PERCEIVED EFFECTS OF LAND DEGRADATION ON AGRICULTURAL PRODUCTION AMONG FARMERS IN IMO STATE, NIGERIA.

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CERTIFICATION

This is to certify that this work entitled **Perceived Effects of Land Degradation on Agricultural Production among Farmers in Imo State, Nigeria,** was carried out by **Onyerika, Anthony Ikechukwu (Reg. No: 20104770738)** in partial fulfillment for the award of Master of Science (M.Sc.) degree in Agricultural Extension in the Department of Agricultural Extension, Federal University of Technology, Owerri, Nigeria.

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DEDICATION

To my parents, Mr. &Mrs. Francis Onyerika, my brothers and sisters, Festus, Charles, Chizoba, and Joy.

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ABSTRACT

Land degradation has remained one of the most serious problems currently affecting agricultural production in Imo State. This study analyzed perceived effects of land degradation on agricultural production among farmers in Imo State, Nigeria. Data were collected using structured and validated questionnaire from 240 randomly selected farmers. Data were analyze using both descriptive and inferential statistical tools such as mean, frequency distribution tables, percentages, Ordinary Least Square (OLS) multiple regression model and analysis of variance (ANOVA) test. The results showed that most of the farmers (87.50%) were aware of land degradation in the area through town criers. The results also showed that the major perceived causes of land degradation in Imo State were erosion/runoff ($\bar{X}$ = 3.58), deforestation ($\bar{X}$ = 3.26), climate change ($\bar{X}$ = 2.96), road grading ($\bar{X}$ = 2.90), and topography ($\bar{X}$ = 2.85). The major perceived effects of land degradation on agricultural production in the area were reduction in crop yield ($\bar{X}$ = 3.57), loss of farm labour due to forced migration ($\bar{X}$ = 3.26), reduction in land productivity ($\bar{X}$ = 3.01), decrease in farm income ($\bar{X}$ = 2.97), and destruction of markets and other infrastructure ($\bar{X}$ = 2.90). Someof the perceived effective methods used by the farmers to control land degradation in the area were terracing ($\bar{X}$ = 3.00), ridging of farmland ($\bar{X}$ = 2.98), avoidance of bush burning ($\bar{X}$ = 2.97), use of organic manure ($\bar{X}$ = 2.88), and planting of grasses ($\bar{X}$ = 2.84). The results revealed that there is a wide variation in the SD value which implied that the farmers' responses differ so much in their mean values. The results also revealed that some socio-economic variables were the determinants of the perceived effects of land degradation. Age, household size, sex, educational level, and major occupation were the significant factors that influenced farmers perceived effects of land degradation in the area. Also, the ANOVA test revealed that the farmers of the three agricultural zones of the state share similar feeling in their perceived effects of land degradation on agricultural production. The study concluded that land degradation has significant effects on agricultural production among farmers in the state, whose major occupation, farming bears the severe effects. The study therefore recommended that government and donor agencies should increase awareness of land degradation through training and workshop, efficient extension services provided, and adequate funding to the farmers on better agricultural practices to enhance improvement in food production in the State.

Keywords - *Perceived, effects, land degradation, farmers, agricultural production, Imo State.*

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Agricultural production remains the main source of livelihood for most rural communities in developing countries and sub-Sahara Africa in particular. Nigeria is abundantly blessed with agricultural resources such as rich arable land; water bodies; vegetation; and active human population that support high productivity. With 30.9 percent Gross Domestic Product (GDP) contribution to the economy in 2012, agriculture remains a significant player in Nigerian economy; it provides most of the world's food and fabrics. Cotton, wool, and leather are all agricultural products (Mundi, 2013). In terms of employment generation, about 70 percent of the Nigerian total labour force is employed within the agricultural sector (Oladele & Oladele, 2011). The sector has been noted as an important food source and foreign exchange earner in the non-oil sector of the economy, as it supplies the bulk of the food consumed in the country as well as the export crops (Banmeke & Balogun, 2011). Agriculture also provides wood for construction and paper products.

Land is an important resource required to achieve agricultural development. Land is a very strategic socio-economic asset, particularly in poor societies where wealth and survival are measured by control of, and access to land (Titilola & Jeje, 2008). If farmers do not have secure land rights, they will have few incentives to engage in sustainable agricultural production or to consider the

long-term environmental impact of over-exploitation of land's nutrients. Sustainable agriculture definition according to recent report by FAO (2010), involves a rational management of resources for agriculture to satisfy human wants and at the same time, maintain the quality of the environment and conserve natural resources. By this definition, sustainable agriculture is aimed primarily at the satisfaction of human wants (directly or indirectly).Agricultural growth and development if vigorously pursued in low income developing countries such as Nigeria would assist in poverty alleviation through employment creation and income generation in rural areas; meet growing food needs driven by rapid population growth and urbanization; stimulate overall economic growth given that agriculture is the most viable lead sector for growth and development in many low-income developing countries; and conserve natural resources (Anitta & Sathya, 2012).

Corliss (2009) observed that the existence of land degradation is a major aspects of environmental degradation that has been a threat to our future generation and entire human existence in various forms as soil erosion, land pollution, flooding, bush burning, improper waste disposal, deforestation, compaction and hard setting of soil and it manifests in various ways: washing away of soil nutrients/particles, exposures of sub soil surfaces, exposure of roots of plants/trees and foundation of buildings, poor vegetative growth and low levels of crop yield as well as total crop failure. Food and Agricultural Organization (FAO) (2003) defined land degradation as a natural process or a human activity that causes the land to no longer be able to sustain properly its economic

functions or the original ecological functions. Also, Eswaran and Reich (2001) defined it as any change or disturbance to the land perceived to be deleterious or undesirable.

The menace of land degradation in Southeast Nigeria in general and Imo State in particular has been in existence for a very long time. According to Asiabaka and Boars (1988), efforts aimed at checking the menace of soil erosion in Southeast Nigeria dates as far back as 1920s with the Udi Forest Reserve in 1922 and 1928. However, the increasing trend of land degradation and its attendant consequences on human survival is suggestive of the fact that priority attention should be further directed towards addressing the menace. Many communities in Southeast Nigeria especially in Imo State have lost their fundamental source of livelihood to land degradation.

Several factors are responsible for the various causes of land degradation in Southeast Nigeria including Imo State. The causes of land degradation in the area are categorized into two types of factors namely: Physical (geologic or natural) factors and anthropogenic (human or accelerated) factors. According to Abu (2011), itemized the causes of land degradation in the State which include: land clearing, poor management of land, overgrazing, flooding, uncontrolled irrigation, illegal sand excavation, erosion/runoff, deforestation, topography, bush burning, road grading, climate change, and land pollution including industrial waste and quarrying of stone, sand and minerals. Like in most ecologically vulnerable communities in Imo State, the problem of land degradation in Nigeria has become a matter of serious concern (Abu, 2011).

The socio-economic effects of land degradation are enormous. Nwosu (2014) itemized them to include: severe hardship, food shortage, soil nutrient loss, reduction in land productivity, increase in cost of input, increase in food prices, reduction in crop yield, death of livestock, destruction of markets and other infrastructure, loss of farmlands, destruction of economic trees, decrease in farm income, and loss of farm labour (due to forced migration). Some of the highly prone communities to land degradation problem in Imo State according to Umahi (2011) include - Orlu, Ideato North and South, Njaba, Onuimo, Okigwe and Oguta. Others are Ikeduru, Nwangele, Ngor-Okpala, Nkwerre and parts of Mbaise and Owerri West. It is feared that the increasing menace of land degradation and its negative consequences on land resources, if not properly managed, are capable of causing social conflicts and communal crisis in the affected areas due to land tussles. Studies have linked many land disputes to shortage of lands either for farming or settlements (Okpala-Okaka, 2009; Abegunde *et al.*, 2006).

1.2 Statement of the problem

Over exploitation of land resources through over grazing, over use of fertilizer, soil erosion, soil acidification and Stalinization, overload of soil nutrients and loss of agricultural land to other users. Under investment in land which includes the degradation of existing components of land that are not maintained such as terrace, irrigation work as well as land improvement that are not made due to lack s of investment incentives (Oyekale, 2008). The impact of land degradation

on the local population includes crop failure and famine, shortage of water, soil erosion, shortage of pasture for livestock and prolong drought (Subair, 2009).One of the challenges facing Nigeria is the production of sufficient food and fiber to meet the need of her ever increasing population (Alao, & Shuaibu, 2011).The rapidly expanding population and consequent pressure on land for socio-economic, agricultural and industrial development as well as increasing human interference on the forests and the environment have put the future of Nigeria forest and agricultural land in great danger (Bifarin, Folayan & Omoniyi, 2013). In spite of the vast arable land, conducive climate and different agricultural programmes, the hope of Nigeria attaining self-sufficiency in food production has not been realized (Idachaba, 2006; FAO, 2006). Increase in world population and other non-agricultural land uses are putting additional pressure on land hence there is progressively less land for food production while demand for food and other agricultural products is increasing, requiring more land which is not available since the earth land area is finite (EL-Swaify, 2002). Increasing food production to keep pace with the demand while retaining the quality of land and the ecological balance of the production system is a current challenge to agricultural research and policy in Nigeria (Onu, 1997).

In Nigeria, it has been reported that over 35 million tonnes of soil particles are lost annually to land degradation and 2 – 3million tonnes are lost annually in Imo state, thereby causing great decline in crops and other agricultural yield (Dike, 2000). The United Nations Convention to Combat Land Degradation (UNCCD) as reported in Shonekan (2004) noted that land degradation results in

severe soil fertility depletion and productivity decline, shrinking crop yield and ecological damages including erosion loss, leaching, water run-off, flood and gullies which are some of the adverse effects of the uncontrollable land use and agricultural intensification in the state. Consequently, Scherr and Yadav (2002) opined that by the year 2020, land degradation may cause serious threat to food security in the rural areas of the developing country such as Nigeria. They went further to advocate for policies that would encourage soil retention strategies, land improving investments and better land management if developing countries are to sustainably meet the food needs of their populations, preserve non-renewable natural resources and hand over their land to future generations.

Unfortunately, Imo State has a high population density and most households particularly in the rural areas depend largely on the output of the land and other natural resources for their means of sustenance. The high population and lowland per capita have led to intensified pressure on land, forests, and other natural resources which have contributed to the increasing natural resources degradation in the state (Imo State Ministry of Environment, 2011). The problem of land degradation in southeast and Imo State as the study area has received varying levels of attention from governments, donor agencies, public spirited individuals and the farmers. However, the increasing rate of the menace appears to have dwarfed all efforts made so far in trying to arrest the situation. Several studies exist on soil erosion and land degradation but tend to focus mainly on the geophysical aspects (Onu, 2011).

Most of the initial responses to land degradation such as studies, media commentaries, and government interventionist programmes have always tended towards controlling the incidence of land degradation or reclaiming already degraded areas. Akporido (2005) observed that one important area to which scanty research attention seems to have been given so far is the effects of land degradation on agricultural production in some part of Nigeria like the South-south and South-eastern region. World Bank has insisted on a fully developed and properly manned Land Use Planning and Agro-forestry component in all the Agricultural Development Programmes (ADPs) that operate in every state in Nigeria particularly in the southeast region in the quest to remedy land degradation.

The good news is that most countries of the world are currently uniting against selected developmental problems such as poverty, hunger, malnutrition, disease, food insecurity, gender inequality and environmental degradation. Land degradation has impacted much on the rural people's livelihood in Imo State, especially on agricultural production. There are currently scanty information on the extent to which this menace has affected their productivity and sustenance, which has consequently created a gap in knowledge. There is therefore, the need to bridge this gap in knowledge by carrying out a detailed study on the perceived effects of land degradation on agricultural production among farmers in Imo State. This gap in knowledge would be filled by providing answers to the following research questions.

a. What are the socio-economic characteristics of the farmers in the study area?
b. Are the farmers aware of land degradation problems in the area?
c. What are their sources of information on land degradation?
d. What are the types of land degradation prevalent in the area?
e. What are the perceived causes of land degradation in the area?
f. What are the perceived effects of land degradation on agricultural production?
g. What are the perceived effective methods used by the farmers in controlling land degradation in the area?

Answers to these research questions would provide the benchmark for this study.

1.3 Objectives of the study

The broad objective of this study was to assess the perceived effects of land degradation on agricultural production among farmers in Imo State, Nigeria.

The specific objectives were to:

1. describe the socio-economic characteristics of the farmers;
2. ascertain the farmers awareness of land degradation problems in the study area;
3. identify the sources of information on land degradation available to the farmers;
4. determine the types of land degradation prevalent in the area;

5. assess the perceived causes of land degradation in the area;
6. analyze the perceived effects of land degradation on agricultural production in the area;
7. identify the perceived effective methods used by the farmers in controlling land degradation.

1.4 Hypotheses of the study

The following null hypotheses were tested:

1. The socio-economic variables of the farmers are not the determinants of the perceived effects of land degradation on agricultural production in Imo State.
2. There is no significant difference among the farmers of the three agricultural zones of Imo State in their perceived effects of land degradation on agricultural production.

1.5 Significance of the study

In many of the developing countries including Nigeria, increasing agricultural production has been one of the most important priorities for agricultural development programs. Agriculture plays significant roles in Nigeria's economy and some of these roles have been outlined by different authors (Okolo, 2004, Ugwu & Kanu, 2012). Agriculture still remains the predominant occupation and indeed the most important livelihood activity of rural households in Nigeria which more than 80% of the total populations live in rural areas (Ajayi, 2009). Increasing climate variability is having profound impact on agriculture and

adapting to climate change is a priority for smallholder farmers (Hailu, 2011). The effects of land degradation in Imo State mostly affect the farmers especially in the areas of crop production and livestock husbandry. To this effect, the farmers will be encouraged to form a cooperative as a group in order to find a solution to the problem of land degradation thereby boosting their food production. As noted by Douglas (2006), land degradation leads to very serious threats e.g. loss of soil nutrient and loss of farmlands, and thus affects the ability of the soil to support crop growth and yield. The increasing occurrence of erosion in Imo State remains a big threat to the realization of most development initiatives especially those aimed at rural poverty and food security. The isolation and documentation of land degradation problems in the State has not been properly addressed and adequate attention not given to its effects on agricultural production which tends to create a gap in knowledge. To this effect, this study will therefore add to existing knowledge and literature on the information on land degradation. It will also aid in research and teaching. It would therefore serve as a reference material and source of useful information for extension workers. It is also, expected that the study would equally assist the policy makers, extension experts, the governments, and researchers on how best to control land degradation and make desired impact on the farmers.

1.6 Scope of the study

This study covered Imo State, Nigeria. The study concentrated on land degradation and how it affects agricultural production of the farmers.

1.7 Limitations of the study

The study suffered several limitations among which include:

a. Lack of funding which limited the scope of the study
b. Poor record keeping by most households from which to obtain accurate figures on some socio-economic features
c. Hoarding of data by some farmers which made data collection difficult
d. Poor rural road network during rainy season affected data collection

CHAPTER TWO

LITERATURE REVIEW

This chapter gives information on the contributions made by other authors and researchers on the subject matter. The aim of this is not to copy their works but to extract those major findings relevant to the present investigation. It is presented under these sub-headings:

1. The concept/types/perceived causes of land degradation
2. Socio-economic effects of land degradation
3. Sources of information on land degradation
4. Perceived effective methods used by farmers in controlling land degradation
5. Constraints/government efforts towards land degradation control
6. The concept/types of agriculture
7. The concept of perception and its measurement
8. The conceptual framework for the study

2.1The concept/types/perceived causes of land degradation

Considering the rate at which the country has been losing her forest and agricultural land areas, there is need for maintenance and enhancement of soil fertility for global food security and environmental sustainability. Therefore, the drive towards ensuring food security should be channeled towards developing agricultural practices and system that will be environmentally friendly and also focus on productivity on the long term rather than immediate production and

accruing returns (Bankole, Adekoya & Nwawe, 2012). Continuous depletion of the forest reserve base and agricultural land has major effects on the agricultural segments of Nigeria economy (Akpabio, Esu & Adedire, 2008). They further explained that land degradation causes a decline in the productive capacity of soils, accelerated erosion, destruction of wildlife habitats and loss of plant genetic diversity, climate change, landslides, soil degradation, and unfavorable hydrological changes. Busari (2010), explained that land degradation is the process of decay in the land's physical and biological resources, which continues until it reduces the lands advantage. According to Dixon and Peter (2001), the process of land degradation can be natural but usually ends with a new natural balance. In most recent cases, land degradation reflects imbalance between man and environments. Man is always seen not as the higher but the acceleration of the land degradation process so that land becomes truly unproductive and difficult to rehabilitate, limited to time and cost. Land degradation has an adverse impact on agronomic productivity, the environment, and consequently, on food security and the quality of life (Eswaran *et al.,* 2001).

Land degradation is a reduction of the biological and economic productivity potentials of rain fed crop land, irrigated crop land or range, pasture and forested land by one or a combination of processes (Amalu, 1998), which include displacement of soil material by wind and water erosion, deterioration of soil physical and chemical properties and long term loss of natural vegetation. It can also be seen as loss of resilience of land, loss of utility or potential utility of land or the decline in soil characteristics as a result of poor management and

conservation of land. Land degradation can cause human, economic, social and infrastructural losses. In an agrarian economy, it can reduce agricultural output and yield thereby precipitating starvation and poverty (Fagbemi, 2002).

Land degradation has been categorized into different types namely:

a. Physical degradation
b. Chemical degradation

a. Physical degradation

Physical degradation results in radical, visible changes in the structure of soil and landscape of the affected area. Physical degradation leads to massive soil loss, and may occur as a result of elements of nature such as wind, rain or earth movements like earthquakes. But it is also often caused by man's activities like excavation and felling of trees. Crop productivity in physically degraded soils can become virtually impossible. Two common types of physical degradation are *erosion* and *desertification* (Aruleba, 2004). It has been noted that 85% of the cause of land degradation worldwide is due to soil erosion. Soil erosion starts from slight to medium, then to severe and extreme soil and vegetative degradation. In Nigeria, erosion by water and wind causes an estimated loss of 30 million tones of soil annually, leading to declining agricultural productivity and farmers' income (Mbagwu & Obi, 2003). Soil erosion is a natural process that removes soil from the land by the forces of water and wind. The eroded particles are transported by wind and water to some other location, where it is deposited as sediment. Erosion is a global problem, and since topsoil production rates are so slow, the lost topsoil is essentially irreplaceable. It has different

forms namely sheet erosion (a more or less uniform removal of a thin layer of topsoil), rill erosion (small channels in the field) and gully erosion (large channels, similar to incised rivers) (Adeniji, 1990).Sheet erosion is caused by the coalescence of rills, prolonged storm and mild slope. This type of soil erosion is regarded by many environmental scientists as the worst type of soil erosion (Igbokwe, 2005). Gully erosion remains the most rampant in Southeast Nigeria, and this form of land degradation has been exacerbated by constant land excavation for building constructions.

A gully is generally defined as a scoured out area that is not crossable with tillage or grading equipment. Gullies are usually deep, wide and in most cases very long. Gully erosion is the most noticeable type of soil erosion. It is caused by the widening and deepening of established or localized channels, and steep slope (Adeniji, 1990). It occurs when surface runoff from larger areas concentrates, water depth, flow velocity and erosive power increase and cause incisions in the land.

The soil erosion by wind is common in the northern part of the country where high velocity wind and long period of dry season interact together to influence soil erosion in the area. In southeast Nigeria, wind erosion is not very common except during harmattan (Adeniji, 1990; Nwachukwu, 2012).

b. Chemical degradation

Chemical degradation includes decreases in soil organic matter, depletion of nutrients, soil acidification, and pollution (Logan, 1990). Chemically, degraded

soils may sustain crop growth over several seasons, but when there is no mitigating action; crop productivity gradually reduces to unprofitable levels. Apart from yield loss, soil chemical degradation can pose a health hazard to humans as toxic substances may be absorbed by growing plants and then transferred into food chain on consumption of such contaminated crops. Chemical degradation is usually anthropogenic, caused by either agricultural activities or industrialization. Among the widespread types of soil chemical degradation that is ravaging the world; soil acidity is the one that is drastically affecting the soils of the world most, especially in Africa countries including Nigeria (Igwe & Ejiofor, 2005). Others are soil reaction (acidity and alkalinity), salinity, sodicity, and loss of mineral nutrients (through leaching, crop uptake and crop harvest).

In the tropics, acidification of soil is one of the major problems facing crop production. By way of definition, soil acidity is a situation in which the soil colloidal complex is dominated by hydrogen ions concentration with less or no hydroxyl ions and basic cations. Any soil with a pH less than 7.0 (neutral) is said to acidic. Farmers in Nigeria who cultivate these nutrient depleted and chemically degraded soils experience decline in crop production and this leads to a surge in food prices and a threat to food security in the region.

Soil salinization is the concentration of salts in the surface or near surface of soils. Human induced salinization is a major problem facing most communities in dry lands, Nigeria, and is often associated with large-scale irrigation. When dry lands are irrigated, the water evaporates quickly, leaving behind previously

dissolved salts. These salts can accumulate since there is little rain to flush the system. The salt in the soil inhibits the uptake of water by plant roots and the soil can no longer sustain a vegetative cover.

Agricultural production faces severe threat to the economic growth and development especially in the southeast, Nigeria. Several factors are responsible for the massive decline of food production in the economy as a result of land degradation. The factors that cause land degradation can be grouped into two namely:

a. Natural processes (physical factors)
b. Anthropogenic activities (human activities)

The causes of land degradation have become a general problem in the southeast Nigeria especially in Imo State. It has affected food production among various agricultural communities in the state. These problems have continued to attract the attention of environmental scientist, the governments and other stakeholders. Several studies (Omofonmwan, 2008; Mbagwu & Obi, 2003) showed that the causes of land degradation are mainly physical and anthropogenic factors as well as deficient agricultural practices which are believed to be responsible for the massive degraded lands in Imo State. According to Eswaran and Reich (2001), accelerated land degradation is most commonly caused as a result of human intervention in the environment. The effects of this intervention are determined by the natural landscape. The major causes of land degradation include: land clearing, poor management of land, overgrazing,

flooding, uncontrolled irrigation, illegal sand excavation, erosion/runoff, deforestation, bush burning, road grading, climate change, topography (sloping land), and land pollution including industrial waste and quarrying of stone, sand and minerals (Umeh, 2011).

2.2 Socio-economic effects of land degradation

It has been pointed out that the socio-economic aspect of land degradation has received very little attention by both researchers and the governments, even when it is obvious that land degradation has a devastating effect on agriculture. These effects are enormous and should be a source of concern to all. Nwosu (2014) noted that absence of articulated environmental and agricultural policies has led to the derailing of agro-forestry initiatives and created impactful environmental degradation. Land degradation is perceived as one of the greatest and persistent threats to human existence and economic impacts (Onumadu, Popoola & Esu, 2001). International Food Policy Research Institute (IFPRI)(2000) observed that nearly 40 percent of the agricultural land experience adverse impacts on productivity due to degradation. According to Sara and Satya (2009), land degradation is the most important environmental problem currently challenging the nation of sustainable development in many parts of the world. The problem is most acute where the environment is intrinsically vulnerable and where the population is losing control of its own resource, unless some local actions are being taken. The willingness of all involved parties to take appropriate local action therefore must be put as the important measure for perceiving the readiness to take control measure against land degradation.

Nwosu (2014) itemized what appeared to be a comprehensive list of the effects of land degradation on farmers agricultural production, which include: severe hardship, food shortage, soil nutrient loss, reduction in land productivity, increase in cost of input, increase in food prices, reduction in crop yield, death of livestock, destruction of markets and other infrastructure, loss of farmlands, destruction of economic trees, decrease in farm income, and loss of farm labour (due to forced migration).

Many people have become refugees in their native communities because they are faced with fast expanding gullies around their homes due to land degradation that affects their market and other infrastructure which is part of their source of livelihood in their communities. Sustainable use of natural resources is being advocated as a better way of managing the environment to avoid degradation and its attendant effects. Various methods are being integrated into farming practices, provision of extension services to change farmers' attitude so as to enhance their efforts on productivity and other land use activities to control land degradation in the state (FAO, 2003).

2.3 Sources of information on land degradation

The farmers obtained their information about land degradation through various means either by individual or various organizations like group meetings, town criers, friends/neighbours, radio service, and many others in the rural areas. Farmers are known to have accumulated knowledge about their environment and their farming systems, but agricultural extension agents (AEAs) could bring

them additional knowledge and information which they lack in improving their practices (FAO, 2003).

Chapman, Blench and Zakariah (2003) reported that the growth of rural radio stations reflects both the improvements in information technologies and shifting of development paradigm towards a more participatory style of information and knowledge transfer. They found that rural radio is effective in improving the sharing of agricultural information by remote rural farming communities. Radio in this regard provides a set of participatory communication techniques that support agricultural extension efforts by using local languages to communicate directly with farmers and listeners' groups.

Chapota, Fatch and Mthinda (2014) have identified the use of mobile cinema vans for mass mobilization and outreach programmes, face-to-face trainings, on-farm demonstrations, agricultural fairs and shows, training and visits, posters, magazines, and leaflets, and public service radio, participatory ICT enhanced radio programming, as some of the media that have been deployed to disseminate information to farmers. The Information and Communication Technologies (ICTs) have the capacity to provide enormous agricultural information and its applications in agriculture and environmental management. ICTs have been used to build the capacities of farmers through farm radio broadcasts, distance education and lifelong learning programs. Access to agricultural information and training allows farmers to learn new techniques in order to raise their productivity and improve farm income.

According to Anderson and Ferder (2002), knowledge delivered by extension agents could be information embodied in inputs or equipment (e.g improved seeds or machinery) or more abstract disembodied information on agricultural practices. Similarly, Mirani and Memon (2011) report that the use of farm visits and result demonstration methods of technology transfer are perceived as means of improving effectiveness in knowledge transfer by the AEAs. However, Arshed, Iqbal and Hussain (2012), observed that use of group discussions is found to be one of the means by the farmers through the AEAs in transferring knowledge on degradation to food production.

Mass media methods such as radio, television and newspaper are important in the communication of improved agricultural technology to farmers, their use are however limited, especially in rural areas. The development of communication infrastructure, especially in the area of telecommunications brings with it both opportunities and challenges. The challenge is to understand and explore how radio, enhanced by ICTs, is contributing to agricultural knowledge exchange in the context of agricultural extension and advisory services models. Over time, radio programming, as an extension and advisory service approach, has proved its power to improve farmers' decision-making by providing them with relevant information and sharpening their analytical perspectives as they undertake decisions that lead to improved farm management, yields, nutrition and food security (Manyozo, 2009). Again, a radio facility for a community facilitates the promotion of awareness of community groups and facilities in the area as well as providing the avenue for the empowerment of these groups to use radio to

promote themselves and to speak directly to the community. Therefore, the interaction between the extension agents and the farmers and the extent to which farmers perceive extension agents as useful to them is vital to bringing change in agricultural output and could explain the dynamics embedded in advices adopted by farmers in a given locale. For example, the frequency of contact by extension agents is crucial because it is through this that, important and useful information about improved and recommended agricultural practices are disseminated to farmers (Sarker & Itohora, 2009). The amount or type of useful information disseminated to farmers could be used to determine the effectiveness of extension agents in transferring knowledge needed by farmers to improve production.

2.4 Perceived effective methods by farmers in control of land degradation

Oyakale (2008) itemized the effective methods employed by farmers in the control of land degradation for agricultural production. The methods are grouped into four different types namely:

a. Conservation method
b. Biological method
c. Chemical method
d. Mechanical method

a. Conservation approach

According to Oyekale (2008), conservation farming is a method of farming which involves making the most efficient use of the land over a long period of time for

sustained or increased yields with minimum soil loss. Conservation has been described as an activity embarked upon by human beings to attempt ways of satisfying their needs while ensuring that little or no damage is done to the environment and other organisms. This is through wise use of the natural environment, which includes protection of nature, controlled protection of useful materials as well as control or elimination of environmental pollution. Several methods have been recommended to the farmers for the conservation of their soil. These include the planting of vetiver grass to reduce erosion, zero tillage and minimum tillage (Akinbile & Odebode, 2007). Other methods may include - afforestation, terracing, construction of contour ridge, cover cropping, alley cropping and agro-forestry, bush fallow, mulching, strip cropping, inter cropping, Irrigation and drainage, minimum tillage, buffer strip, contour farming (Akinbile & Odebode, 2007; Oyakale, 2008). Vegetable cowpea (Vigna unguiculata) is widely cultivated as a food crop (Ekeleme & Nwofia, 2005) in the Southeast, and may have a high potential to act as a cover crop to check surface erosion while at the same time contributing to food security. This method of farming is a deliberate effort at controlling land degradation problem towards the process of food production.

b. Biological approach

This involves planting of cover crops, metal accumulated plants (phytoextraction), the use of micro-organisms like mycorhyza and fungi to break down organic pollutants (bioremediation), or the amendment of contaminated

soils with organic materials which immobilize toxic elements in soil (stabilization). This method is economical and environmental friendly, as the plant is able to act as a natural barrier against erosion and pollution (Khan, 2006).

c. Chemical approach

This method can be classified into two categories namely: *Amelioration of acidic soils by liming, and fertilizer application to nutrient depleted soils*. Acidic soils can be ameliorated through the addition of lime and lime is any material which, upon reaction with the soil, increases pH (decreases soil acidity) and does not add harmful elements to the soil (Rengel, 2003). Soil nutrients may be depleted as a result of continuous cultivation, poor fertilizer practices or due to leaching by heavy rainfall. The application of appropriate chemical fertilizers to sustain crop growth will ensure minimal nutrient depletion after such crops are harvested. Care must be taken to ensure application at the specified rates and at the required stages of growth of the plant.

d. Mechanical approach

Building of dykes and embankments, landscaping to reduce slopes and construction of concrete channels are proven mechanical methods of intervention which have been used successfully to control land degradation. In land areas where degradation led to loss of topsoil, fresh topsoil is excavated from another location (perhaps undergoing road construction) and deposited on the degraded area. Gullies may be filled with rocks and locked in with rust

resistant wire mesh. All these involve heavy earth moving machinery, huge capital investment, and it is a radical, last resort approach to control physically degraded land (Nwachukwu, 2012). Example include: mounting an awareness campaign on the proper use of agricultural land, effective stakeholder participation in land use planning and management.

2.5 The Constraints/government efforts to land degradation control

Some constraints have been identified as militating factors against control of land degradation on agriculture. These constraints include inadequate funding, lack of incentives from governments, high cost of some land degradation control measures, poor extension education. Saka *et al.* (2011) observed inadequate funding and land ownership problems as the major constraints in southwestern Nigeria. Many communities in Imo State are faced with some of these constraints where the rural people depend on agriculture for better livelihood.

The government at all levels have at one time or the other taken steps toward finding solution to the problems of land degradation in Nigeria at large and Imo State in particular. The Federal Ministry of Environment and the World Bank have contributed immensely through Ecological Fund towards the development and growth of food production in Nigeria with the responsibility of installation of useful device that will help in handling and controlling land degradation in the study area.

Similarly, the government of Imo State has made some concrete efforts towards land degradation control in the state. The efforts include legislation, public

enlightenment and direct interventions. The federal ministry of agriculture report (2010), indicate that the federal government of Nigeria under the World Bank Assisted Environment Management Project for Nigeria have contributed towards the controlling of land degradation in the areas thereby avoiding bush burning and cutting of vegetation. Increasing awareness of land degradation through training and workshop, efficient extension services provided, and adequate funding to the farmers on better agricultural practices will be enhanced in the improvement of agricultural production in the State.

2.6The concept of agriculture

Agriculture plays an important role in reducing poverty and serves as an engine for growth in developing countries. Agriculture is the art and science of cultivating the soil, growing crops and raising livestock for man's consumption. It also consists of all activities geared towards the production of crops (food, cash, forest trees) and animals (livestock, poultry, fisheries) for food and fibre for the benefit of man. It is the principal source of food and livelihood and, in Nigeria, employs nearly three quarters of the nation's workforce (Philip *et al.,* 2008). The Central Bank of Nigeria (CBN 1990) noted that if Nigeria is to meet its food requirement and generate financial resources needed for its overall development programme, it must improve its agricultural performance.

Agricultural production is on a small and subsistence scale, with small farm holdings. According to FAO (2003), concentration on small farmers towards agricultural activities leads to faster growth rates of both economic output and

employment. However, in order to reach small holder farmers effectively, there is a need for innovative strategies in agricultural extension. Additionally, it contributes to the provision of food for the people, raw materials for industries, savings and tax revenue to support the development of other sectors of the economy, generation of foreign exchange and the provision of employment opportunities for the populace(Aker, 2010).Agriculture is responsible for about 30% of the total greenhouse gas emissions of CO_2, N_2O and CH_4 while being directly affected by the consequences of a changing climate, Intergovernmental Panel on Climate Change (IPCC) (2007).

Eboh (2009) notes that countries in sub-Saharan Africa, including Nigeria, are likely to suffer the most because of their greater reliance on climate-sensitive renewable natural resources sectors like agriculture. A system of production such as agriculture requires information to flow from producers to consumers and from facilitators to utilizers of agricultural information, technologies and knowledge (Aju, 2014). Bello and Salau (2009) observed that effective extension delivery system and acceptance of new technologies by farmers is a pre-condition for agricultural extension and rural development. Currently, agriculture is divided into two different types, including industrialized agriculture and subsistence agriculture.

Types of agriculture

a. Industrialized Agriculture

Industrialized agriculture is the type of agriculture where large quantities of crops and livestock are produced through industrialized techniques for the purpose of sale. The goal of industrialized agriculture is to increase crop yield, which is the amount of food that is produced for each unit of land. Crops and livestock made through this type of agriculture are produced to feed the masses and the products are sold worldwide (Umeh, 2008).

Industrialized agriculture is able to produce large quantities of food due to the farming methods used. Instead of using animal and manpower to work the fields, industrialized agriculture utilizes large machines, which are more powerful and can work faster and harder. The shift towards machines has increased the use of fossil fuels on industrial farms, and, therefore, the price of food can fluctuate as the price of oil changes. Industrialized agriculture also increases crop yield by investing in large irrigation systems and by using chemical fertilizers and pesticides (Olujide & Oladele, 2011).

The chemical fertilizers that are used in industrialized agriculture often add inorganic nutrients to the soil to increase yield and plant size. The use of pesticides is also common in industrialized agriculture, and most pesticides help increase yield by killing pests that are harming or consuming the crops. Another farming technique that is used in industrialized agriculture is the method of growing monocultures, which is when a single crop is planted on a large scale. Although planting monocultures can increase overall yield, this

method of farming is also more susceptible to disease and causes a reduction in the dietary variation of consumers.

b. Subsistence Agriculture

Subsistence agriculture is when a farmer lives on a small amount of land and produces enough food to feed his or her household and have a small cash crop. The goal of subsistence agriculture is to produce enough food to ensure the survival of the individual family (Okolo, 2004). If there is excess food produced, it is sold locally to other families or individuals. The agricultural extension and advisory service system plays a crucial role in this respect since it drives agricultural productivity and ensures that smallholder farmers who are within the communities are provided with useful information and appropriate knowledge on relevant technologies that can help boost their food production in the State. This, in turn, is vital in stimulating growth in other parts of the economy although accelerated growth requires a sharp productivity increase in smallholder farming and effective support to the millions coping as subsistence farmers (World Bank, 2008).Subsistence agriculture varies a great deal from industrialized agriculture in terms of the farming methods used. This type of agriculture is very labor-intensive because all of the work is done by humans and animals and only hand tools and simple machines are used to work the land.

Subsistence agriculture does not rely on chemical fertilizers or pesticides and instead utilizes more natural techniques. Instead of using chemical pesticides,

subsistence farmers rely on natural predators of pests to control the pest population. Unlike industrialized agriculture that utilizes monocultures, subsistence agriculture relies on polycultures, which is when different types of crops are planted in one area. Planting polycultures is a method used to get the most crop yield out of a small area of land.

2.7 The concept of perception and its measurement

Farmers in the state perceived the threat of land degradation on food production as a problem in their environment that affect smallholders' farmers in the rural area. Perception may mean many things to different people. Perception is defined as the organization, identification, and interpretation of sensory information in order to represent and understand the environment (John, Robert & Michael, 2005). It could also be seen as an idea or an image one has as a result of how one sees or understand something (Advanced Learners Dictionary, 2006). All perception involves signals in the nervous system, which in turn result from physical or chemical stimulation of the sense organs.

Measurement of perception

There are two major ways by which farmers perceived degradation on food production which include: Sensory evaluation and Objective evaluation.

a. Sensory evaluation

Oliveira (2011) defined sensory evaluation as:

i. Identification of food product(s) properties;

ii. Scientific measurement of food product(s) properties;

iii. Analysis and interpretation of the identified and measured food properties – as perceived through the five senses (sight, smell, taste, touch, and hearing). Therefore, sensory science rely on the fact that human beings are the best measuring instruments which can accurately describe and identify the sensory properties of products and materials related to the basic senses in order to minimize the potential biasing effects of other information influences on farmers perception.

b. Objective evaluation

This test measures one particular attribute of food rather than overall quality of the product. The farmers perceive reduction in the cost of food production as the effects of land degradation which is one factor that hinders agricultural production (Umezuruike, 2013). Objective evaluation of food also involves instrumentation and use of physical and chemical techniques instead of variable human sensory organs to evaluate food quality.

However, both sensory evaluation and objective evaluation of food quality are essential in agricultural production and to ensure that the foods being produced are acceptable to the rural people within their various communities.

Findings by Oladosu (2006) in Nigeria on farmers attitude towards extension agents have also shown that farmers complained about the lack of regular contacts and the duration of the visit was too brief for meaningful exchange of idea and this might have affected effectiveness of AEAs in transferring knowledge to them. According to Oladosu (2006) in Nigeria on farmer attitude found that farmers complained that AEAs were using unfamiliar terminologies to explain

recommended agricultural practices to them and this made them fail to comprehend what was intended by AEAs.

Samuel (2000) reported that the extension agents are responsible for providing knowledge and information that will facilitate farmers to acquire new knowledge and skills that encourage them to make independent decisions. Extension services bear great potentials for improving the productivity of natural resources and promoting the right attitudes among natural resource managers (Adebayo, Anyanwu & Osiyale, 2003). The perceptions farmers have about an innovation are very closely related to the knowledge they have about it. Whereas knowledge refers to factual information and understanding of how the new technology works and what it can achieve, perceptions relate to the views farmers hold about it based on their felt needs and prior experiences; and these do not necessarily align with reality. The knowledge and perceptions about an innovation then together determine the attitude towards it. In accordance with the theory of planned behaviour, the attitude component comprises not only the attitude towards the behaviour, but also the attitudes with regard to the subjective norms and perceived behavioural control. In this case, we expect that a positive attitude towards an agricultural innovation will increase the likelihood of adoption and a negative attitude to reduce the probability of adoption.

There are a large number of extrinsic variables which help shape the knowledge, attitudes and perceptions. The extrinsic variables can be grouped into three categories: characteristics of the farmer, characteristics of the external environment, and characteristics of the innovation. First, knowledge, attitudes

and perceptions are influenced by the characteristics of the farmer, which include personal characteristics (gender, age, marital status, etc.), socio-economic characteristics (education, etc.). Second, the characteristics of the external environment affect the development of knowledge, attitudes and perceptions as well, the geographical settings (ecology, topology, soil conditions, climate, demography, proximity to markets, roads and forests, etc.). Third, the characteristics of the new technology also shape the knowledge, attitudes and perceptions.

2.8 The conceptual framework for the study

The study focused on the perceived effects of land degradation on agricultural production among farmers in Imo State, Nigeria. The schema for the study is represented in blocks. Block A shows the farmers socio-economic variables and the sources of information on land degradation by the farmers which include; radio, television, newspapers, friends/neighbours, town criers, extension agents, village/town union meetings, and market association. The causes of land degradation in Imo State as reported in the literature include: land clearing, poor management of land, overgrazing, flooding, uncontrolled irrigation, erosion/runoff, deforestation, topography, bush burning, road grading, sand excavation, climate change, and land pollution including industrial waste and quarrying of stone, sand and minerals which are outlined in block B. Land degradation on the other hand affects farmers agricultural production on severe

hardship, food shortage, soil nutrient loss, reduction in land productivity, increase in cost of input, increase in food prices, reduction in crop yield, and death of livestock, destruction of markets and other infrastructure, loss of farmlands, destruction of economic trees, decrease in farm income, loss of farm labour (due to forced migration) as shown in block C. Therefore, these effects of land degradation on agriculture can be controlled by employing effective solution that are outlined in block D which includes: increasing awareness of land degradation through training and workshop, efficient extension services provided, and adequate funding to the farmers on better agricultural practices to improve agricultural production in the State and Nigeria in particular. The framework is illustrated in figure 1.0.

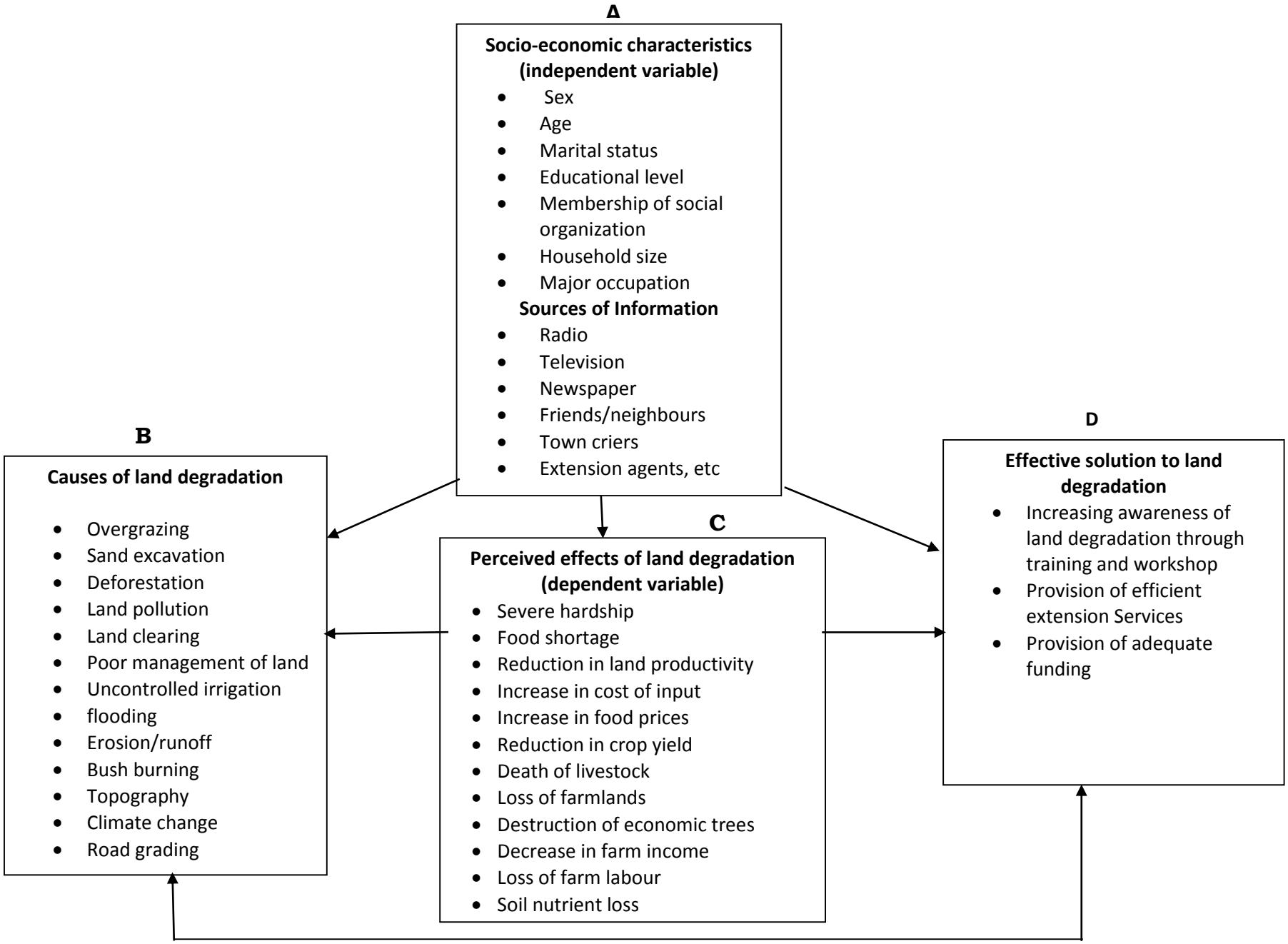

Figure 1.0: A Schema explaining the perceived effects of land degradation on agricultural production in Imo State, Nigeria.

Source: Adapted from Nwosu (2014).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter deals with the methods employed in data collection and analyses. It covers the following specific areas:

1. area of study
2. sample and sampling techniques
3. method of data collection
4. standardization of data collection instrument
5. measurement of variables
6. method of data analysis

3.2 Area of study

The study was carried out in Imo State, Nigeria. Imo State is among the five States that make up the southeast geopolitical zone of Nigeria. The State is divided into three agricultural zones which are Orlu, Owerri and Okigwe with 39 blocks and 326 circles. It lies within latitudes $4^{0}45^{I}$ N and $7^{0}15^{I}$N and longitudes $6^{0}50^{I}$ E and $7^{0}25^{I}$ E, and covers a total land area of about 5,530 square kilometer (www.imostate.gov.ng). It is bordered by Abia State on the east, Anambra State on the north, Rivers State on the south, and on the west by Delta State and River Niger. Imo State has an estimated population of about 4.8 million people and an annual population growth rate of 3.35 percent (National Population Commission (NPC), 2010). The state has a high population density which varies from 230

persons per square kilometer in Oguta/Egbema areas to about 1400 persons per square kilometer in Mbaise, Mbano, Orlu and Mbaitoli area (Federal Republic of Nigeria Official Gazette, 2007). The population density of Imo State is higher than the national average which is 166.0 persons per square kilometer (National Bureau of Statistics (NBS), 2009), and this has contributed to the increasing pressure on land, forests and other natural resources in the state (www.imostate.gov.ng).

Rainfall distribution is bi-modal with peaks in July and September and a two week break in August. The rainy season begins in March and last till October or early November. Rainfall is often at its maximum at night and during the early morning hours, and most times comes with violent storms which destroy crops, houses and other infrastructural installations such as electricity poles and telecommunication masts. Annual rainfall varies from 1990mm – 2200mm. Temperatures are similar all over the State, with the hottest months being between January and March. The mean annual temperature is around 20^0C, while the annual relative humidity is 75 percent. The State lies within the rainforest agro-ecological zone of Nigeria (www.imostate,gov.ng).

The people are predominately Ibos by tribe and practice Christianity as their main religion. The major economic activities of the people include farming, petty trading, agro-processing, etc. The major crops grown include cassava, yam, cocoyam, maize, rice, citrus, leafy vegetables, etc. Economic trees commonly found in the State are iroko, mahogany, obeche, oil palm, cashew, mango, etc.

Animal reared include goat, sheep, swine, rabbit, poultry, etc. The State is endowed with vast mineral resources like crude oil, natural gas, lead, zinc, aluminum, etc (www.imostate.gov.ng).

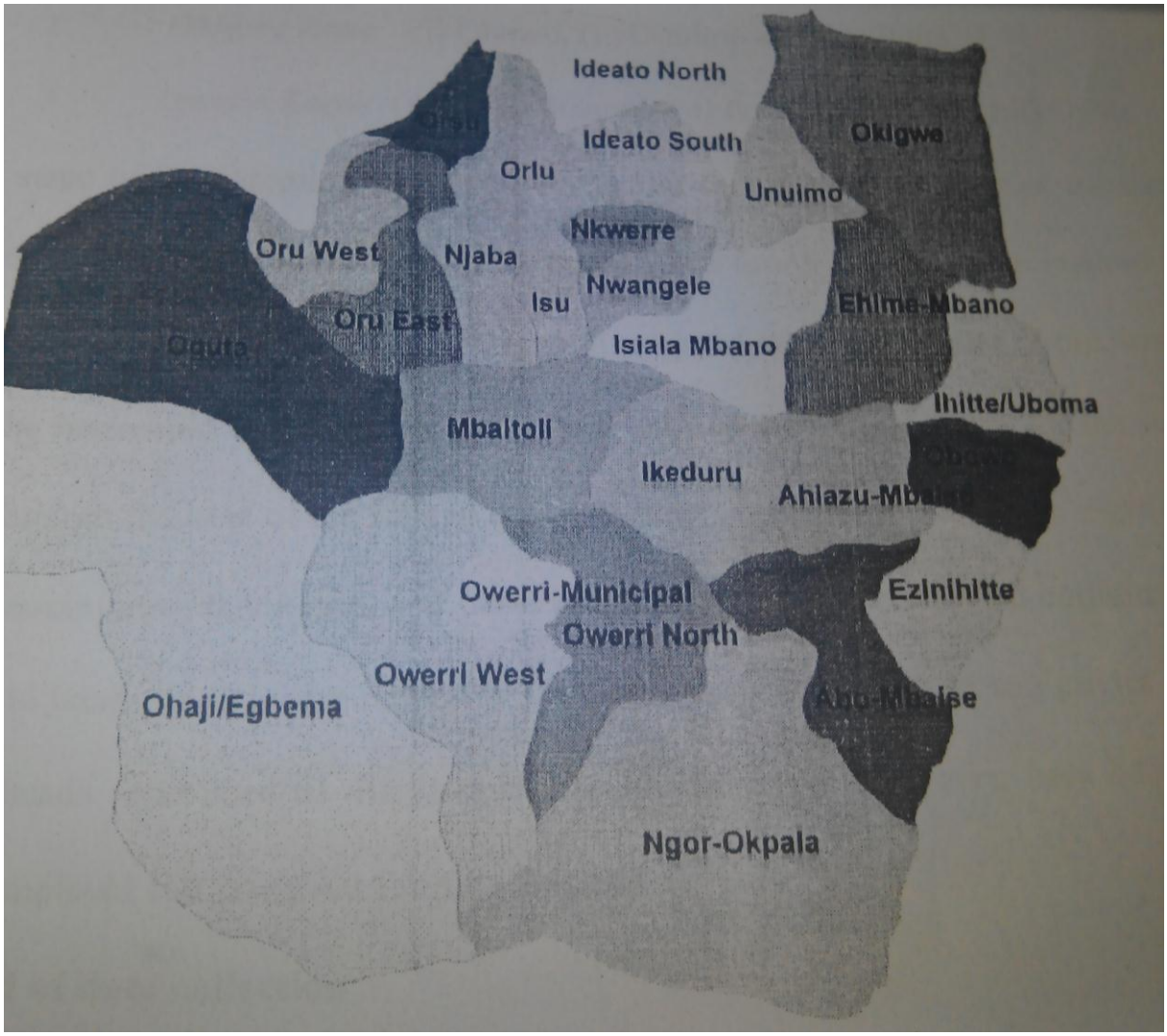

Figure 2.0: Map of Imo State showing the 27 Local Government Areas

3.3 Sample and sampling techniques

The population for this study comprised all the farmers in Imo State. A multi-stage sampling technique was used for the selection of sample for the study. The first stage was the purposive selection of the three agricultural zones of the state namely: Orlu zone, Okigwe zone, and Owerri zone. The reason was to ensure proper representation of the state. The second stage was the purposive selection of two local government areas (LGAs) each from the three agricultural zones of the state. These LGAs were those with the incidence of land degradation in the state as contained in literature and preliminary field survey conducted by the researcher. The third stage of the sampling involved the random sampling of two communities from each of the six LGAs already selected, giving a total of 12 communities. The fourth stage was the random sampling of two villages each from the 12 selected communities to give a total of 24 villages. From these villages, the list of all the farmers was compiled with the help of Village Extension Agents (VEAs) and other key informants in the selected communities and then used as the sample frame for the study. From the list, 10 farmers were randomly sampled from each of the 24 villages. In all, a total of 240 farmers were used as the simple size for the study. The illustration for the sample selection is seen in figure 3.0.

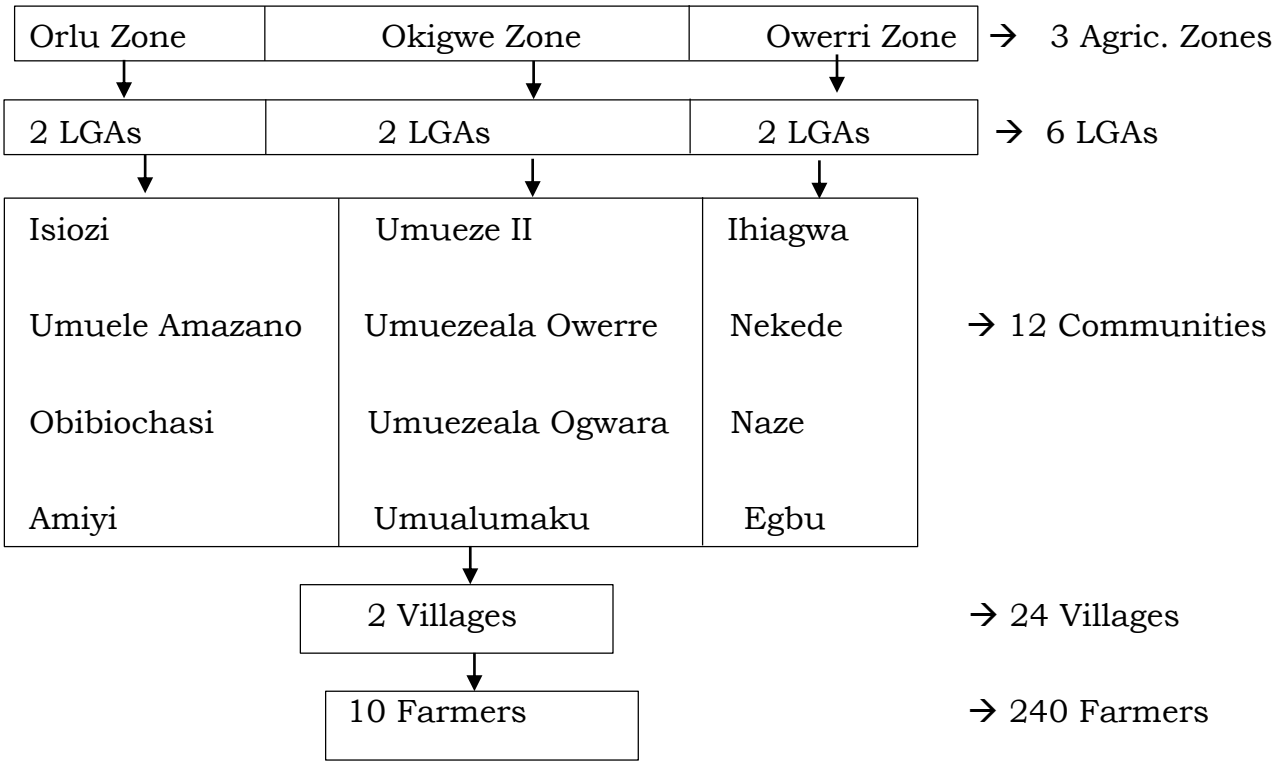

Figure 3.0: A table representing sample selection

3.4 Method of data collection

Data were collected from primary and secondary sources. The primary data were obtained from field survey using structured and validated questionnaire. The questionnaire contained questions addressing the objectives and hypotheses of the study. The secondary data were collected from research reports, academic journals, conference proceedings, newspaper articles, textbooks, internet materials and annual reports of relevant government ministries, departments and agencies.

3.5 Standardization of the data collection instrument

In order to control errors, the research instrument was standardized to ensure that it was valid and reliable.

3.5.1 Estimating validity

Validity test was undertaken to ensure that the instrument measured the variables it was designed to measure. To achieve this, the Jury method of content validity was employed to ascertain how well the content sampled the subject under investigation (Akinbile, 2004). A sample of the questions was given to the supervisor and other experts in the Department of Agricultural Extension to critically and independently review the items and questions for relevance, clarity and adequacy in eliciting the needed information. Those questions for which there were agreement by the two or more experts of the jury concerning their relevance and importance to the objective of the study were thus used for the study.

3.5.2 Estimating reliability

The reliability of a measuring instrument refers to the ability of the instrument to consistently produce the same result when applied to the same farmers at different intervals. For this study, the test-re-test method of estimating reliability was used. Thus, the questionnaire were administered to 40 farmers at first, and after an interval of three months, the same questionnaire were re-administered again to the 40 farmers. Scores obtained from the farmers at the two intervals were analyzed using the Pearson Product Moment Correlation Coefficient (PPMCC) correlation analysis. The value of the PPMCC (r) was 0.94 indicating a very high correlation between the first and the second intervals using same

instrument. The result revealed that the instrument (questionnaire) was reliable for data collection.

3.6 Measurement of variables

The variables used in this study were measured as follows:

Objective one - To describe the socio-economic characteristics of the farmers. The variables measured under this objective include: age, sex, marital status, educational level, household size, membership of social organization, major occupation. These variables were measured as follows:

Age - age of farmers in years.

Sex - sex measured as dummy, male = 1, female = 0.

Marital status - single = 1, married = 2, divorced = 3, separated = 4and widowed = 5.

Educational level - No formal education = 1, Primary education = 2, Secondary education = 3, Tertiary education = 4.

Membership of social organization - It was measured as dummy, Yes =1, No= 0.

Household size - 1-3, 4-6, 7-9, 10-12

Major occupation - It was measured as dummy, farming = 1, non-farming = 0.

Objective two - To ascertain the farmers awareness of land degradation. This was measured as dummy, Yes = 1, No = 0.

Objective three - To identify the sources of information on land degradation available to the farmers. Radio = 1, Television = 2, Newspaper = 3, Friends = 4, Town criers = 5, Extension agents = 6, Village/town union meetings = 7, Market association = 8.

Objective four - To determine the types of land degradation prevalent in the area. Gully erosion = 1, Sheet erosion = 2. Rill erosion = 3, Soil salinization = 4, Soil compaction = 5, Soil nutrient depletion = 6.

Objective five - To assess the perceived causes of land degradation by the farmers. This was measured using a four point Likert-type scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, Strongly Disagree (SD) = 1.

Objective six - To analyze the perceived effects of land degradation on agricultural production. This was measured using a four point Likert-type scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, Strongly Disagree (SD) = 1.

Objective seven- To identify the perceived effective methods used by the farmers to control land degradation in the area. Their responses were measured using a four point Likert-type scale of Very Effective (VE) = 4, Effective (E) = 3, Ineffective (IE) = 2, Very Ineffective (VIE) = 1.

3.7 Method of data analysis

The data for this study were analyzed using both descriptive and inferential statistical techniques. The descriptive statistical tools such as mean, frequency

distribution tables and percentages were used to analyze the data in objectives one, two, three and four. On the other hand, mean score was used to analyze the data in objectives five, six and seven. The mean scores were obtained by adding up the weighted values and divide by the number of scales to obtain the discriminating index.

For objective five (5), which involved four point Likert- type scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1. The value of the scales were added together and was then divided by the number of scales to obtain the discriminating index. e.g.

$$\frac{(4 + 3 + 2 + 1)}{4} = 2.5$$

All items with $\bar{X} \geq 2.5$ were regarded as "Agreed" while those with $\bar{X} < 2.5$were regarded as "Disagreed".

For objective six (6), which involved four point Likert- type scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1. The value of the scales were added together and was then divided by the number of scales to obtain the discriminating index. e.g.

$$\frac{(4 + 3 + 2 + 1)}{4} = 2.5$$

All items with $\bar{X} \geq 2.5$ were regarded as "Agreed" while those with $\bar{X} < 2.5$were regarded as "Disagreed".

For objective seven (7), which involved four point Likert- type scale of Very Effective (VE) = 4, Effective (E) = 3, Ineffective (IE) = 2, Very Ineffective (VIE) = 1. The value of the scales were added together and was then divided by the number of scales to obtain the discriminating index. e.g.

$$\frac{(4 + 3 + 2 + 1)}{4} = 2.5$$

All items with $\bar{X} \geq 2.5$ were regarded as "Effective" while those with $\bar{X} < 2.5$were regarded as "Ineffective".

Similarly, to test for significant relationships between hypothesized variables, the following inferential statistical tools were used.

Hypothesis one –This hypothesis sought to ascertain the socio-economic determinants of the perceived effects of land degradation on agricultural production in Imo State, Ordinary Least Square (OLS) Multiple Regression Model was used. The four functional forms of the model (i.e. the Linear,

Semi-log, Exponential-log and Double-log function) were tried.

The model is implicitly specified as follows:

$$Y = f (X_1, X_2, X_3, X_4, X_5, X_6, X_7, e)$$

Where,

Y = Perceived effects of land degradation on agricultural production (measured on a four point Likert - type scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1)

X_1= Sex (Dummy, male = 1, female = 0)

X_2 = Age of farmers (in years)

X_3= Educational level (No formal education = 1, Primary education = 2,

Secondary education = 3, Tertiary education = 4)

X_4= Marital status (recorded as single = 1, married = 2, divorced = 3, separated = 4, widowed = 5)

X_5= Household size (the number of persons under one roof and feeding from the same pot)

X_6= Membership of social organization (Dummy, Yes = 1, No = 0)

X_7= Major occupation (Dummy, farming = 1, non-farming = 0)

e = Error term

Hypothesis two – The farmers from the three agricultural zones of Imo State do not differ significantly in their perceived effects of land degradation on agricultural production, Analysis of Variance (ANOVA) test was used to determine the differential levels in the mean perceived effects of land degradation among farmers from the three agricultural zones of Imo State.

The ANOVA model is specified as follows:

$$F = \frac{MSSB}{MSSW} = \frac{SSB(n-k)}{SSW\,(k-1)}$$

$$SSB = \sum_{i=1}^{k} nj\,[(\bar{x}-\bar{\bar{x}})]^2$$

$$SSW = \sum_{i=1}^{nj}\sum_{j=1}^{k}(\times ij - \bar{x})^2$$

Source: Pedhazur (1999).

Where,

F =the value by which the statistical significance of the mean differences was judged.

SSB = sum of squared deviations between the mean perceived effects of land degradation among farmers from the three agricultural zones.

SSW = sum of squared deviations within the mean perceived effects of land degradation among farmers from the three agricultural zones.

$\bar{X}$= mean perceived effects of land degradation among farmers from zone j

$\bar{\bar{X}}$= grand mean perceived effects of land degradationamong farmers.

X_{ij}= ith level of the perceived effects of land degradation among farmers from agricultural zone j

nj= sample size of farmers from agricultural zone j

n= number of observations from the three agricultural zones.

k = number of agricultural zones of the state.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-economic characteristics of the farmers

The socio-economic variables of the farmers that were examined for the study included:

a. Distribution of farmers according to sex
b. Distribution of farmers according to age
c. Distribution of farmers according to educational level
d. Distribution of farmers according to marital status
e. Distribution of farmers according to household size
f. Distribution of farmers according to membership of social organization
g. Distribution of farmers according to major occupation

The findings of the study were as follows:

Table 1.Distribution of farmers based on their socio-economic characteristics

Socio-economic characteristics	Frequency (n=240)	%	$\bar{X}$
Sex			
Male	60	25.0	
Female	180	75.0	
Age (years)			
31-40	38	15.83	
41-50	60	25.00	
51-60	99	41.60	51.63
61-70	43	17.92	
Educational level			
No formal education	65	27.08	
Primary education	121	50.42	
Secondary education	40	16.67	
Tertiary education	14	5.83	
Marital status			
Single	12	5.00	
Married	139	57.92	
Divorced	27	16.67	
Widowed	62	5.83	
Household size			
1-3	12	5.00	
4-6	75	31.25	
7-9	101	42.08	7
10-12	52	21.67	
Membership of social org.			
Yes	162	67.5	
No	78	32.5	
Major occupation	194	80.82	
Farming	46	19.17	
Non-farming			

Source: Field Survey data, 2015

In most developing countries like Nigeria and sub-Sahara Africa, agricultural activities are mostly done by women. The women are seen as the active labour force who solely embraces farming as their major occupation that increases their farm income. From the result in Table 1 revealed that the female farmers were more than male farmers with a percentage rate of 25 percent for males and 75 percent for females. This could be due to the fact that most males tend to go into other businesses. Research reports have confirmed that women all over the world engage in farm activities more than the men (Saito & Spurling, 1992). This implied that women were more involved in agricultural activities in the area. Therefore, the women should be specially targeted in the campaign against land degradation in the area.

Data in Table 1further showed that, greater proportion 41.25 percent of the farmers were between the age range of 51 - 60 years, while 25 percent of them were between 41 - 50 years of age. Those that fell within 61 - 70 years accounted for 17.92 percent. The remaining 15.83 percent fell between 31 - 40 years of age. The mean age was 51.63 years. The findings showed that the farmers comprised mainly of the elderly persons in the sampled communities. This is dangerous for food security, since the elderly ones cannot sustain agricultural production. The youths should be encouraged to go into agriculture through provision of incentives by government. This result is in line with the studies of Odebode and Adetunji (2010), and Ozor and Nnaji (2010).

Data in Table 1 also revealed that the rural farmers have various educational qualifications. Greater proportion 50.42 percent had primary education while

27.08 percent had no formal education. About 17 percent of the farmers had secondary education. The results also indicated that only 5.83 percent had tertiary education. This implied that majority of the farmers are literate. The high level of literacy is an asset in agricultural development especially for extension services. This implies that farmers will be fast to adopt new technologies given to them to control the occurrence of land degradation. Imbur, Agwu and Akinnagbe (2008) noted that the literacy level of the farmers is a very important variable as it influences the ability to properly comprehend new techniques and methods required to bring positive changes in knowledge, attitudes, skills and aspirations of the farmers. According to Okezie and Amaefula (2006), education is an important factors influencing adoption of innovation, therefore, farmers were likely to adopt innovations on soil and land management practices in order to reduce incidences of land degradation.

Data in Table 1 further revealed that greater proportion 57.92 percent of the respondents were married, while 25.83 percent, 11.25 percent and 5.00 percent of them were widowed, divorced and single respectively. This showed that majority of the farmers were married. The reason is due to the fact marriage have contributed to the higher level of responsibilities and thus increase the number of household in which the married ones are likely to readily adopt innovative measures to checkmate land degradation in the area. This result also tallies with the work of Umukoro and Akinnagbe (2011), and NBS (2009).

Household size plays a vital role in the family by indicating the total number of people living or occupying a family setup under one roof. Data in Table 1 also

showed that greater proportion 42.08 percent of the respondents had a household size of 7 - 9 persons, while 31.25 percent and 21.67 percent of them had a household size of 4 - 6 persons and 10 - 12 persons. Only 5.00% of the respondents had household size of 1 - 3 persons. The mean household size was 7 persons. This implied that the farmers had a large household size in the area which could help to reduce the demand for hired labour as members of the farm families could carry out some of the farming and non-farming activities and also help in checkmating land degradation, hence more food will be produced resulting in food security among the rural households. This result is in line with the finding of Ifeanyi - Obi (2012).

Farmers in the state belong to various organizations for different motive especially with respect to diffusion of information, help and problem solving. Data in Table 1 further showed that majority 67.5 percent of the farmers belongs to social organizations, while the remaining 32.5 percent did not belong to any social organization. This implied that huge numbers of the farmers were members of social organizations in order to help themselves out in time of trouble and most times information is disseminated which may aid to boost their agricultural productivity. The implication is that information regarding land degradation and its control measures can easily be diffused to the farmers using the various organizations existing around the area, since these organizations serve as avenues for information dissemination. This result is in agreement with the work of Youdeowei, Ezedinma and Onazi (1986).

Data in Table 1 also showed that majority 80.83 percent of the farmers in this study had farming as their major occupation, while 19.17 percent of them were involved in diverse non - farming activities as their major occupation. This implied that the majority of the farmers in Imo State had farming as their major source of generating income for their livelihood. Therefore, efforts made at reducing land degradation in the state will indirectly improve their livelihood. The farmers should equally be enlightened by the Federal, State and Local government on better land management practices in order to reduce incidences of land degradation. This result tally with the work of Nzeh and Eboh (2010).

4.2 Awareness of land degradation

Table 2: Distribution of farmers according to the awareness of land degradation

Awareness	Frequency	Percentage (%)
Yes	240	100.00
No	00	0.00
Total	**240**	**100.00**

Source: Field Survey data, 2015

Data in Table 2 revealed that all the farmers were aware of the existence of land degradation in the area. The high level of awareness may have resulted from various campaigns and sensitization of the farmers on land degradation menace by the state government especially through the Agricultural Development Programme, academic institutions, and other concerned stakeholders. The implication is that all the farmers in the state were exposed to various innovations and methods of farming to boost their food production and therefore

help to reduce the incidence of degradation in the area. This result is in line with the work of Okezie and Amaefula (2006).

4.3 Sources of information on land degradation

Table 3: Distribution of farmers according to sources of information on land degradation

Sources	*Frequency	Percentage (%)
Radio	78	32.50
Television	56	23.33
Newspapers	42	17.50
Friends/neighbours	70	29.17
Town criers	210	87.50
Extension agents	15	6.25
Village/town union meetings	90	37.50
Market association	72	30.00

Source: Field Survey data, 2015 *Multiple responses

Data in Table 3 showed that 32.50 percent, 23.33 percent, 17.50 percent, and 29.17 percent of the farmers got information about land degradation through the radio, television, newspapers, and friends respectively. The remaining 87.50 percent, 6.25 percent, 37.50 percent, and 30 percent got information about the problems of land degradation through town criers, extension agents, village/town union meetings, and market association respectively. This implied that there were varieties of information sources on land degradation among farmers in Imo State. The result also revealed that majority of the farmers indicated their sources of information through town criers. This result is in agreement with the work of Umahi (2011).

4.4 Types of land degradation observed in the area

Table 4: Distribution of farmers according to types of land degradation observed

Type of land degradation	*Frequency	Percentage (%)
Gully erosion	121	50.4
Sheet erosion	46	19.2
Rill erosion	24	10.0
Soil salinization	62	25.8
Soil compaction	56	23.3
Soil nutrient depletion	40	16.7

Source: Field Survey data, 2015 *Multiple responses

The result in Table 4 indicated that majority 50.42 percent of the farmers observed gully erosion in their communities. The result also showed that 19.17 percent and 10 percent of them observed sheet erosion and rill erosion respectively in their communities. The remaining 25.83 percent, 23.33 percent and 16.67 percent observed soil salinization, soil compaction, and soil nutrient depletion respectively. This implied that the most observable land degradation type by farmers in Imo State is gully erosion. The low observance of rill and sheet erosion is dangerous since these are the major avenues of soil nutrient loss. The farmers therefore need to be more aware of this situation and efforts towards minimizing them geared up. Umahi (2011) observed that the spreads of gullies are the most observable land degradation menace in the area.

4.5 Perceived causes of land degradation in the study area

Table 5: Distribution of farmers according to their perceived causes of land degradation

Causes	Strongly Agree (4)	Agree (3)	Disagree (2)	Strongly Disagree (1)	Mean ($\bar{X}$)	SD
Erosion/runoff	162(67.5)	62(25.83)	10 (4.17)	6 (2.5)	3.58	1.47
Flooding	53 (22.08)	120(50.0)	27(11.25)	40(16.67)	2.78	0.74
Overgrazing	17 (7.08)	42 (17.5)	57 (23.75)	124 (51.67)	1.80	1.18
Sand excavation	41 (17.08)	69(28.75)	102 (42.5)	28 (11.67)	2.51	0.15
Deforestation	130(54.17)	62(25.83)	28 (11.67)	20 (8.33)	3.26	1.23
Land clearing	34 (14.17)	48 (20)	80 (33.33)	78 (32.5)	2.16	0.83
Poor management of the land	57 (23.75)	90 (37.5)	72 (30)	21 (8.75)	2.76	0.72
Uncontrolled irrigation	32 (13.33)	55(22.92)	63 (26.25)	90 (37.5)	2.12	0.87
Land pollution	42 (17.5)	102(42.5)	66 (27.5)	30 (12.5)	2.65	0.55
Bush burning	70 (29.17)	98(40.83)	42 (17.5)	30 (12.5)	2.76	0.79
Topography (sloping land)	68 (28.33)	102(42.5)	35 (14.58)	35 (14.58)	2.85	0.83
Climate change	92 (38.33)	72 (30)	50 (20.83)	26 (10.83)	2.96	0.96
road grading	85 (35.42)	65(27.08)	70 (29.17)	20 (8.33)	2.90	0.89

Source: Field Survey data, 2015 $\bar{X} \geq 2.5$= agree (A), $\bar{X} < 2.5$ = disagree (D)

A discriminating index of $\bar{X} \geq 2.5$ for agreement and $\bar{X} < 2.5$ for disagreement was used. Table 5 showed the various causes of land degradation in the study area. The farmers perceived the following as the major causes of land degradation in the area: erosion/runoff ($\bar{X}$= 3.58), deforestation ($\bar{X}$= 3.26), climate change ($\bar{X}$=

2.96), road grading ($\bar{X}$= 2.90), topography ($\bar{X}$= 2.85) and flooding ($\bar{X}$= 2.78). Others were poor management of the land ($\bar{X}$= 2.76), bush burning ($\bar{X}$= 2.76), land pollution ($\bar{X}$= 2.65) and illegal sand excavation ($\bar{X}$ = 2.51). However, the result showed that land clearing ($\bar{X}$= 2.16), uncontrolled irrigation ($\bar{X}$= 2.12) and overgrazing ($\bar{X}$= 1.80) were not perceived as major causes of land degradation in Imo State. It is important to make the farmers understand that improper land clearing, uncontrolled irrigation (especially during dry season) and overgrazing (especially by the Fulani herdsmen who have now moved down southeast massively) can actually cause land degradation. Since the standard deviation (SD) value is closer to one, it implied that there is a wide variation in the perceived causes of land degradation in Imo State, which stipulates that the farmers responses differ so much in their mean values. This result is in line with the findings of Okpala-Okaka (2009), Umahi (2011) and Mbagwu (2003).

4.6 Perceived effects of land degradation on agricultural production

Table 6: Distribution of farmers according to perceived effects of land degradation on agricultural production

Perceived effects	Strongly Agree (4)	Agree (3)	Disagree (2)	Strongly Disagree (1)	Mean ($\bar{X}$)	SD
Severe hardship	38(15.83)	92 (38.33)	64 (26.67)	46 (19.17)	2.51	0.14
Food shortage	60 (25)	62 (25.83)	86 (35.83)	32 (13.33)	2.63	0.50
Reduction in land productivity	90 (37.5)	90 (37.5)	32 (13.33)	28 (11.67)	3.01	1.01
Increase in cost of input	85(35.42)	60 (25)	45 (18.75)	50 (20.83)	2.75	0.71
Increase in food prices	40(16.67)	120 (50)	32 (13.33)	48 (20)	2.63	0.51
Reduction in crop yield	162(67.5)	60 (25)	10 (4.17)	8 (3.33)	3.57	1.46
Death of livestock	70 (29.17)	70 (29.17)	70 (29.17)	30 (12.5)	2.71	0.67
Destruction of markets and other infrastructure	85(35.42)	65 (27.08)	70 (29.17)	20 (8.33)	2.90	1.04
Loss of farmlands	100(41.67)	28 (11.67)	70 (29.17)	42 (17.5)	2.78	0.74
Decrease in farm income	92 (38.33)	72 (30)	52 (21.67)	24 (10)	2.97	0.97
Destruction of economic trees	60 (25)	40 (16.67)	110 (45.83)	30 (12.5)	2.54	0.29
Destruction of rural roads	130(54.17)	62 (25.83)	28 (11.67)	20 (8.33)	3.26	1.23
Soil nutrient loss	69 (28.75)	52 (21.67)	94 (39.17)	25 (10.42)	2.69	0.61

Source: Field Survey data, 2015 $\bar{X} \geq 2.5$ = agree (A), $\bar{X} < 2.5$ = disagree (D)

The result in Table 6 showed the farmers perceived effects of land degradation on agricultural production in Imo State. Using a discriminating index of $\bar{X} \geq 2.5$ for agreement and $\bar{X} < 2.5$ for disagreement, the table showed that the perceived effects were numerous and among which included severe hardship ($\bar{X}$= 2.51), food shortage ($\bar{X}$= 2.63), reduction in land productivity ($\bar{X}$= 3.01), increase in cost of input ($\bar{X}$= 2.75), increase in food prices ($\bar{X}$= 2.63), reduction in crop yield ($\bar{X}$= 3.57) and death of livestock ($\bar{X}$= 2.71). Other effects included destruction of markets and other infrastructure ($\bar{X}$= 2.90), loss of farmlands ($\bar{X}$= 2.78), decrease in farm income ($\bar{X}$= 2.97), destruction of economic trees ($\bar{X}$= 2.54), destruction of rural roads ($\bar{X}$= 3.26) and soil nutrient loss ($\bar{X}$= 2.69). The result revealed that land degradation has several devastating effects on agricultural production as well as the socio-economic life of the farmers. These entire effects may combine together to make life difficult in the area. Since the standard deviation (SD) value is closer to one, it implied that there is a wide variation in the perceived effects of land degradation in Imo State, which stipulates that the farmers responses differ so much in their mean values. The result is in line with the findings of Nwosu (2014), Okpala-Okaka (2009), and Europeans Commission for Agriculture (ECA) (2006).

4.7 Perceived effective methods used by the farmers in controlling land degradation

Table 7: Distribution of farmers according to perceived effective methods used by farmers in controlling land degradation

Methods	Very Effective(4)	Effective(3)	Ineffective (2)	Very Ineffective (1)	Mean ($\bar{X}$)	SD
Afforestation	58 (24.17)	98 (40.83)	49 (20.42)	35 (14.58)	2.75	0.70
Zero/minimal tillage	30 (12.5)	60 (25)	82 (34.17)	68 (28.33)	2.22	0.75
Controlled grazing	70 (29.17)	98 (40.83)	42 (17.5)	30(12.5)	2.76	0.79
Avoidance of bush burning	92 (38.33)	72 (30)	52 (21.67)	24 (10)	2.97	0.97
Terracing	90 (37.50)	90 (37.50)	30 (12.5)	30 (12.5)	3.00	1.00
Mulching of farmland	48 (20)	100(41.67)	70 (29.17)	22 (9.17)	2.73	0.67
Use of cover crops	64 (26.67)	92 (38.33)	46 (19.17)	38 (15.83)	2.76	0.72
Agro-forestry	60 (25)	88 (36.67)	52 (21.67)	40 (16.67)	2.70	0.63
Alley cropping	50 (20.83)	80 (33.33)	90 (37.50)	20 (8.33)	2.67	0.58
Ridging of farmland	80 (33.33)	120 (50)	14 (5.83)	6(2.5)	2.98	1.17
Planting of grasses	78 (32.5)	80 (33.33)	48 (20)	34 (14.17)	2.84	0.83
Bush fallowing	52 (21.67)	110(45.83)	60 (25)	18 (7.5)	2.82	0.80
Use of organic manure	75 (31.25)	85 (35.42)	55 (22.92)	25 (10.42)	2.88	0.87

Source: Field Survey data, 2015 $\bar{X} \geq 2.5$ = Effective (E), $\bar{X} < 2.5$ = Ineffective (IE)

The result in Table 7 revealed the perceived effective methods used by farmers in controlling land degradation in the area. The methods range from agronomic to mechanical. Using a discriminating index of $\bar{X} \geq 2.5$ for effective and $\bar{X} < 2.5$ for ineffective, the table showed that the methods perceived as effective included afforestation ($\bar{X}$= 2.75), controlled grazing ($\bar{X}$= 2.76), avoidance of bush burning ($\bar{X}$= 2.97), terracing ($\bar{X}$= 3.00), mulching of farmland ($\bar{X}$= 2.73), use of cover crops ($\bar{X}$= 2.76) and agro-forestry ($\bar{X}$= 2.70). Others were alley cropping ($\bar{X}$= 2.67), ridging of farmland ($\bar{X}$= 2.98), planting of grasses ($\bar{X}$= 2.84), bush fallowing ($\bar{X}$= 2.82), and use of organic manure ($\bar{X}$= 2.69). However, the result indicated that the farmers did not perceive zero/minimal tillage ($\bar{X}$= 2.22) as effective. It implied that the farmers used almost all the listed methods. However, increased campaign for sustained use of measures is necessary. Since the standard deviation (SD) value is closer to one, it implied that there is a wide variation in the perceived effective methods used by farmers towards the control of land degradation in Imo State, which stipulates that the farmers responses differ so much in their mean values. This result is in agreement with the findings of Akinbile and Odebode (2007), and Oyakale (2008).

4.8 Hypothesis Testing

Two hypotheses were tested for the study. In hypothesis one, Ordinary Least Square (OLS) multiple regression model was used to test that the socio-economic variables of the farmers are not the determinants of the perceived effects of land degradation on agricultural production in Imo State while in hypothesis two, Analysis of Variance (ANOVA) was used to test for significant difference among the farmers of the three agricultural zones of Imo State in their perceived effects of land degradation on agricultural production. The results of the tests were as shown below:

4.8.1 Socio-economic determinants of the perceived effects of land degradation on agricultural production.

Table 8: Ordinary Least Square multiple regression analysis

Explanatory Variable	Linear function	Semi-log function	Double-log function	Exponential function
Constant	231.3518	107.4821	96.6318	85.9116
Std.Err of YEst	18.1493	16.0793	0.0443	0.1839
R^2	0.4437	0.3962	0.7049	0.5943
No of observation	240	240	240	240
F-value	26.4107	21.7692	77.4615	48.5143
Sex X_1	-13.0391	-9.1384	-0.0689	-0.0083
	(-6.1893)**	(-1.0251)	(-2.1735)*	(-2.2432)*
Age X_2	11.2247	8.2165	0.2674	0.0074
	(1.0286)	(2.6499)**	(3.2809)**	(2.3226)*
Educational level X_3	10.8012	3.7718	0.0476	0.0097
	(1.1765)	(0.9971)	(2.2775)*	(1.1829)
Marital status X_4	13.9124	5.2694	0.0321	0.0068
	(4.9427)**	(1.1031)	$(1.0844)^{NS}$	(1.333)
Household size X_5	-15.1026	-2.5097	-0.1039	-0.0074
	(-1.0768)	(-1.1929)	(-3.2984)**	(1.1746)
Membership of	14.3314	1.4474	0.0921	0.0082
social org. X_6	(1.0936)	(0.9988)	$(1.1043)^{NS}$	(1.1232)
Major occupation	10.2912	1.3794	0.0895	0.0081
X_7	(1.0478)	(0.9983)	(2.1671)*	(4.2631)**

Source: Field Survey data, 2015

Figures in parenthesis are t-ratios

*= t – ratio significant at 5% probability level

**= t – ratio significant at 1% probability level

The result in Table 8 showed that the double log functional form of the Ordinary Least Square (OLS) multiple regression model provided the best fit by having the highest number of statistically significant variables, highest F-value, least value of Y estimate, and the highest coefficient of multiple determination (R^2). The value of R^2 was 0.7049 which implied that about 70 percent of the variations in the perceived effects of land degradation on agricultural production were accounted for by the joint actions of the socio-economic characteristics investigated in the study. The coefficients of age (t = 3.2809) and household size (t = -3.2984) were all significant at 1% probability level, implying that these variables were important factors influencing the farmers perception of the effects of land degradation.

The influence of age (t = 3.2809) implied that as age increases, the farmers perception on the effects of land degradation also increases. The negative coefficient of household size (t = -3.2984) implied that the larger the size of household the less the perceived effects of land degradation on agricultural production. This could be attributed to the fact that larger households depending on agriculture for livelihood will be at risk management by the action of land degradation and vice - versa.

The result also showed that the coefficient of sex (t = -2.1735), educational level (t = 2.2775) and major occupation (t = 2.1671) were all significant at 5% probability level, implying also that they were important variables influencing the perceived effects of land degradation. The coefficient of sex has a negative sign, which revealed that the larger the number of sex, the smaller the perceived effects of land degradation. Similarly, the coefficient of educational level has a positive sign, implying that each additional year of schooling increases the people perception of the effects of land degradation. The result also indicated that the coefficient of major occupation has a positive sign which revealed that the larger the people engage in farming as their occupation, the greater the effects of land degradation and vice-versa. Land degradation has direct impact on traditional land cultivation (farming) commonly practiced by rural people in Nigeria (Umahi, 2011).

The table also showed that the coefficient of marital status (t = 1.0844) and membership of social organization (t = 1.1043) all positive were not statistically significant at 5% level, implying that they were not important factors influencing the perceived effects of land degradation.

4.8.2 Differential perceived effects of land degradation on agricultural production among farmers in the three Agricultural Zones of Imo State.

Table 9: Analysis of Variance (ANOVA)

	Sum of squares	DF	Mean square	F-cal	F-tab (0.05)	Decision
Between groups	86038	2	43019	1.74^{ns}	2.99	Null Hypothesis is accepted
Within groups	5860964	237	24729.8			
Total	**5947002**	**239**				

Source: Field Survey data, 2015

ns = F-cal not significant at 5% level

The result in Table 9 showed the Analysis of Variance (ANOVA) test carried out to ascertain if there were significant differences in the perceived effects of land degradation among farmers in the three agricultural zones of Imo State. The ANOVA test produced an F-value of 1.74 which was not significant at 5% level, when compared with the critical F-value of 2.99 at 5% level at $V_1 = 2$, and $V_2 = 237$ degree of freedom. Since the F-calculated (F-cal = 1.74) was less than the F-tabulated (F-tab = 2.99), the hypothesis which states that there is no significant differences in the perceived effects of land degradation on agricultural production among farmers in the three agricultural zones of Imo State was therefore accepted. This result implied that the inhabitants of the three agricultural zones of the state share similar feeling about the effects of land degradation on agricultural production in the state. The result is in line with the findings of Umahi (2011), and NBS (2009).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Land degradation has widely been known as the most devastating environmental problem facing the southeast Nigeria in general and Imo State in particular. The ever growing population density and the high pressure on land and other natural resources further increase the trend of land degradation in this part of the country. Initial efforts at controlling land degradation menace in Imo State had always concentrated more on the mechanical and geological aspects, with little or no attention given to the socio-economic aspects of the problem. This study on perceived effects of land degradation on agricultural production among farmers in Imo State, Nigeria is an effort by the researcher to generate empirical data on the above topic to be used as a working document for policy formulation on tackling socio-economic problems arising from land degradation. The study specifically sought to, among other things, describe the socio-economic characteristics of the farmers, ascertain the farmers awareness on land degradation, identify the sources of information on land degradation available to the farmers, determine the types of land degradation prevalent in the area, assess the perceived causes of land degradation in the area, analyze the perceived effects of land degradation on agricultural production in the area, identify the perceived effective methods used by the farmers in controlling land degradation.

Data for the study were collected using structured and validated questionnaire from 240 randomly selected farmers from the three zones of Imo State. The data were analyzed using both descriptive and inferential statistical tools such as mean, frequency distribution tables, percentages, Ordinary Least Square (OLS) multiple regression model and analysis of variance (ANOVA) test. The findings were as follows:

Majority of the farmers were aware of land degradation in the area through town criers. Gully erosion was the most common type of land degradation observed in the area. The results also showed that the major perceived causes of land degradation in Imo State were erosion/runoff, deforestation, climate change, road grading, and topography. The major perceived effects of land degradation on agricultural production in the area were reduction in crop yield, loss of farm labour (due to forced migration), reduction in land productivity, decrease in farm income, and destruction of markets and other infrastructure. Some of the perceived effective methods used by the farmers to control land degradation in the area were terracing, ridging of farmland, avoidance of bush burning, use of organic manure, and planting of grasses. However, there is wide variation in the SD among the farmers since the standard deviation (SD) value is closer to one, it implied that the farmers responses differ so much in their mean values.

In hypothesis one, which sought to ascertain the socio-economic determinants of the perceived effects of land degradation on agricultural production. The results also revealed that some socio-economic variables were the determinants

of the perceived effects of land degradation. Age, household size, sex, educational level, and major occupation were the significant factors that influenced farmers perceived effects of land degradation in the area. The value of the coefficient of multiple determinations (R^2) was 0.7049, which implied that about 70 percent variations of the perceived effects of land degradation on agricultural production were accounted for by the joint actions of the socio-economic variables investigated.

In hypothesis two, which sought to establish significant difference in the perceived effects of land degradation among farmers in the three agricultural zones of Imo State, the result of the ANOVA test revealed that the farmers of the three agricultural zones of the state share similar feeling in their perceived effects of land degradation on agricultural production in the state (F-cal. = 1.74 < F-tab. = 2.99 at 5% level). Based on the result, the null hypothesis was accepted which implied that the people from the three zones of the state perceived the effects of land degradation equally.

5.2 CONCLUSION

Land degradation has reached a devastating stage in Imo State. The study concluded that majority of the farmers in Imo State engaged in farming activities as their major occupation for source of livelihood, all the farmers were aware of the land degradation problems in the area. The causes of land degradation in the state were mainly due to climatic factors and human factors which include

erosion/runoff, deforestation, climate change, road grading, and topography of the land. They are the highly rated causes of land degradation in Imo State.

Land degradation affects agricultural production among farmers significantly. The effects include reduction in crop yield, loss of farm labour (due to forced migration), reduction in land productivity, decrease in farm income, and destruction of markets and other infrastructure. All these combined together to cause high poverty and also make life difficult for the farmers. The perceived effective methods used by farmers in the control of land degradation in the area include terracing, ridging of farmland, avoidance of bush burning, use of organic manure, and planting of grasses. The socio-economic characteristics of the farmers such as age, educational level, major occupation, sex and household size were important factors influencing their perceived effects of land degradation on agricultural production. Land degradation affects the farmers in the three agricultural zones of the state. However, there is wide variation in the SD among the farmers since the standard deviation (SD) value is closer to one, it implied that the farmers responses differ so much in their mean values.

5.3 RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

1. both the federal, state, and local government and other intervention agencies should enforce legislation on excavation for buildings or road construction and on the disposal of industrial and municipal wastes

through a well-structured Environmental Protection Agency. The reason is to forestall or avoid massive land degradation.

2. government and donor agencies should provide awareness campaign on the part of the farmers on how best to increase food production.
3. bush burning on the farmland should be restricted by a law enacted by government to control land degradation in the state.
4. excessive cutting down of trees by the farmers should be discouraged to avoid land degradation.
5. the farmers should come together to form a cooperative societies among themselves to discuss and look for a best way on how to tackle land degradation menace.
6. Reforestation programmes should be embarked upon to reclaim the lands after mechanical/civil works must have been carried out earlier to check the gullies.
7. educate and inform the farmers on land degradation and control measures.
8. The number of extension visit to farmers is not encouraging and this could affect dissemination of land degradation. Therefore, there is need for the three tiers of government to improve the extension-farmers ratio so that more farmers could be reached and the contact period could be enhanced for sustained production.

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QUESTIONNAIRE

Dear Respondent,

The researcher is carrying out a study on **perceived effects of land degradation on agricultural production among farmers in Imo State**. You are kindly requested to assist by completing this questionnaire. The information you provide will be treated confidentially. Please answer the questions as frankly as possible.

Thank you.

ONYERIKA, ANTHONY. I.

(Researcher)

SECTION A: Socio-economic characteristics

1. **Sex**: Male ☐ Female ☐
2. **Age** (in years) 31-40 ☐ 41-50 ☐ 51-60 ☐ 61-70 ☐
3. **Educational level:** No formal education ☐ Primary education ☐ Secondary education ☐ Tertiary education ☐
4. **Marital status:** Single ☐ Married ☐ Divorced ☐ separated ☐ Widowed ☐
5. **What is your household size?** 1-3 ☐ 4-6 ☐ 7-9 ☐ 10 and above ☐
6. **Do you belong to any social organization?** Yes ☐ No ☐
7. **What is your major occupation?** Farming ☐ Non - farming ☐

SECTION B: Awareness of land degradation

8. **Are you are aware of land degradation in your area?** Yes ☐ No ☐

SECTION C: Sources of information on land degradation

9. **What are your sources of information on land degradation in your area**? (Tick as many as apply to you).

Radio ☐ Television ☐ Newspaper ☐

Friends ☐ Town criers ☐ Extension Agents ☐

Village/town union meetings ☐ Market association ☐

Others (specify)----------

SECTION D: Types of land degradation

10.**What type of land degradation occur in your area?** (Tick as many as apply to you).

Gully erosion ☐ Sheet erosion ☐ Rill erosion ☐

Soil salinization ☐ Soil compaction ☐ Soil nutrient depletion ☐

Others (specify)----------

SECTION E: Perceived causes of land degradation

Please indicate: the under listed are possible perceived causes of land degradation in your area. Do you agree?

Causes	**Strongly Agree (4)**	**Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
Erosion/runoff				
Flooding				
Overgrazing				
Sand excavation				
Deforestation				
Land clearing				
Poor management of the land				
Uncontrolled irrigation				
Land pollution				
Bush burning				
Topography (sloping land)				
Climate change				
road grading				
Others (specify)				

SECTION F: Perceived effects of land degradation

Please indicate, are these possible perceived effects of land degradation on agricultural production in your area.

Perceived effects	**Strongly Agree (4)**	**Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**
Severe hardship				
Food shortage				
Reduction in land productivity				
Increase in cost of input				
Increase in food prices				
Reduction in crop yield				
Death of livestock				
Destruction of markets and other infrastructure				
Loss of farmlands				
Decrease in farm income				
Destruction of economic trees				
Loss of farm labour				
Soil nutrient loss				
Others (specify)				

SECTION G: Perceived effective methods used by the farmers in controlling land degradation

Please indicate: are all the under listed perceived effective methods used by the farmers in controlling land degradation.

Methods	**Very Effective (4)**	**Effective (3)**	**Ineffective (2)**	**Very Ineffective (1)**
Afforestation				
Zero/minimal tillage				
Controlled grazing				
Avoidance of bush burning				
Terracing				
Mulching of farmland				
Use of cover crops				
Agroforestry				
Alley cropping				
Ridging of farmland				
Planting of grasses				
Bush fallowing				
Use of organic manure				
Others (specify)				