and disadvantages of events by measuring their potential effects (European Commission, EC, 2009). In conducting impact study, some questions are vital and inevitable such as; what is the nature and scale of the problem, how is it evolving, and who is most affected by it?, what are the views of the stakeholders concerned?, what objectives should it set to address the problem?, what are the main options for reaching these objectives?, what are the likely economic, social and environmental importance of the result?, how do the main options compare in terms of effectiveness, efficiency and coherence in solving the problems?, and how could future monitoring and evaluation be organised?(EC, 2009). A correct answer to these questions forms the bases for an impact assessment.

An environmental impact assessment (EIA) is an assessment of the possible positive or negative impacts that a proposed project may have on the environment, consisting of the environmental, social and economic aspects. According to Osinem, (2005) EIA involves the gathering and analysis of all relevant information on a proposed undertaking to determine the likely consequences if the undertaking is implemented in a given area; and if it should

what appropriate mitigation or alternatives must be considered in order to ensure environmentally sound and sustainable implementation or development. The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts when deciding whether or not to proceed with a project. He further asserted that, environmental impact includes any direct or indirect, positive or negative change in the environment caused by man-made works or activity when such change affects life in general, biodiversity, the quality or a significant quantity of natural or environmental resources and their uses, wellbeing, health, personal safety, habits, and customs, the cultural heritage or legitimate means of livelihood.

Umeh and Uchegbu 1997 observed that, the first thrust in dealing with the issues of environmental quality was made in the U.S.A., in 1969. This was sequel two disasters. The first was the disintegration of ñTorrey Canyonò, an oil tanker loaded with some 120 tonnes of oil. The incidence happened in England in 1967. The second disaster was incidental to the accidental striking of oil by an off-shore drilling crew in the region of California in January 1969. Both disasters caused large spillage which in turn led to unprecedented damages to aquatic and marine life. They added that, the unfortunate events necessitated the setting up of Environmental Policy Organization by the Unites States Government. The organization was charged with the responsibility of advising the U.S congress on matters concerning the environment, especially as they

relate to planning, aesthetics, design and protection, among other. Subsequently the National Environmental Policy Act (NEPA) was passed in 1969, which became effective in January 1, 1970. The act created the Council on Environmental Quality (CEQ) and required analysis of the environmental impact of major federal actions significantly affecting the quality of the human environment. In this legislation, the terms ñEnvironmental Impact Assessmentò (EIA) and ñEnvironmental Impact Statementò (EIS) were first used officially. Both developed and developing countries has adopted EIA and many countries and other jurisdiction have continued to adopt an EIA process in decision making.

According to Umeh and Uchegbu 1997, in Nigeria, the new-found awareness on environmental quality led to the establishment of the Federal Environmental Protection Agency (FEPA) in 1988, charged with the responsibility for the protection and development of the Nigerian environment including policy initiation in relation to environmental research and technology. In 1989 FEPAôs responsibilities were translated into the National Policy on Environment. As part of the implementation of the National Environmental Policy, interim guidelines and standards for environmental control in Nigeria were fashioned out in 1991.In 1992, the EIA Degree No. 86 was promulgated solely to give legal muscle for the enforcement of the various policy provisions

on the need for studies in the environmental impact of both public and private sector projects as such projects are being planned.

Umeh and Uchegbu (1997) also identified the Environmental Guidelines and Standards for Nigerian Petroleum industry enacted in 1991 by the Department of Petroleum Resource (DPR). Embodied in the general guidelines is a guideline on EIA for oil related activities that need such assessment or evaluation. The oil projects or activities are as follows:

(i) Drilling operations (exploratory, appraisal and development wells) for onshore or near shore areas.

(ii) Construction of crude oil production, tank farm and terminal facilities.

(iii) Laying of crude oil and gas delivery line, flow line and pipeline in excess of 50 kilometres in length.

(iv) Hydrocarbon processing facilities.

(a) Oil refineries and petrochemical.

(b) Liquid natural gas/natural gas plant.

(c) Liquified petroleum gas (above 20,000 litres) located within 3 kilometres of any commercial, industrial or residential area.

(d) Blending plants.

(v) Construction of product depot with combined capacity of 80,000 bbls and located within 3 kilometres of any commercial, industrial or residential area.

They further added that, for EIA within the oil industry, two tools are in use, namely, an Environmental Evaluation (post-impact) Report (EER) and an Environmental Impact assessment (EIA) Report. EER is required at the discretion of the Director, Petroleum Resources, is an activity is observed to cause significant and adverse environmental effects. Activities under this category include spillages of oil and hazardous wastes.

Farmers Coping Mechanisms to curtail the Problems of Oil and Gas Exploitation

Oil and gas activities have created uncertainty in the rainfall pattern (timing and amount of rainfall) in every part of Nigeria. The problem is more severe in the rain forest zone of the Niger Delta which Bayelsa State is inclusive where rain-fed agriculture is mainly practiced (Uyigue and Agho, 2007). Because of the uncertainties in predicting the rain, farmers now delay their time of planting. After the first or second rain, they watch the rain sometime to ensure that the rain fall regularly enough before planting. The change in planting pattern is necessary to avoid scorching of young plants at the delay of rainfall. To strengthen this strategy for coping with the variation in rainfall pattern, the government authorities in charge of climate data need detailed

record of rainfall data from year to year and pre-inform farmers on the time to start planting with the rainfall data from successive year.

Uyigue and Agho, 2007 pointed out that another way farmers overcome this problem are by the use of fast-maturing varieties. Fast-maturing varieties of (such as) maize with high yields have been introduced and are being used by farmers. The risk involved in this strategy is that local species are being displaced by these species, though some farmers still cultivate the local ones. The risk involved in this strategy is that in future, hybrid species may completely displaced local species; this may lead to the extinction of local ones. These improved varieties can adapt to drastic change and still produce high and quality yield. It is important that the right mechanisms are put in place to protect local species from extinction.Where water scarcity is a problem, farmers should select crops on the basis of water requirements. With appropriate extension advice, farmers should develop alternative water sources and rainwater harvesting and storage techniques. Also, diversify production systems to include home gardens, crop fields, orchards, livestock, and agroforestry areas, and to maintain high crop genetic diversity to improve food and income security. Government and nongovernmental organizations can support seed banks for local varieties and community seed exchanges to promote the crop diversity.

The scorching effect of the sun is presently severe in Bayelsa state than what was obtainable in the past two decades and this is relative to Niger Delta region where oil and gas exploitation activities like gas flaring are constantly carried out. The use of mulching material (such as palm front and dead grasses) is being adopted for all seedlings at the germination period. This is to reduce the amount of direct sunlight that reaches the ground thus excessively heating up the soil and reducing the number of germinated seedlings. The use of nursery for some transplantable crops such as melon, maize and okra is being considered and practiced (Uyigue and Agho, 2007). Though this practice increases the amount of physical labour for the farmers, it is preferred to poor produce and decreased crop germination.Apata, Samuel and Adeola (2009) observed that, farmersô actual coping measures among others includes diversifying into multiple and mixed crop-livestock system, switching from crops to livestock and from dry land to irrigation, practicing zero tillage, making ridges across farms and cereal/legume intercropping, mulching.

Human activities are rapidly depleting fish stocks and destroying coral reefs and other critical aquatic habitats. Increasing demand for marine products and services, coupled with degradation of inland watersheds and fishery habitat and excessive capture of fish in many inland waters, are resulting in irreversible losses in the productivity of fisheries and aquatic ecosystems. Slowing degradation requires managing fisheries at sustainable levels, rebuilding depleted fish populations to healthy levels, and establishing a network of representative, fully

protected reserves (Sidahmed, 2008). Managing fisheries at sustainable levels requires taking an ecosystem-based approach. Robust fisheries depend on healthy marine ecosystems. Restoring depleted fish populations to healthy levels requires eliminating unsustainable fishing practices, aligning land and water conservation policies, controlling overfishing, and establishing and achieving biomass targets (Apata, Samuel and Adeola (2009).

The fish farmers in Bayelsa State are adopting tree planting system by the sides of the pond (mainly earth pond) to reduce the effect of sunlight on water. Some farmers are using crop materials (mainly palm fronts) to cover some portion of the top pond (either earthen or constructed). This is also to reduce the amount of direct sunlight which heat up the pond thereby raising the temperature above required due to increased sunlight intensity. Since the pond is an artificial habitat without a natural means of normalizing the water temperature, the pond becomes too hot and unconducive for the fishes and may lead to death of the domesticated fishes (mostly the fingerlings) (Uyigue and Agho, 2007).

Environmental degradation caused by oil and gas activities has led to climate change which in turn has led to flooding. There is the need to raise dikes and guard against increased farmland flooding. A dike is an embankment to prevent floods, it is built along the shore of the sea or lake or beside a river to hold back the water and prevent flooding (Hornby, 2001). It is a drainage channel or other artificial watercourse built to redirect water flow towards an

undesirable direction. The indigenes of the Niger Delta are beginning to construct dikes usually with sand-filled-bags or concrete walls to redirect the flow of runoff water and water from the over flowing surrounding sea and other water bodies. In some areas the over flowing water is redirected with the help of the dikes into constructed large ditches which are used to conserve water for artificial irrigation and watering the germinating seedlings at the nursery during minute drought.

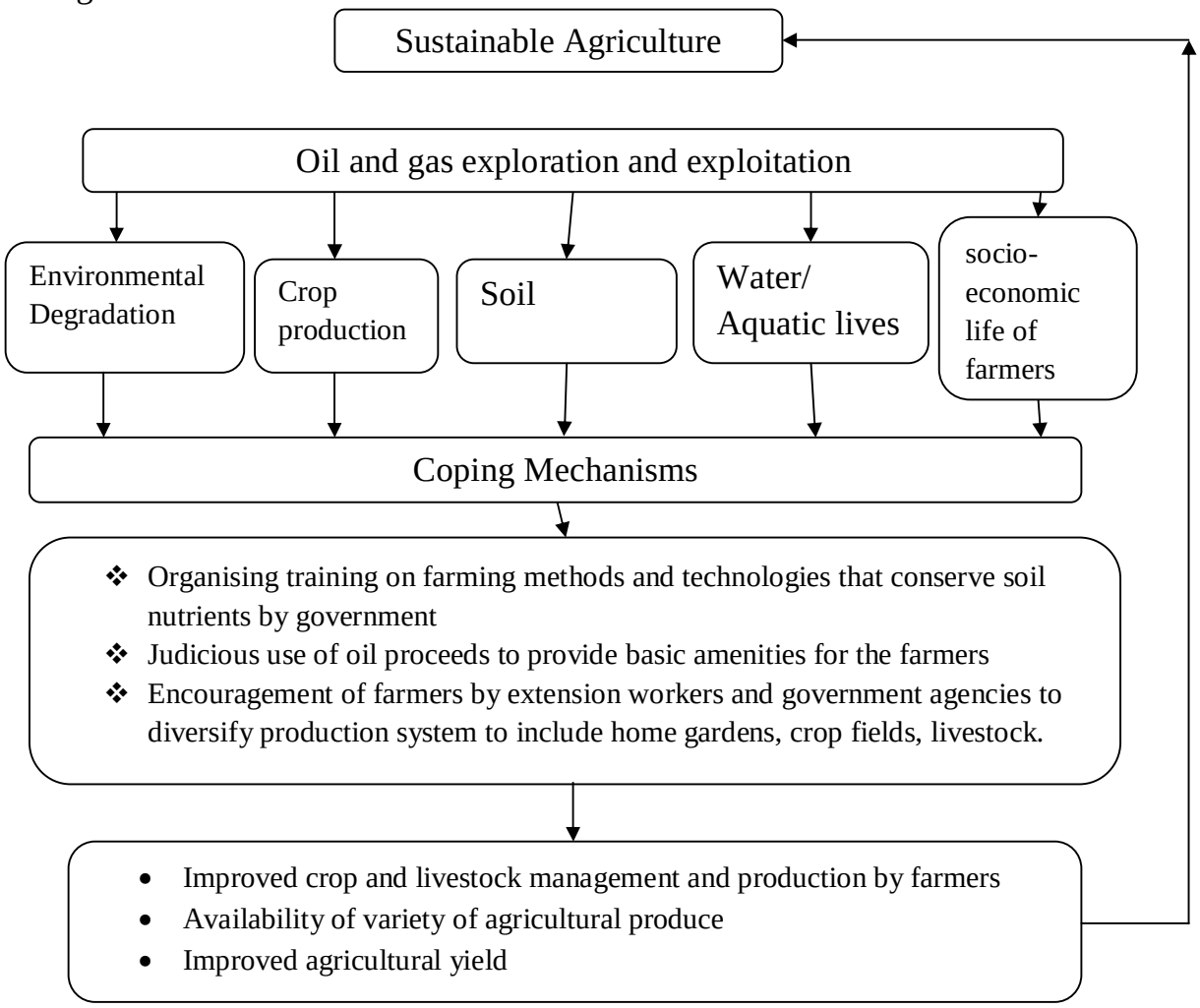
Acid rain impacts livelihood in two ways; loss of biodiversity through the destruction of vegetation and corrosion of metallic surfaces such as zinc-plated roofing sheet. Many people in the region are overcoming this impact by painting the surface of metallic roofing sheets vulnerable to corrosion by acid rain with gloss paint. The paint will prevent the roofing sheets from having contact with acid rain, thus reducing the rate of corrosion (Uyigue and Agho, 2007).

Protect and improve soil production systems should include multifunctional tree crops, such as fruit and timber, perennial crops, and no-till farming techniques. Farmers at all scales of production can reduce farm soil loss and erosion into rivers by maintaining vegetative cover on fields as permanent crops or seasonal cover crops, particularly nitrogen-fixing plants. Systems that include multipurpose treesð those that provide multiple uses, such as fuel wood, timber, and fruitsð are especially useful (Sidahmed, 2008). Where soil

fertility is limiting, production systems should include components that provide green and animal manure.

SCHEMA

Influence of oil and gas exploitation on agricultural production and sustainable agriculture.



Sustainable agriculture is heavily dependent on farmerôs activities and environmental conditions which are distorted by oil and gas exploration and exploitation operations. These operations/activities have resulted to problems

that affect the environment, crop production, soil, water/aquatic lives and socio-economic life of the farmers. Indigenous coping mechanisms could be adopted by farmers to curtail the problems. Appropriate measures among others such as organising training on farming methods and technologies that conserve soil nutrients by government, judicious use of oil proceeds to provide basic amenities for the farmers and encouragement of farmers by extension workers and government agencies to diversify production system to include home gardens, crop fields, livestock will help improve agricultural production. Combination of some or all of the measures will be of great benefit as it will improve crop and livestock management by farmers, availability of variety of agricultural produce, improve agricultural yield, enhance sustainable agricultural practices by farmers among others.

Theoretical Framework of the Study

A theory is an idea or concept that guides knowledge. Theory is a tool by which explanation is furthered. It is an analytical tool for understanding, explaining and making prediction about a given subject matter. Okorie (2000) viewed theory as a formulation of apparent relationship or underlying principles of certain observed phenomena, which have been verified to some degree. Also a theory is general principles explaining the operation of a certain phenomenon.

Ecological System Theory

The ecological system theory was propounded by UrieBronfenbrenner (1979) in his publication titled the *Ecology of Human Development*. The rationale for the ecological system theory is based on human behaviour and his environment and its main tenets are as follows;

Persons are in continual transaction with their environment; Environment affects behaviour; Understanding the changes in the environment is a better way to adapting to the environment; Systems (components of the environment) are interrelated parts or subsystems constituting an ordered whole (entire environment); Each subsystem impacts all other and whole system; System can have closed or open boundaries; Systems tend toward equilibrium.

This theory focuses on how persons interact with their environment. The major outcome of this theory is its usefulness in ecological counselling, which offers an approach to the conceptualisation of human issues that integrates personal and environmental changes through focusing on the interactions between personal and environmental factors. This process attempts to assist people in the recreation of their lives, as in the case with the various forms of counselling (Bronfenbrenner, 1979).

Some practical applications of the ecological system theory includes that its useful for developing holistic view of persons-in-environment; enhances understanding of interactions between micro-meso-macro levels of

organisation; enriches contextual understanding of behaviour; strengthen one part of the system or subsystem to impact the whole system.

The ecological system theory focuses on how persons interact with their environment. Several relationships exist between the living world including man and his environment. Osinem (2005) gave examples of such relationship to include a palm tree in its natural forest setting interacts with certain abiotic and biotic factors. Such abiotic factors include soil water, wind, soil minerals, the amount of soil oxygen, atmospheric carbon dioxide, and the amount of sunlight, the prevailing temperatures and countless other abiotic factors (the non-living elements of the environment). For the biotic factors (the living elements of the environment), they include bark beetle, birds, squirrels, soil bacteria and fungi, worms and parasites of various kinds all of which may directly or indirectly affect the tree and its life. Also, he explained this relationship using food chain. Plants (producers) in the habitat will be eaten by animals (herbivorous consumer) and they will in turn be eaten by other animals (carnivorous consumers). In this way their lives are connected like a chain. This relationship affects the number of organisms at each level. He therefore, defined ecosystem as an assemblage of plants, animals and microbe species in a particular place, which interact with each other and with their physical and chemical environment in such a way as to constitute a self-maintaining and self-regulating system. The ecological systems theory explains the interactions between man and his environment and the resulting change of behaviour

towards noticeable changes in his environment. This theory is useful in this research as it provides guides in understanding the adaptive behaviour of farmers in the area of study and Niger Delta at large. Understanding the change in behaviour is a necessary tool in proposing suitable agricultural practices and policies to conform to existing impacts of degraded environment caused by oil and gas activities. Furthermore this theory is useful to this research as it will help in the implementing of the coping mechanisms needed for farmers to survive and continue cultivating.

Review of Empirical Studies

Okoko (2002) conducted a research on the impact of oil prospective activities on Farmland in Okirika Local Government Area of Rivers State, three research questions were formulated. Seventeen villages were identified and 220 farmers were interviewed and extent of damage done on their farmland was gauged. Survey research design and stratified random sampling technique was adopted. Data obtained from respondents revealed that 39% of farmers in Okirika Local Government Area of Rivers State have been deprived of their means of livelihood namely farmland. The study revealed also that among others that there is no amount of compensation that could be given to practicing farmers that can be equivalent to continual source of revenue as land. This study is related to the present study. This is because it focused the effects of oil prospecting activities which are embedded in the exploration and exploitation of

oil which the current work is also focusing at. However, this study did not evaluate the impact of oil prospective activities on aquacultural production as well as farmers coping mechanisms from problems of oil activities which are the present studyôs objective. Also this study adopted interview method for data collection, whereas the present adopts use of structured questionnaire.

Adinkwu (2003) carried out a study on environmental hazards associated with oil production in Warri. Four research questions were formulated and survey research design was used for the study. The instrument used was 50 copies of questionnaire and also physical observation and direct interview. The respondents included oil company operators in the area such as Shell Petroleum Development Company (SPDC) West, NNPC-PPMC, Nigeria Gas Company Limited and inhabitants of the area. The results from the responses shows that there are various negative impact of oil production on aquatic life, vegetation, soil, climate, portable water among others. In addition to this observation, the inhabitants also complained bitterly that apart from discomfort from heat, vibration, noise and glows from flares, they had serious health problems such as cancer, lead poisoning among others. However, it was discovered from the study that prevailing oil pollution is an act of sabotage and equipment failure. This study is similar to the current as it focused on the environmental hazards associated with oil production which is influence of oil exploitation that the present study is also focused at but the respondents and area of study differs. However, this study did not examine the activities of oil production whereas the

present study examines the activities of oil and gas exploitation that affects agricultural production as well as the coping mechanisms adopted by farmers to curtail problems of oil and gas exploitation. Information were retrieved from different sources as this study retrieved information from residents of the area (warri) as well as staff of oil companies whereas the respondents of the present study are specifically farmers. This study is different from the present as the present specifically examines the activities of oil and gas as well as the coping mechanism adopted by farmers.

Yasuo (2006) conducted a study on an assessment of the effects of oil exploration and production on farming in Bayelsa State. The study examined the effects of oil exploration and production on soil fertility, crop growth and development, crop yields and aquatic lives. Four research questions were formulated. The study adopted survey design and questionnaire as its instrument for data collection from 500 respondents. The findings identified serious effects of oil exploration and production and they include among others the following; destruction of soil texture, destruction of macro organisms in the soil, reduction of crop yield, death of fishes, loss of farmlands and fishing grounds. The study recommended among others that the oil companies should continue to ensure timely supply of adequate farming facilities and materials needed for farming. This is similar to the current as it focused on the effects of oil exploration and production on farming, whereas the present focus on the influence of oil and gas on agricultural production and coping mechanisms adopted by farmers. Also the

content scope varies. This study is related to the present as they both seek to assess the effects posed by oil exploration and production. However, this study varies from the present as its specific purpose only include the effect of oil exploration and production on growth and crop yield whereas the present study focus on all aspects and processes of crop production. Also, the present study specifically examined the influence of oil and gas on farmers as well as coping mechanisms adopted by farmers. The present study also examined various activities of oil and gas that affects agricultural production.

Bayode, Adewunmi and Odunwole (2011) carried out a study which appraises the implications of oil exploration and exploitation in the coastal region of Ondo State. Three research questions were formulated. Data were obtained through physical verification, regular observations, constant monitoring, documentation and records of oral history and administration of questionnaire in some selected settlements in the region. The study highlighted several direct environmental and associated problems that emanated from oil exploration and exploitation in the region. The problems identified among others include large-scale environmental pollution and degradation of agricultural land which serves as source of income for the people coupled with social unrest arising from unpaid claims of compensation and lack of concern for the people in the exploration area. The study advocates for oil spill management plan, control and clearance of spills; giving concessions to indigenous oil companies during bidding process by granting licenses to operate

in the Niger-Delta region; adoption of long-term monitoring and surveillance mechanism; continuous provision of infrastructure for the host communities by prospecting oil companies; and development of national oil spill contingency plan among others with the view to guarantee sustainable development of the environment in the region. This is similar with the current as they both focused on the effects oil exploration and exploitation but in different study area and the former sought the effects only on biodiversity. The present study is at variances with this study as the present sought the influence of oil and gas exploitation on agricultural production. Specificallyexamines oil and gas exploitation activities, its influence on crop production, aquacultural production and farmers as well as coping mechanisms adopted by farmers. The method for data collection also varies as the present study adopted structured questionnaire.

In a study by Olusola and Okoroigwe (2007) on evaluation findings for exploration and exploitation activities and its effect on biodiversity using GIS, remote and GPS technology, a case study of Nigeria Niger Delta coastal environment with particular reference to River State, the study examined the use of geographic information system (GIS) and Remote Sensing in identifying the effects of manôs activities (exploration and exploitation) on biodiversity. The results shows that in Nigeria there are more than 4600 plants species of which about 205 are endemic (that is they cannot be found elsewhere).Of these, about 484 plants in 112 families are threatened with extinction which is resulted

through the impact of oil exploitation. Many animals and birds are also threatened with extinction. Also 25 out of 274 mammals, 10 out of 831 birds, and 2 out of 114 reptile know to exit in Nigeria are endangered. This is similar with the current study as they both examine information on oil exploration and exploitation and its effects. However, Olusola and Okoroigwe (2007) specifically examine oil exploration and exploitation effects on biodiversity using GIS, remote and GPS technology while the present study focus on the influence of oil and gas exploitation on agricultural production by using structured questionnaire for data collection.

Study by Legborsi (2007) on the adverse impact of oil pollution on the environment and wellbeing of a local indigenous community: the experience of the Ogoni people of Nigeria. It was found that in Ogoni, between 1993 and mid-2007, there has been a recorded 35 incidences of oil spills. This is aside from the unnoticed slicks and unreported cases of oil spills. The result of the unchecked oil pollution in Ogoni has been the complete destruction of the ecosystem. Mangrove forests have fallen to the toxicity of oil spills and are being replaced by noxious nypa palms, the rainforest has fallen to the axe of oil companies, wild-life and game have been driven away and farmlands have been rendered infertile with gross implication on the right to adequate food. The combination of the effects of oil spill and acid rain resulting from gas flaring has been soil degradation which affects crop yield and harvest. Fish are driven

away from in-shore or shallow waters into deep-sea as a result of flaring. This is similar with the present as they both examine the impact of oil pollution. This study concentrates on oil pollution on the environment and wellbeing of a local indigenous community whereas the present study concentrates on the influence of oil and gas exploitation on agricultural production and specifically examines oil and gas exploitation activities, its influence on crop production, aquacultural production and farmers as well as coping mechanisms adopted by farmers.

Alam, Ahmed and Munna (2010) carried out a study on environmental impact assessment of oil and gas sector: a case study of the Magurchara gas field. The objective was to assess the socio-economic impacts the projects, to assess the impacts on land use pattern and to identify and qualify the environmental effects of these projects. The findings revealed that the effects are stronger on the eco-logical and socioeconomic environment rather than physical environment. The effect on plane land is evaluated on low and hilly terrain land medium. Most of the components of physical environment are evaluated as insignificantly affected. Ecological environment of the study area is seriously affected by the gas field explosion. In the study area a huge amount of forests are distracted and got high grade in evaluation. The effects on wildlife and migrated birds are evaluated as low and medium, respectively. Distribution of wetland is also considered by the gas field. In socio-economic environment agriculture sector, crops and plantation, and farming are affected and the effects are evaluated as medium. The workers of the gas field and the irrigation are

affected highly by the gas field explosion. Other important components of socio-economic environment like industrial, residential, commerce and industry, household, land communication, social structure are also affected and effects are evaluated as low. This result was obtained so because mitigation measures are adapted to reduce effect to the most possible minimum.The present study is at variances with this study as the present sought the influence of oil and gas exploitation on agricultural production. Specifically, it examines oil and gas exploitation activities, its influence on crop production, aquacultural production and farmers as well as coping mechanisms adopted by farmers.

Summary of Literature Reviewed

The reviewed literature revealed that Bayelsa and any other oil communities in the Niger Delta is endowed with rich endemic flora and fauna species distributed with the four main ecological zones: coastal inland zone, mangrove swamp zone, freshwater zone and lowland rain forest zone with varying sensitivities.

The literature reviewed helped in identifying possible causes of environmental degradation associated with oil and gas exploitation in the Niger Delta region of Nigeria. The literature further explained the various activities of oil and gas exploration and exploitation capable of affecting biodiversity (aquatic lives, other organisms, crops and soil), socio-economic life and health of the communities.

The literature reviewed revealed that farmersô possible coping mechanisms to curtail the problems of oil and gas exploitation could entail use of fast-maturing varieties, raising dikes to guard against increased farmland flooding, use of mulching materials for all seedlings at the germination period, tree planting system by the sides of the ponds, among others. Also, crops and aquatic lives are well adapted to survive in their normal environment but when the environment changes as a result of human activities they face degradation.

The theoretical framework used in this study accounted for the relationship between human behaviour and his environment. The ecological system theory dealt with the interaction of man and his environmental coexistence and survival irrespective of the changes in the surrounding. This study is anchored on this theory as it form a guide for understanding the environment while providing options for continued production.

The reviewed empirical studies focused on the effects of oil and gas exploitation on biodiversity and the environment at large. No known studies particularly examine the influence of oil and gas exploitation on agricultural production. One of the studies in the empirical which was carried out in Bayelsa State only examined the assessment of the effects of oil exploration and production on farming but failed to determine the activities of oil andgas that affects agricultural production, influence of oil and gas activities on farmers as well as the coping mechanisms required by farmers for sustainable agriculture,

whereas the present study specifically examined them. However, from the related empirical studies reviewed, it can be deduced that there has not been any known studies carried out on the influence of oil and gas exploitation on agricultural production and coping mechanisms required by farmers for sustainable agriculture in Bayelsa State. Therefore, this study seeks to fill this gap by establishing the influence of oil and gas exploitation on agricultural production in Bayelsa State.

CHAPTER THREE

METHODOLOGY

This chapter describes the procedure that was adopted in carrying out the study. The procedure is presented under the following sub-headings: design of the study, area of the study, population for the study, sample and sampling technique, instrument for data collection, validation of the instrument, reliability of the instrument, method of data collection and method of data analysis.

Design of the Study

The study adopted descriptive survey research design. Descriptive survey research design, according to Nworgu (2006), is the one in which a group of people or item is studied by collecting and analysing data from only a few individuals or items considered to be representative of the entire group. This design is appropriate for this study since information will be gathered from a sample of the population (farmers) who are familiar with the ideas relating to the purpose of the study with the aim of generalizing to the entire population.

Area of the Study

The study was carried out in Bayelsa State. The study covered all the eight local government area of the State. They include; Yenagoa, Kolokuma/Opokuma, Sagbama, Ekeremor, Southern Ijaw, Ogbia, Brass and Nembe local government areas. The state was preferred for the study because it

one of the states in the Niger Delta where oil and gas exploration and exploitation takes place. The state is also chosen for the study because it is one of the highest producers of oil and gas among the Niger Delta States hence the heavy presence of the influence of oil and gas exploitation on agricultural production.

Population for the Study

The population for the study is 67,551, made up of all registered farmers of Federal Ministry of Agriculture and Rural Development in Bayelsa State (2013). The farmers are privileged to know the communities very well and the changes in the environment associated with oil and gas exploitation as they engage in animal, crop and fish production.

Sample and Sampling Technique

The sample for the study consists of 674 of registered farmers in the State. According Uzoagulu (2011), for a population equal to 10,000 but less than 20,000, 5% of such population size can be used as the sample size while for a population higher than 20,000, a lowered percentage can be used. Based on the authorôs recommendation, proportionate stratified random sampling technique was be used to select 1% of the farmers according to their LGAôs (strata) (see appendix B).

Instruments for Data Collection

Structured questionnaire was used to collect data for the study. The structured questionnaire developed by the researcher and titled ñQuestionnaire on the Influence of Oil and Gas Exploitation on and Sustainable Agricultureò (IOGESA), was used to collect information from the respondents. The questionnaire was divided into two parts (I & II). Part I solicited information on the socio-economic status of the respondent while part II collected information relating to the influence of oil and gas exploitation in the study area based on the specific purposes of the study and was divided into five sections (A-E). Section A addressed the activities of oil and gas exploitation that affects agricultural production; Section B sought information on the influence of oil and gas exploitation on crop production; Section C solicited information on the influence of oil and gas exploitation on aquacultural production; Section D sought for information on the influence of oil and gas exploitation on farmers and section E addressed information onfarmers coping mechanisms to curtail the problems of oil and gas exploitation.

Items in Section A, & E had a 4-point response scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with weight of 4, 3, 2, and 1 respectively. While each item in section B, C and D also had a 4-point response scale of High Influence (HI), Moderate Influence (MI), Slight

Influence (SI) and No Influence (NI) with weight 4, 3, 2, and 1respectively as the weight.

Validation of the Instruments

According to Okoko (2000), validity is concerned with ensuring that a test measures what it is supposed to measure. To ensure validity, therefore, the research instrument was subjected to face validation by three experts; all from the Department of Vocational Teacher Education, University of Nigeria, Nsukka. These validates were asked to read and correct statements with respect to clarity, sentence construction, suitability of items, missing information and other observed errors. Validates were also asked to make suggestions for the improvement of the instruments. Their corrections and suggestions were used to produce the final copy of the instruments (see appendix A).

Reliability of the Instruments

The reliability of the structured questionnaire instrument was determined by using Cronbach Alpha reliability test for obtaining the internal consistency of the validated items.To determine the internal consistency of the items, 30 copies of the questionnaire were administered on farmers in River state which were not among the respondents used for the study. The distributed copies were collected and analysed to obtain the reliability coefficient. The Cronbach Alpha coefficient for the questionnaire instrument was 0.78.

Method of Data Collection

The structured questionnaires were administered on the respondents by the researcher through personal contact with the help of two assistants. The research assistants were instructed on how to distribute and collect the copies of the completed questionnaire.

Method of Data Analyses

Data collected from the respondents were analysed using Statistical Package for the Social Sciences (SPSS- 20.0). The statistical tools used for data analysiswere mean and standard deviation to answer research questions and t-test to test the null hypothesesat 0.05 level of significance at the appropriate degree of freedom. The research questions were answered using real limit of numbers or values of the mean as follows:

Response Option	**Nominal Value**		**Real limit of number**
Strongly Agree	(SA)	4	3.50 ï 4.00
Agree	(A)	3	2.50 ï 3.49
Disagree	(D)	2	1.50 ï 2.49
Strongly Disagree	(SD)	1	0.50 ï 1.49
High Influence	(HI)	4	3.50 ï 4.00
Moderate Influence	(MI)	3	2.50 ï 3.49

Slight Influence	(SI)	2	1.50 ï 2.49
No Influence	(NI)	1	0.50 ï 1.49

In taking decision for research question 2, 3 and 4; any item with a mean value ranging from 3.50 ï 4.00 was interpreted as high, 2.50 ï 3.49 moderate, 1.50 ï 2.49 slight while any item with a mean value below 1.50 (0.50 ï 1.49) was interpreted as no influence or meaning oil and gas exploitation has no influence on the items. With reference to research question 1 & 5; any item with a mean value ranging from 3.50 ï 4.00 was interpreted as strongly agree, 2.50 ï 3.49 agree, 1.50 ï 2.49 disagree while any item with a mean value below 1.50 (0.50 ï 1.49) was interpreted as strongly disagree.For the hypotheses, any item that itôs t-calculated was less than t-table value at the appropriate degree of freedom, the null hypothesis of no significant difference was not rejected, but rejected if otherwise.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

In this chapter, the data collected for the study were presented and analyzed based on the research questions and hypotheses that guided the study.

Research Question 1

What are various activities of oil and gas exploitation that affect agricultural production in Bayelsa State?

Table 1

Mean Ratings and Standard Deviation of Respondents on the Various Activities of Oil and Gas Exploitation that Affect Agricultural Production in Bayelsa State

n_1= 361 n_2= 289 N_T=650

S/N	Items	Respondents (farmers)								
		Small scale			Large scale			AV Resp.		Dec
		X	SD	Dec	X	SD	Dec	X	SD	
1.	Land surveying and surface mapping.	3.15	0.66	A	3.43	0.49	A	3.29	0.58	A
2.	Collecting seismic data to evaluate a geologic formations potential	3.34	0.63	A	3.40	0.68	A	3.37	0.66	A
3.	Acquisition of chunk area of agricultural lands	3.36	0.65	A	3.53	0.49	SA	3.45	0.57	A
4.	Deforestation	3.62	0.48	SA	3.71	0.45	SA	3.67	0.47	SA
5.	Construction of access road to drilling sites	3.40	0.49	A	3.43	0.49	A	3.41	0.49	A
6.	Construction of network pipelines and canals	3.44	0.49	A	3.71	0.45	SA	3.58	0.47	SA
7.	Drilling exploration and delineation wells	3.58	0.49	SA	3.50	0.50	SA	3.54	0.49	SA
8.	Exploding dynamites in the soil	3.34	0.61	A	3.70	0.45	SA	3.52	0.53	SA
9.	Noise pollution from seismic blast and equipment	3.29	0.72	A	3.32	0.64	A	3.31	0.68	A
10.	Shaking the ground with vibrasizer and other equipment	3.12	0.51	A	3.25	0.62	A	3.19	0.57	A
11.	Gas flaring and oil spillage	3.52	0.50	SA	3.59	0.49	SA	3.56	0.49	SA
12.	Discharge of untreated effluents into the environment	3.05	0.62	A	3.54	0.49	SA	3.29	0.56	A
13.	Poor management of waste products	3.12	0.56	A	3.31	0.46	A	3.22	0.51	A
14.	Decommissioning/reclamation of land	3.32	0.51	A	3.23	0.98	A	3.28	0.75	A
15.	Installation of equipment to separate oil, natural gas and water	3.73	0.44	SA	3.29	0.45	A	3.51	0.45	SA
16.	Pumping hydrocarbons to the surface of land	3.12	0.56	A	3.31	0.66	A	3.22	0.61	A
Cluster Response		**3.34**	**0.55**	**A**	**3.45**	**0.55**	**A**	**3.40**	**0.56**	**A**

Note. Dec – Decision. Av Resp.- Average Response. Strongly Agree (SA=3.50 – 4.00) Agree (A=2.50 – 3.49) Disagree (D=1.50 – 2.49). Strongly Disagree (SD=0.50 – 1.49).

The data presented on Table 1 showed that subsistent farmers strongly agreed (SA) to four items (No. 4, 7, 11, and 15) with mean values between 3.50 and 4.00, as the activities of oil and gas exploitation that affect agricultural production, while they agreed (A) to twelve items (No. 1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 14 and 16) as their means fell within 2.50 to 3.49 mean range. Responses from the commercial farmers indicated that they strongly agree (SA) to seven items (No. 3, 4, 6, 7, 8, 11 and 12) as their means were within 3.50 to 4.00 while they agreed (A) to nine items (No. 1, 2, 5, 9, 10, 13, 14, 15 and 16) with mean values between 2.50 and 3.49, as the activities of oil and gas exploitation that affect agricultural production.

The average response of the small scale and large scale farmers revealed that they strongly agreed (SD) to six items (No. 4, 6, 7, 8, 11 and 15) as their means fell within 3.50 to 4.00 while they agreed (A) to the remaining ten items (No. 1, 2, 3, 5, 9, 10, 12, 13, 14 and 16) with mean values within 2.50 to 3.49 as the activities of oil and gas exploitation that affect agricultural production. In summary, the respondents Agreed (A) to the items in table 1 (as indicated by the average mean response value of 3.40) as the activities of oil and gas exploitation that affect agricultural production in Bayelsa State. The standard deviation of all the items ranged from 0.44-0.98 with an average of 0.56; indicating that the respondents were not far from the mean and from each other in their responses.

Research Question 2

What are the influences of oil and gas exploitation on crop production in Bayelsa State?

Table 2

Mean Ratings and Standard Deviation of Respondents on the Influence of Oil and Gas Exploitation on Crop Production in Bayelsa State

n_1= 361 n_2= 289 N_T=650

S/N	Items	Respondents (farmers)								
		Small scale			Large scale			AV Resp.		Dec.
		X	SD	Dec	X	SD	Dec	X	SD	
1.	Webs of pipelines layout impede crop production activities	3.24	0.58	MI	3.26	0.67	MI	3.25	0.63	MI
2.	Oil spillage/chemical discharge destroys crops	3.72	0.45	HI	3.67	0.47	HI	3.69	0.46	HI
3.	Obstruction of farming activities in the area	3.11	0.69	MI	3.09	0.71	MI	3.10	0.70	MI
4.	Gas flaring increases ambient temperature which causes stunted growth, wilting and defoliation of crops	3.46	0.59	MI	3.45	0.59	MI	3.46	0.59	MI
5.	Gas flaring causes global warning and influences rainfall pattern leading to extreme of floods, drought and humid conditions which reduce crop production activities	3.56	0.58	HI	3.54	0.61	HI	3.55	0.59	HI
6.	Consumption of the toxic emissions by the surrounding vegetation affects the quality and aesthetic value of crops and their products	3.43	0.67	MI	3.38	0.65	MI	3.40	0.66	MI
7.	Leads to retarded growth of crops	3.57	0.49	HI	3.64	0.48	HI	3.60	0.49	HI
8.	Leads to reduction of crop yields	3.62	0.48	HI	3.58	0.49	HI	3.60	0.49	HI
9.	Reduction of total land for agricultural activities	3.49	0.62	MI	3.62	0.55	HI	3.56	0.59	HI
10.	Oil spillage renders the soil unproductive for agriculture	3.46	0.61	MI	3.45	0.56	MI	3.46	0.59	MI
11.	Webs of pipelines layout in the soil impede agricultural activities	3.34	0.59	MI	3.48	0.56	MI	3.41	0.58	MI
12.	Obstruction of farming activities in the area	3.54	0.49	HI	3.46	0.49	MI	3.50	0.49	HI
13.	Emission of gases during gas flaring reduces soil moisture and inhibits nutrient availability for plants use	3.49	0.57	MI	3.52	0.61	HI	3.51	0.59	HI
14.	Destruction of soil texture which affects crop production	3.00	0.85	MI	2.99	0.82	MI	2.99	0.84	MI
15.	Poor soil water infiltration leading to poor yield of crops	3.41	0.62	MI	3.39	0.71	MI	3.40	0.67	MI
16.	Destruction of micro and macro organisms in the soil which aids organic matter decomposition for crop use	3.48	0.64	MI	3.41	0.70	MI	3.45	0.67	MI
17.	Increase the growth of algae and fungi in the soil leading to nutrient competition with crops	3.17	0.74	MI	3.28	0.76	MI	3.23	0.75	MI
Cluster Response		**3.41**	**0.60**	**MI**	**3.42**	**0.61**	**MI**	**3.41**	**0.61**	**MI**

Note. Dec. – Decision. Av Resp.- Average Response. High Influence (HI=3.50 – 4.00) Moderate Influence (MI=2.50 – 3.49) Slight Influence (SI=1.50 – 2.49) No Influence (NI=0.50 – 1.49).

Data on Table 2 revealed that five items (No. 2, 5, 7, 8 and 12) responded to by subsistent farmers had high influence (HI) on crop production as their means values fell within 3.50 – 4.00 while they indicated that the remaining twelve items (No. 1, 3, 4, 6, 9, 10, 11 and 13-17) had moderate influence (MI) as their means were within 2.50 to 3.49. Responses from commercial farmers showed that six items (No. 2, 5, 7, 8, 9, and 13) had high influence (HI) as their means fell between 3.50 and 4.00 while the remaining eleven items (No. 1, 3, 4, 6, 10, 11, 12 and 14-17) had moderate influence (MI) as their means were within 2.50 to 3.49 mean range.

However, the average response of the small subsistent and commercial farmers revealed that seven items (No. 2, 5, 7, 8, 9, 12 and 13) with mean values within 3.50 – 4.00 had high influence (HI). They further indicated that the remaining ten items (No. 1, 3, 4, 6, 10, 11 and 14-17) had moderate influence (MI) as their means were between 2.50 and 3.49. In summary, the influence of oil and gas exploitation on crop production in Bayelsa State is moderate (MI) as indicated by the average mean response (3.41) of both small scale and large scale farmers. The standard deviation of all the items ranged from 0.45-0.85 with an average of 0.61; indicating that the respondents were not far from the mean and each other in their responses.

Hypothesis 1

H_{01} There is no significant difference in the mean responses of subsistent and commercial farmers on the influence of oil and gas exploitation on crop production in Bayelsa State.

Table 3

Summary of t-test Comparison of the Mean Responses of Small Scale and Large Scale Farmers on the Influence of Oil and Gas Exploitation on Crop Production in Bayelsa State

Type of Agriculture	Mean	Standard Deviation	N	df	Standard Error	t-cal	t-tab	Decision
Small Scale Farmers	3.41	0.60	321	648	0.05	-0.2*	1.97	NS
Large Scale Farmers	3.42	0.61	274					

*Note. * P<0.0 NS – Not Significant*

From Table 3, t-test failed to reveal statistically reliable difference between the mean responses of subsistent and commercial farmers on the influence of oil and gas exploitation on crop production in Bayelsa State. This is because the t-calculated -0.2 (t-cal)is less than the t-table 1.97 (t-tab) value at 0.05 level of significance and 648degree of freedom.

Thus the null hypothesis (H_{01}) of no significant difference is not rejected.

Research Question 3

What are the influences of oil and gas exploitation on aquacultural production in Bayelsa State?

Table 4

Mean Ratings and Standard Deviation of Respondents on the Influence of Oil and Gas Exploitation on Aquacultural Production

		n_1= 361			n_2= 289			N_T=650		
S/N	Items	Respondents (farmers)								
		Small scale			Large scale			AV Resp.		Dec.
		X	SD	Dec	X	SD	Dec	X	SD	
1.	Oil spillage renders the water unproductive for fishing	3.57	0.59	HI	3.51	0.59	HI	3.54	0.59	HI
2.	Oil spillage/chemical discharge destroys aquatic life	3.67	0.58	HI	3.62	0.57	HI	3.65	0.57	HI
3.	Oil film on the water surface prevents aeration and taints fishing gears	3.41	0.60	MI	3.37	0.57	MI	3.39	0.59	MI
4.	Poisonous and insoluble elements (mercury, lead) swollen by fish reduces the quality and quantity of fish availability to man	3.39	0.59	MI	3.42	0.58	MI	3.41	0.58	MI
5.	Consumption of acidic rainwater and other pollutants leads to lung problems, asthma and death thereby reducing productivity of farmers	3.45	0.57	MI	3.38	0.58	MI	3.42	0.57	MI
6.	Pollution of groundwater	3.59	0.49	HI	3.59	0.49	HI	3.59	0.49	HI
7.	Pollution of water bodies	3.43	0.72	MI	3.43	0.64	MI	3.43	0.68	MI
8.	Distortion of fishing activities	3.59	0.49	HI	3.58	0.49	HI	3.58	0.49	HI
9.	Destruction of aquatic lives	3.70	0.46	HI	3.59	0.49	HI	3.66	0.48	HI
10.	Affects reproduction of fish as well as sending fish to deep sea areas	3.49	0.61	MI	3.50	0.59	HI	3.49	0.60	MI
11.	Causes extinction of fish species	3.49	0.62	MI	3.46	0.58	MI	3.48	0.60	MI
Cluster Response		**3.53**	**0.57**	**HI**	**3.50**	**0.51**	**HI**	**3.51**	**0.57**	**HI**

Note. Dec. – Decision. Av Resp.- Average Response. High Influence (HI=3.50 – 4.00) Moderate Influence (MI=2.50 – 3.49) Slight Influence (SI=1.50 – 2.49) No Influence (NI=0.50 – 1.49).

The data presented on Table 4 showed that five items (No. 1, 2, 6, 8 and 9) responded to by the subsistent farmers had high influence (HI) as their means were within 3.50 – 4.00 real limit of number. Six items (No. 3-5, 7, 10 and 11)

had moderate influence (MI) as their means fell within 2.50 to 3.49. Responses from the commercial farmers showed that six items (No. 1, 2, 6, 8, 9, and 10) had high influence (HI) as their mean values fell between 3.50 and 4.00 while five items (No. 3-5, 7 and 11) had moderate influence (MI) with mean values within 2.50 to 3.49.

On average response of the small scale and large scale farmers, five items (No. 1, 2, 6, 8, and 9) had high influence (HI) as their means values fell between 3.50 and 4.00 real limit of number. The remaining six items (No. 3-5, 7, 10, and 11) had moderate influence (MI) as their means fell within 2.50 to 3.49. In summary, the influence of oil and gas exploitation on aquacultural production in Bayelsa State is high (HI) as indicated by the average mean response (3.51) of both the small scale and large scale farmers. The standard deviation of all the items ranged from 0.46 -0.72 with an average of 0.57; indicating that the respondents were not far from the mean and each other in their responses.

Hypothesis 2

H_{02} There is no significant difference in the mean responses of subsistent and commercial farmers on the influence of oil and gas exploitation on aquacultural production in Bayelsa State.

Table 5

Summary of t-test Comparison of the Mean Responses of Subsistent and Commercial Farmers on the Influence of Oil and Gas Activities on Aquacultural Production in Bayelsa State

Type of agriculture	Mean	Standard Deviation	N	df	Standard Error	t-cal	t-tab	Decision
Subsistent Farmers	3.53	0.57	321	648	0.04	0.75*	1.97	NS
Commercial Farmers	3.50	0.51	274					

Note. ** P<0.05* *NS – Not Significant*

From the Table 5, t-test revealed that no statistically difference exits between the mean responses of subsistent and commercial farmers on the influence of oil and gas activities on aquacultural production in Bayelsa State. This is because the t-calculated 0.75 (t-cal) is less than the t-table 1.97 (t-tab) value at 0.05 level of significance and at 648 degree of freedom.

Thus the null hypothesis (H_{02}) of no significant difference is not rejected.

Research Question 4

What are the influences of oil and gas exploitation on farmers in Bayelsa State?

Table 6

Mean Ratings and Standard Deviation of Respondents on the Influences of Oil and Gas Exploitation on Farmers in Bayelsa State

n_1= 361 n_2= 289 N_T=650

S/N	Items	Respondents (farmers)								
		Small scale			Large scale			AV Resp.		Dec.
		X	SD	Dec	X	SD	Dec	X	SD	
1.	Oil polluted water causes disease problems among residents including farmers	3.22	0.71	MI	3.20	0.70	MI	3.21	0.70	MI
2.	Fishes and other organisms from oil polluted medium are unpalatable and avoided as source of food	3.36	0.55	MI	3.32	0.57	MI	3.34	0.56	MI
3.	There is displacement of some settlements from their original locations leading to low morale of the farmers	3.57	0.50	HI	3.56	0.50	HI	3.56	0.50	HI
4.	Loss of properties and farm land for agricultural activities	3.51	0.50	HI	3.52	0.50	HI	3.51	0.50	HI
5.	Communal clashes abound on account of claim of ownership of land leading to distortion of agricultural programmes	3.46	0.50	MI	3.46	0.49	MI	3.46	0.49	MI
6.	Obstruction of farming activities in the area	3.33	0.69	MI	3.28	0.70	MI	3.31	0.69	MI
7.	Consumption of acidic rainwater and other pollutants leads to lung problems, asthma and death thereby reducing productivity of farmers	3.35	0.56	MI	3.24	0.56	MI	3.29	0.56	MI
8.	Deprivation of traditional occupation of fishing and farming	3.16	0.87	MI	3.23	0.85	MI	3.20	0.86	MI
	Cluster Response	**3.37**	**0.61**	**MI**	**3.35**	**0.61**	**MI**	**3.36**	**0.61**	**MI**

Note. Dec. – Decision. Av Resp.- Average Response. High Influence (HI=3.50 – 4.00) Moderate Influence (MI=2.50 – 3.49) Slight Influence (SI=1.50 – 2.49) No Influence (NI=0.50 – 1.49).

The data contained on Table 6 revealed that two items (No. 3 and 4) responded to by the subsistent farmers had high influence (H1) as their means fell within 3.50 – 4.00 real limit of number. Six items (No. 1, 2, and 5-8) had moderate influence (MI) as their means fell within 2.50 to 3.49. Responses from the commercial farmers showed that two items (No. 3 and 4) with mean values

within 3.50 – 4.00 real limit of number had high influence (HI) while six items (No. 1, 2, and 5-8) had moderate influence (MI) and their means fell between 2.50 and 3.49.

On average response of subsistent and commercial farmers, two items (No.3 and 4) had high influence (HI) as their mean values fell between 3.50 and 4.00, while six items (No. 1, 2, and 5-8) had moderate influence (MI) as their means were within 2.50 to 3.49. In summary, the influences of oil and gas exploitation on farmers in Bayelsa state is moderate (MI) as indicated by the average mean response (3.36) of both subsistent and commercial farmers. The standard deviation of all the items ranged from 0.49-0.87 with an average of 0.61; indicating that the respondents were not far from the mean and each other in their responses.

Hypothesis 3

H_{03} There is no significant difference in the mean responses of subsistent and commercial farmers on the influence of oil and gas activities on farmers in Bayelsa State.

Table 7

Summary of t-test Comparison of the Mean Responses of Subsistent and Commercial Farmers on the Influence of Oil and Gas Exploitation on Farmers in Bayelsa State.

Type of agriculture	Mean	Standard Deviation	N	df	Standard Error	t-cal	t-tab	Decision
Subsistent Farmers	3.37	0.61	321	648	0.05	9.71*	1.97	S
Commercial Farmers	3.35	0.61	274					

*Note. * P<0.05 S - Significant*

From the Table 7, t-test showed statistically difference between the mean of subsistent and commercial farmers on the influence of oil and gas activities on farmers in Bayelsa State, as t-calculated 9.71 (t-cal) is greater than the t-table 1.97 (t-tab) value at 0.05 level of significance and at 648 degree of freedom indicating far response between the groups.

Thus the null hypothesis (H_{04}) of no significant difference is rejected as the difference in the mean response of subsistent and commercial farmers is significant

Research Question 5

What are farmers coping mechanisms to curtail the problems of oil and gas exploitation in Bayelsa State?

Table 8

Mean Ratings and Standard Deviation of Respondents on the Coping Mechanisms to Curtail the Problems of Oil and Gas Exploitation in Bayelsa State

n_1= 361 n_2= 289 N_T=650

S/N	Items	Respondents (farmers)								
		Small scale			Large scale			AV Resp.		Dec.
		X	SD	Dec	X	SD	Dec	X	SD	
1.	Engaging in non-farming activities	3.16	0.67	A	3.14	0.63	A	3.15	0.65	A
2.	Sale of personal or family assets to engage in agricultural production	3.07	0.78	A	3.15	0.76	A	3.11	0.77	A
3.	Use of bank savings for agricultural production	3.25	0.52	A	3.24	0.55	A	3.24	0.53	A
4.	Obtaining loan facilities for agricultural activities	3.51	0.50	SA	3.50	0.50	SA	3.50	0.50	SA
5.	Consumption of imported food	3.13	0.69	A	3.18	0.73	A	3.15	0.71	A
6.	Reduction in household expenditures	2.98	0.84	A	3.05	0.84	A	3.01	0.84	A
7.	Use of alms received form relations and friends for agricultural production	3.31	0.85	A	3.31	0.82	A	3.31	0.83	A
8.	Use of succour received from prospecting companies and government for agricultural production	2.79	0.68	A	2.81	0.69	A	2.80	0.68	A
9.	Change in planting pattern to cope with the environmental problems	3.41	0.66	A	3.37	0.67	A	3.39	0.66	A
10.	Use of fast-maturing varieties of crops and breeds of animals	3.15	0.71	A	3.14	0.75	A	3.14	0.73	A
11.	Raising dikes and guard against increased farmland flooding	3.31	0.74	A	3.29	0.70	A	3.30	0.72	A
12.	The use of mulching materials to protect young crops	3.29	0.57	A	3.31	0.55	A	3.30	0.56	A
13.	Use of nursery for some transplantable crops	3.25	0.61	A	3.28	0.63	A	3.27	0.62	A
14.	Adoption of tree planting system as shades for ponds	3.26	0.54	A	3.24	0.54	A	3.25	0.54	A
15.	Diversifying into multiple and mixed crop-livestock system	3.23	0.81	A	3.22	0.85	A	3.22	0.83	A
16.	Switching from crop to livestock	3.06	0.49	A	3.03	0.51	A	3.05	0.50	A
17.	Switching from dry land to irrigation	3.28	0.64	A	3.35	0.64	A	3.32	0.64	A
18.	Adoption of improved production adjustments	3.15	0.36	A	3.15	0.36	A	3.15	0.36	A
19.	Use of improved breeding strategies	3.58	0.49	SA	3.63	0.48	SA	3.60	0.48	SA
20.	Use of adaptation technologies	3.33	0.47	A	3.37	0.48	A	3.35	0.47	A
21.	Improved management of water resources	3.23	0.77	A	3.28	0.76	A	3.25	0.76	A
22.	Introduction of simple techniques for localized irrigation	3.21	0.82	A	3.18	0.81	A	3.20	0.81	A
23.	Use of facilities for storing rainwater	3.29	0.89	A	3.19	0.89	A	3.24	0.89	A
	Cluster Response	**3.23**	**0.66**	**A**	**3.24**	**0.65**	**A**	**3.23**	**0.65**	**A**

Note. Dec – Decision. Strongly Agree (SA=3.50 – 4.00) Agree (A=2.50 – 3.49) Disagree (D=1.50 – 2.49) Strongly Disagree (SD=0.50 – 1.49).

The data presented on Table 8 showed that both the subsistent and commercial farmers strongly agreed (SA) to two items (No. 4 and 19; with

mean values 3.51 and 3.58 for subsistent farmers while 3.50 and 3.60 for commercial farmers, as their means fell within 3.50 – 4.00 real limit of number) as coping mechanisms to curtail the problems of oil and gas exploitation in Bayelsa State. The table also showed that they both agreed (A) to twenty-one items (No. 1-3, 5-18, and 20-23) as their means were within 2.50 to 3.49. In summary, for the coping mechanisms as indicated in the table 10, two items was strongly agreed to, twenty-one items were agreed to by the respondents. The standard deviation of all the items responded to by the small scale and large scale farmers ranged from 0.36 - 0.89; indicating that the respondents were not far from the mean and each other in their responses.

Hypothesis 4

H_{04} There is no significant difference in the mean responses of subsistent and commercial farmers on coping mechanism to curtail the problems of oil and gas exploitation in Bayelsa State.

Table 9

t-test Comparison of the Mean Responses of Subsistent and Commercial Farmers on Coping Mechanism to Curtail the Problems of Oil and Gas Exploitation in Bayelsa State.

Type of agriculture	Mean	Standard Deviation	n	df	Standard Error	t-cal	t-tab	Decision
Subsistent Farmers	3.23	0.66	321	648	0.05	-0.2*	1.97	NS
Commercial Farmers	3.24	0.65	274					

Note. * *P<0.05* *NS – Not Significant*

From Table 9, t-test did not show reliable statistical difference between the mean of subsistent and commercial farmers on coping mechanism to curtail the problems of oil and gas exploitation in Bayelsa State. This is because the t-calculated -0.2 (t-cal) in less than the t-table1.97 (t-tab) value at 0.05 level of significance and at 648 degree of freedom.

Thus the null hypothesis (H_{04}) of no significant difference is not rejected.

Findings of the Study

The major findings of the study are presented below according to research questions and hypotheses tested.

Various Activities of Oil and Gas Exploitation that Affect Agricultural Production in Bayelsa State

1. Deforestation, construction of network pipelines and canals, drilling exploration and delineation of wells, exploding of dynamites in soil as well as gas flaring and oil spillage were strongly agreed to by farmers as the activities of oil and gas exploitation .
2. Generally, the respondents agreed and to all the suggested items as the activities of oil and gas exploitation that affect agricultural production in Bayelsa State.

The Influences of Oil and Gas Exploitation on Crop Production in Bayelsa State

1. Oil and gas exploitation has resulted to high reduction of crop yield, retarded growth rate of crops as well as reduction in total land for crop production activities as indicated by farmers.
2. As revealed by the study, the influence of oil and gas exploitation on crop production in Bayelsa State is moderate.
3. The subsistent and commercial farmers do not significantly differ in their opinion about the influence of oil and gas exploitation in Bayelsa State.

The Influence of Oil and Gas Exploitation on Aquacultural Production in Bayelsa State

1. To a high influence, oil and gas exploitation has led to destruction of aquactic lives, distortion of fishing activities and pollution of groundwater as well as rendering water bodies unproductive for fishing as indicated by farmers.
2. Generally, the influence of oil and gas exploitation on aquacultural production in Bayelsa state is moderate.
3. The subsistent and commercial farmers do not significantly differ in theiropinion about the influence of oil and gas exploitation on aquacultural production in Bayelsa State.

The Influences of Oil and Gas Exploitation on Farmers in Bayelsa State

1. Oil and gas exploitation has resulted to high displacement of farmers from their settlements and has led to loss of properties and farm land for agricultural activities as indicated by farmers.
2. Generally, the influence of oil and gas exploitation on farmers in Bayelsa State is moderate.
3. The subsistent and commercial farmers seem to have differing level of opinions about the influence of oil and gas exploitation on farmers.

Farmers on Coping Mechanism to Curtail the Problems of Oil and Gas Exploitation in Bayelsa State

1. Farmers strongly agreed to obtaining loan facilities for agricultural activities to help curtail the problems of oil and gas exploitation.
2. The respondents agreed to use the of mulching materials to protect young crops, consumption of imported food and use of fast-maturing varieties of crops as well as use of nursery for some transplantable crops.
3. Generally, the respondents agreed to majority of the coping mechanisms help to curtail the problems of oil and gas exploitation.
4. The subsistent and commercial farmers have close related opinions about coping mechanisms to curtail problems of oil and gas exploitation.

Discussion of Findings

The discussion of findings of this study is presented below, according to the research questions.

Activities of Oil and Gas Exploitation that Affect Agricultural Production in Bayelsa State

The respondents agreed on the following as activities of oil and gas exploitation; acquisition of chuck area of agricultural lands, exploding of dynamites, noise pollution from seismic blast and equipment, drilling exploration and delineation of wells, land surveying and mapping, construction of network pipelines and canals, gas flaring and oil spillage among others, as the activities that affect agricultural production in Bayelsa State. These findings are favoured by the views of many authors such as Nwadiaro (1993), Smart (1998), Jebbach (2000), Ibaba (2001), Tari (2003) and TEEIC (2009).

The major activities that occur during the exploration phase include seismic survey and exploratory well drilling (Ibaba2001). During the drilling/development phase, full field development occurs. This involves the construction of well pads, access roads, gathering pipelines, and other ancillary facilities (e.g., wellhead compressors, dehydrators, storage tanks, reserve pits, flare pits, dynamites and seismic blast equipmentand so forth) and the drilling and completion of wells (Nwadiaro, 1993). The activities also include building roads to the drilling area; clearing vegetation and levelling the drilling area (Tari, 2003). Also flaring is done at the wells that produce only a small amount of natural gas and that have no on-site use for the gas or no pipelines nearby to transport the gas to market (Smart, 1998). These activities pointed out by the

authors are in agreement with the opinions of farmers as the activities of oil and gas affecting agricultural production in Bayelsa State.

Influences of Oil and Gas Exploitation on Crop Production in Bayelsa State

Indications from the study revealed that oil and gas exploitation has highly influenced crop production as it leads to retarded crop growth and reduction of crop yield as well as destruction of crops. The observation of Legborsi (2007) supported this finding as the author stated thatDuring oil spill, the process of photosynthesis which enhances plant diversity is impaired since the process is reduced due to the fact that spilled crude have a high absorbance property so when the crude spreads on to the surface of leaves, the latter find it difficult to photosynthesize and thus die. Oil and gas exploration and exploitation activities have led to the death and poisoning of crops (Antony, 2003).Respondents reveal that gas flaring has high influence on crop production as it influences rainfall pattern leading to extreme floods, drought and humid conditions which reduces crop production activities. This is supported by the observations and finding from literature reviewed in the study such as Okoko (2002) who identified that, gas flaring has been the most constant causes of environmental pollution because in many places it has been going on 24 hours a day for over 35 years.The farmers indicated that oil and gas exploitation has moderate influence to most of the suggested items.

There is every reason from the findings of the study to conclude that significant difference does not exist between the mean responses of subsistent and commercial farmers on the influence of oil and gas exploitation on crop production in Bayelsa State, as indicated by the t-test analysis.

Influence of Oil and Gas Exploitation on Aquacultural Production in Bayelsa State

Response from the farmers indicated that oil and gas exploitation have highly influenced aquacultural production as oil spillage renders the water unproductive for fishing, oil spillage/chemical discharge destroys aquatic lives, pollution of groundwater and distortion of fishing activities as well as destruction of aquatic lives. These findings are in agreement with that of Jebbah (2000) and Bayode et al (2011) who stated that oil spillage and other activities resulting from oil and gas exploitation that wash off to the water bodies damage aquatic ecosystem and kills aquatic organisms that cannot survive in such unfavourable conditions.

Subsistent and commercial framer's response revealed that oil and gas exploitation has affected aquacultural production to a moderate level as oil film on water surface prevents aeration and taints fishing gears, pollution of water bodies, affecting reproduction of fish as well as sending fish to deep sea areas and causes extinction of fish species among others. These finding collaborates with that of Ibaba (2001) who asserted that oil on the water surface will reduce

the interphase between atmosphere and surface of the water, resulting in less oxygen that has to dissolve in water. The low oxygen in waterwill induce physiological strengthening on the organisms which on human consumption, may eventually lead to death, because the oil contains many toxic chemical including benzene, foluene, xylene, and polycyclic aromatic hydrocarbons (PAHs). Also the findings was in agreement with that of Bayode et al (2011) who stated that water bodies pollution has been caused by oil spillage and chemical discharges which has led to the destruction aquatic lives. The findings also agreed with the observations of Legborsi (2007) who pointed out that gas flaring has caused light pollution which subjects the living organisms around the vicinity of the flare to 24-hour daylight. This affects the reproduction of fish as well as sending fish to deep sea areas, it also lead to the depletion of some species of fish.

The study concludes that there is no significant difference between the mean response of subsistent and commercial farmers on the influence of oil and gas exploitation on aquacultural production in Bayelsa state as indicated by t-test.

Influence of Oil and Gas Exploitation on Farmers in Bayelsa State

Oil and gas exploitation has highly influenced the lives of farmers in Bayelsa state as revealed by the response of farmers. It has resulted to displacement of farmers from original settlement and has led to loss of

properties and farmland. This finding is in agreement with Legborsi (2007) that one of the influences of oil pollution is the destruction of traditional local economic support system of fishing and farming. As a result, people are immigrating out of the polluted areas to non-polluted areas.

Response from farmers showed that oil polluted water causes disease problems among residents including farmers. This is likely so because some of the rural areas source of drinking water is the water bodies and they have little alternative source of drinking water. This finding is in line with Smart (1998) who stated that drinking or direct utilization of oil polluted water exposes the users to diseases and other health related issues. Both subsistent and commercial farmers agreed to most items suggested as having moderate influence.

The opinion of the subsistent and commercial farmers is at variance with each other. This might be largely due to level of exposure of the respondents to degradation resulting from oil and gas exploitation at various geographical locations in the state. It could also be as a result of varying level of education, awareness and in farming experiences of the farmers.

Farmers on Coping Mechanism to Curtail the Problems of Oil and Gas Exploitation in Bayelsa State

The subsistent and commercial farmers strongly agreed to use of improved breeding species and obtaining loan facilities for agricultural activities as coping mechanisms. The respondents agreed to the following coping

mechanisms; use of fast-maturing varieties of crops, use of nursery for some transplantable crops, adoption of tree planting system as shades for ponds, switching from dry land to irrigation, improved management of water resources among others. This is in agreement with some authors such as Uyigue and Agho, 2007 who pointed out that farmers overcome problems of uncertain rainfall pattern as a result of gas flaring with the use of fast-maturing varieties of crops, use of mulching material to reduce the scorching effect of the sun; Apata, Samuel and Adeola, 2009 who stated that farmers coping measures are switching from dry land to irrigation, mulching and use of nursery for some transplantable crops.

The study revealed that significant difference does not exist between the mean responses of the subsistent and commercial farmers on coping mechanism to curtail the problems of oil and gas exploitation in Bayelsa State, as indicated by the t-test.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

In this chapter, the summary, conclusion and recommendations are presented. The implications of the findings and suggestions for further study are also rendered.

Re-Statement of the Problem

Divers oil and gas exploration and exploitation activities in Bayelsa State have constituted source of environmental degradation, ecological destruction, drastic changes in the traditional socio-economic life of the people and deprivation of traditional occupation of fishing and farming.

Gas flaring in the state, has caused climatic upheaval in rainfall pattern which has affected farm planning, culminating to delay in planting season, late harvesting and low harvest. Similarly, one observes frequent crop wilting, defoliation, wrinkling and stunted growth caused by increased temperature from gas flaring. Gas released during flaring (methane, carbon dioxide, sulphur, nitrogen oxides, organic acids, hydro carbons) causes acidification of rainwater and increases soil acidity which reduces soil fertility resulting to crop growth retardation. The poisonous gas emissions have deleteriously affected the health of farmers, as cases of respiratory, blood circulatory and reproductory problems abound in Bayelsa state health centres. Besides, there is high incidence of crop

pests which gather from the forest to enjoy the warmth and light of gas flared at night.

Bayelsa state is a lowland maritime area that is largely covered by water bodies with abundant organisms but oil pollution from spills and effluent have killed several mangrove vegetation, fishes, crabs, molluscs and periwinkles in the contaminated waters. Intensive oil exploration and exploitation activities in the riverine communities are responsible for the increasing rate of coastal recession that has led to incessant displacement of some of the fishermenôs settlement from their original locations while others are thrown out of fishing jobs that have affected fishing business in the state.

The premature death of marine lives and human beings in the study area had been partially attributed to oil prospective activities due to the consumption of polluted water. Worse still, several clashes amongst farmers have resulted over claims of ownership of portions of land where exploration activities are carried out which has led to loss of several lives and properties. The magnitude of the associated problems of oil and gas activities, is what has informed the need to critically examine the influence of oil and gas exploitation on agricultural production and farmers coping mechanisms to curtail the problems of oil and gas exploitation, hence this study.

The study was aimed at determining the influence of oil and gas exploitation on agricultural production and coping mechanisms required by

farmers for sustainable agricultural in Bayelsa State. The study specifically determined (a) the activities of oil and gas exploitation, (b) influence of oil and gas exploitation on crop, (c)) influence of oil and gas exploitation onaquacultural production, (d)the influence on farmers and also (e) explored the coping mechanisms to curtail problems of oil and gas exploitation.

Based on the specific objectives of the study, five research questions and four hypotheses were formulated. The hypotheses were tested at 0.05 level of confidence. Relevant literature were reviewed and used to generate items for the research instruments for the study while reviewed theory served as bases for the study.

Description of Methods Adopted

The study was focused on the influence of oil and gas exploitation in Bayelsa State. The study adopted descriptive survey research design. The population of the study was 67,551 respondents made up of registered farmers of the Federal Ministry of Agriculture and Rural Development in the State. Proportionate stratified random sampling technique was used to select 1% of the farmers according to their LGAs (strata) bringing the sample to 674 respondents.

A 75-item structured questionnaire was face validated by three experts: all from the Department of Vocational Teacher Education of the University of Nigeria, Nsukka. Out of the 674 copies of the instrument administered, 650

were found adequately completed for use in answering the research questions. Data were analysed using mean and standard deviation to answer research questions while t-test statistics was used to test the null hypotheses.

Principal Findings of the Study

The principal findings of the study include the following:

1. Farmers strongly agree to deforestation, construction of network pipelines and canals, drilling exploration and delineation wells and exploding of dynamites in soil as well as gas flaring and oil spillage as the activities of oil and gas exploitation affecting agricultural production in the Bayelsa state.
2. Oil and gas exploitation has resulted to reduction of crop yield, retarded growth rate in crops and has as well led to reduction in total land for crop production activities as indicated by farmers.
3. The influence of oil and gas exploitation on crop and aquacultural production as well as on the farmers in Bayelsa State is moderate.
4. Oil and gas exploitation has highly influenced aquatic lives and fishing activities and has affected groundwater thus rendering water bodies unproductive for fishing with increased polluted water -related diseases for the residents, mostly indigent farmers who cannot afford portal source of water in the state.

5. Oil and gas exploitation has influenced farmers negatively as it has led to high displacement of farmers from their settlements and as well led to loss of farmland for agricultural activities.
6. Farmers strongly agreed to obtaining loan facilities for agricultural activities as a more effective way of curtailing and cushioning the adverse impacts of oil and gas exploitation on agricultural production in the state.
7. The farmers also agreed to use of mulching materials to protect young crops and use of fast-maturing varieties of crops as well as use of nursery for some transplantable crops as coping mechanisms.

Conclusion

Based on the findings of the study, the study thus concludes as follow:

Almost all the activities of oil and gas exploitation influence agricultural production in Bayelsa State.The influence of oil and gas exploitation on agricultural production in Bayelsa State is moderate.The opinion of the subsistent and commercial farmers on the influence of oil and gas exploitation on agricultural production in Bayelsa State is similar.

Gas flaring and oil spill is a major threat to sustainable agriculture in Bayelsa State.Low level of agricultural production is on the rise as a result of low net profit from agriculture caused by the negative influence of oil and gas exploitation.

Implication of the Study

The results of this study have provided empirical evidence of the influence of oil and gas exploitation on agricultural production in Bayelsa state and report the influence to be moderate. This makes a demand on the government and relevant authorities to help provide information to the farmers to encourage production in the state.

The opinions of subsistent and commercial farmers seem to be at variance with each other on the influence of oil and gas exploitation on farmers. The farmers probably have variance in opinion based on the differences in the type of agriculture and farming needs of their enterprise. This is an indication that subsistent and commercial farmers have different needs thus would require different level of support and orientation on how to adequately provide and/or improvise to meet their individual needs.

Recommendations

Based on the findings of the study, the study recommends the following:

1. Extension workers should be continuously trained and educated on current information about curtailing problems of oil and gas exploitation and sent out to enlighten the farmers irrespective of their farm size. This will enable them to synchronize ideas with the farmers.

2. Farmers in Bayelsa State should be encouraged by providing incentives and subsidizing inputs for them. This will go a long way in improving production especially as most farmers strongly agreed to the obtaining of loan for agricultural production.
3. Government and other relevant authorities should constantly provide information on rainfall distribution ahead of time to help the farmers plan especially as farmers indicated that gas flaring influences rainfall pattern in Bayelsa State.
4. Farmers should be encouraged and provided with improved species and breeding strategies by government of the state and other well-meaning non-governmental organisations to help improve food and fish supply in the state, even at continued exploitation.

Suggestions for Further Studies

1. A study of similar nature should be carried out in other oil and gas producing states in the Niger Delta region.
2. Influence of oil and gas exploitation on animal and poultry farming in Bayelsa state, Niger Delta and Nigeria.

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APPENDIX A

FACULTY OF EDUCATION

DEPARTMENT OF VOCATIONAL TEACHER EDUCATION

(AGRIC. EDUCATION SECTION)

INFLUENCE OF OIL AND GAS EXPLOITATION ON AGRICULTURAL PRODUCTION AND SUSTAINABLE AGRICULTURE IN BAYELSA STATE (IOGEAP).

Note: Kindly spare your tight schedule to complete the questionnaire as honestly as possible. Any information given will be treated as confidential and strictly used for the purpose of this study.

Part I: Socio-economic characteristics of farmers

Please complete the information below as appropriate by checking [ã]

1. **Educational qualification:** NCE/OND/ND [ ] B.SC/ B.ED/HND [ ]
   MSC/MED/PGD [ ] Any other (please specify) **……**
2. **Location:** Upland [ ] Lowland [ ]
3. **Age:** Below 20 [ ] 20-40 [ ] Above 40 [ ]
4. **Type of Agriculture:** Subsistence (small scale) [ ] commercial (large scale) [ ]

Part II

For these sections below, please indicate by checking [ã]

The response categories for this section are:

Strongly Agree = **SA** Agree = **A** Disagree = **D** Strongly Disagree = **SD**

Section A: Activities of oil and gas exploitation that affects agricultural production

Indicate the level of agreement or disagreement on the activities of oil and gas exploitation that affect agricultural production.

S/NO	ITEM	SA	A	D	SD
1.	Land surveying and surface mapping.				
2.	Collecting seismic data to evaluate a geologic formations. potential				
3.	Acquisition of chunk area of agricultural lands				
4.	Deforestation				
5.	Construction of access road to drilling sites				
6.	Construction of network of pipelines and canals				
7.	Drilling exploration and delineation wells.				
8.	Exploding dynamites in the soil				
9.	Noise pollution from seismic blast and equipment				
10.	Shaking the ground with vibrasizer and other equipment				

11.	Gas flaring and oil spillage				
12.	Discharge of untreated effluents into the environment				
13.	Poor management of waste products				
14.	Decommissioning/reclamation of land				
15.	Installation of equipment to separate oil, natural gas and water				
16.	Pumping hydrocarbons to the surface of land				

The response categories for this section are:

High Influence = **HI** Moderate Influence = **MI** Slight Influence = **SI** No Influence = **NI**

Section B: Influence of oil and gas exploitation on crop production

To what extent has oil and gas exploitation affected crop production?

S/NO	ITEM	HI	MI	SI	NI
17.	Webs of pipelines layout impede crop production activities				
18.	Oil spillage/chemical discharge destroys crops				
19.	Obstruction of farming activities in the area				
20.	Gas flaring increases ambient temperature which causes stunted growth, wilting and defoliation of crops				
21.	Gas flaring causes global warning and influences rainfall pattern leading to extreme of floods, drought and humid conditions which reduce crop production activities				
22.	Consumption of the toxic emissions by the surrounding vegetation affects the quality and aesthetic value of crops and their products				
23.	Leads to retarded growth of crops				
24.	Leads to reduction of crop yields				
25.	Reduction of total land for agricultural activities				
26.	Oil spillage renders the soil unproductive for agriculture				
27.	Webs of pipelines layout in the soil impede agricultural activities				
28.	Obstruction of farming activities in the area				
29.	Emission of gases during gas flaring reduces soil moisture and inhibits nutrient availability for plants use				
30.	Destruction of soil texture which affects crop production				
31.	Poor soil water infiltration leading to poor yield of crops				
32.	Destruction of micro and macro organisms in the soil which aids organic matter decomposition for crop use				
33.	Increases the growth of algae and fungi in the soil leading to nutrient competition with crops				

Section D: Influence of oil and gas exploitation on aquacultural production

To what extent has oil and gas exploitation affected aquacultural production?

S/NO	ITEM	HI	MI	SI	NI
34.	Oil spillage renders the water unproductive for fishing				
35.	Oil spillage/chemical discharge destroys aquatic life				
36.	Oil film on the water surface prevents aeration and taints fishing gears				
37.	Poisonous and insoluble elements (mercury, lead) swollen by fish reduces the quality and quantity of fish availability to man				
38.	Consumption of acidic rainwater and other pollutants leads to lung problems, asthma and death thereby reducing productivity of farmers				
39.	Pollution of groundwater				
40.	Pollution of water bodies				
41.	Distortion of fishing activities				
42.	Destruction of aquatic lives				
43.	Affects reproduction of fish as well as sending fish to deep sea areas				
44.	Causes extinction of fish species				

Section E: Influence of oil and gas exploitation on farmers

To what extent has oil and gas exploitation affected farmers?

S/NO	ITEM	HI	MI	SI	NI
45.	Oil polluted water causes disease problems among residents including farmers				
46.	Fishes and other organisms from oil polluted medium are unpalatable and avoided as source of food				
47.	There is displacement of some settlements from their original locations leading to low moral of the farmers				
48.	Loss of properties and farm land for agricultural activities				
49.	Communal clashes abound on account of claim of ownership of land leading to distortion of agricultural programmes				
50.	Obstruction of farming activities in the area				
51.	Consumption of acidic rainwater and other pollutants leads to lung problems, asthma and death thereby reducing productivity of farmers				
52.	Deprivation of traditional occupation of fishing and farming				

Section F: Farmers coping mechanisms to curtail the problems of oil and gas exploitation

Indicate the level of agreement or disagreement on the coping mechanisms

S/NO	ITEM	SA	A	D	SD
53.	Engaging in non-farming activities				
54.	Sale of personal or family assets to engage in agricultural production				
55.	Use of bank savings for agricultural production				
56.	Obtaining loan facilities for agricultural activities				
57.	Consumption of imported food				
58.	Reduction in household expenditures				
59.	Use of alms received form relations and friends for agricultural production				
60.	Use of succour received from prospecting companies and government for agricultural production				
61.	Change in planting pattern to cope with the environmental problems				
62.	Use of fast-maturing varieties of crops and breeds of animals				
63.	Raising dikes and guard against increased farmland flooding				
64.	The use of mulching materials to protect young crops from				
65.	Use of nursery for some transplantable crops				
66.	Adoption of tree planting system as shades for ponds				
67.	Diversifying into multiple and mixed crop-livestock system				
68.	Switching from crop to livestock				
69.	Switching from dry land to irrigation				
70.	Adoption of improved production adjustments				
71.	Use of improved breeding strategies				
72.	Use of adaptation technologies				
73.	Improved management of water resources				
74.	Introduction of simple techniques for localized irrigation				
75.	Use of facilities for storing rainwater				

Thank you for your help

APPENDIX B

Sample procedure

LGA	REGISTERED FARMERS (100%)	SAMPLE USED (1%)
BRASS	3,797	38
OGBIA	8,846	88
NEMBE	5,721	57
EKEREMOR	11,647	116
SOUTHERN IJAW	19,344	193
SAGBAMA	7,188	72
YENAGOA	7,673	77
KOLOKUMA/OPOKUMA	3,335	33
Total	**67,551**	**674**

Source: (Federal Ministry of Agriculture and Rural Development, Bayelsa State Branch, 2013)

APPENDIX C

Outlaw gas flaring in the Bayelsa State

APPENDIX D

Gathering of spilled oil in Bayelsa State