ANALYSIS OF THE EFFECTS OF TYPHA GRASS INFESTATION ON THE LIVELIHOOD OF THE FARMERS LIVING WITHIN HADEJIA-NGURU CONSERVATION PROJECT

BY

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DECLARATION

I hereby declare that this thesistitled "**Analysis of the Effect of Typha Grass Infestation on the Livelihood of the Farmers Living within Hadejia-Nguru Conservation Project"** has been written by me and it is a record of my research work. No part of this thesis has been presented in any previous application for another Degree or Diploma in this or any other institution. All borrowed information has been duly acknowledged in the text and a list of references provided.

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CERTIFICATION

This thesis titled '**Analysis of the Effect of Typha Grass Infestation on the Livelihood of the Farmers Living within Hadejia-Nguru Conservation Project',** by Yarima Mohammed meets the regulations governing the award of the Degree of Doctor of Philosophy in Agricultural Extension and Rural Sociology inAhmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesisis dedicated to my late wife (BintaGarba), my late father (Alh. Mohammed Chiroma) and Hajiya Aisha Zubair.

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I glorify the exalted name of Almighty Allah (SWT),the cherisher and sustainer of the universe, for His mercy, assistance and protection especially for seeing me through this programme successfully. I say: "*ShukranJazeelanLakaYaa Rabbi.*"I specially wish to express my deep appreciation and sincere gratitude to my supervisors, namely Prof. D. F. Omokore, Prof. Mrs S.J.Autaand Dr. A. A. Hassan for their invaluable assistance, close supervision, constructive criticisms, suggestions and pieces of advice that aided the completion of this research work. May God bless you all and your families. My appreciation also to Head of Department, Prof. Z. Abdulsalamfor his support and encouragement. May Allah bless you and your family too.

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ABSTRACT

This study evaluated impact of Typha grass on the livelihood of the crop, fishery and livestock farmers in selected areas of Yobe and Jigawa states, Nigeria. A multi-stage sampling technique was used to select respondents for this study. A total of two hundred and fourty (240) respondents comprising of one hundred and fourty-five Typha grass affected farmland (145) and ninety-five (95) non-affected Typha grass farmland.Primary data were collected from 240 respondents through the use of random sampling techniques with the aid of structured questionnaire. The statistical tools used to analyze the data were descriptive statistics, regression analysis, chow test statistics and t-test.The study shows that 96% of the farmers were married, about (46%) of the respondents fall within the age range of 40-59years, the majority of the farmers (51%) had no formal education. The majority of farmers operate farm size ranging from 1-3 hectares, about 82% of the respondents do not had access to extension services. The household size ranged from1-10 persons with 58%. Majority of the farmers, (79%) were not members of a cooperative society.Regression on factors influencing livelihood activities on crop, fishery and livestock using output, income and level of living indices, the value of coefficient of determination of crop output, income and level of living, were 0.62, 0.58 and 0.42 respectively meaning that about 62%, 58%, 42% of the variation in the Typha grass area was explained by the independent variables in the regression model. Chow test statistics was to assess the impact of Typha grass on the output, income and level of living for crop, fishery and livestock farmers. Chow test F-calculated for crop output, income and level of living was 15.58, 4.61and 13.28respectively while that of F-tabulated value for 6 degree of freedom with sample size of 240 was 2.80, at 5% level of probability, hence there is significant impact of Typha grass on crop, output, income and level of living on crop production in the study area. In terms of fishery output, income and level of living, Chow test F-calculated was 16.65, 21.06 and 28.01, while the F-tabulated value for 6 degree of freedom with sample size of 240 was 1.86 at 5% level of probability, hence significant impact of Typha grass on fish output, income and level of living. Also, Chow test F-calculated for livestock output, income and level of living was 4.96. 4.58 and 2.94 respectively, while that of F-tabulated value for 6 degree of freedom with sample size of 240 was 1.96 at 5% level of probability, hence there is significant impact of Typha grass on output, income and level of living of livestock farmers in the study area. About63.6% of the farmers have farm sizes (0.1-0.5 hectares) covered with typha grass scattered in differnt location. This was closely followed by those respondent whose farm sizes covered by Typha grass are between 0.6-1.0 hectares and 1.1-1.5 hectares constituting 27.3% and 9.1% of the respondents respectively. Majority of the farmers 56% employed method of cutting and at the same time flooding the area to avoid seed germination and stem sprouting. About 36% of the farmers use mechanical clearing method by slashing the weed while about 9% of the farmers use chemical method as a strategy to reduce the weed.The most severe problems encountered in crop and animal production in the study area is weed. This constraint constitute serious impediments to production and need to be addressed adequately before crop, fishery and livestock production can be improved in the study area. It is recommended that agro based industries and non-governmental organization should be encouraged by the local government to support research on this weed.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Agriculture has been the mainstay of the Nigerian economy despite the decline especially since the oil boom of the 1970's that heralded the petro-dollar era, till date, a greater proportion of the population-about two-third of the total labour force of the nation, depends on the sector for their livelihood and the rural economy is propelled by agriculture (Sunday, 2009). The country has an area covering 92.94 million hectares including 91.1 million hectare of land mass and 1.3 million hectares of water bodies. Of this, agricultural land area of 83.6 million hectares is classified: as follows 28.2 million hectares arable land, 2 million hectares *fadama* (irrigable land), 2.5 million hectares permanent crops, 10.9 million hectares forest/wood and 40 million hectares pastures. It is in light of this fact that the Nigerian Government put agriculture at the forefront of its economic agenda (Sani, 2012).

Human communities no matter how sophisticated could not ignore the importance of agriculture. In modern times however, many in the urban world have forgotten this fundamental connection. Insulated by the apparent abundance of food that has come from new technologies for the growing, transportation, and storage of food, humanity's fundamental dependence on agriculture is often overlooked (Sani, 2012).

Agriculture is the predominant occupation of two-third of working population for their livelihood. It is the main source of food for most of the population and is also main source of feed to livestock more especially the ruminant. It is also the dominant

economic activity in terms of employment and linkages with other sector of the economy, serving as the major source of raw materials for the agro-allied industries and a potent source of foreign exchange. The sector has been highest contributor to the nation's GDP over the years accounting for 42.07 percent in 2008, 35.8 percent in the first quarter of 2009 (Sunday, 2009).

Despite the contribution of agriculture, the sector still faces obvious challenges. One of these problems is weed invasion for example Typha grass. It constitutes a vital limiting factor to crop production. In the tropics they grow fast and luxuriously during the rainy season. This enhance their competition with the main crop for water sunlight, air space, and soil nutrients, which culminate in significant reduction in the actual quality and yield of crops (Isa *et al*., 2010). Weed control consumes the greater portion of pre-harvest farm labour and expenditure. Weed serves as medium of pest and diseases organisms seasonalcarry over or intermediate host hampers operation of equipment, and contaminate harvested grain with foreign matter materials such asweed seeds. The problem caused by weeds in Nigerian agriculture is becoming increasingly very difficult to manage. The traditional farming system in the country is depended mostly on hand tools, local crop varieties, and weed is controlled by a combination of manual methods such as. slashing, burning and hoe weeding (Chikoye *et al*., 2002).

Typha grass (*Typha spp)*, also known as cattail, is a plant locally referred to as "Kachala" by the people living around Hadejia-Nguru wetland area of North-eastern, Jigawa State (Akinsola, 2000). Typha, a local invasive, is perceived to have established itself because of the recent changes in water regime in the basin from seasonal to all-year-round flows (caused by dry season dam releases), making traditional water level

manipulation for farming purposes very difficult (UNOPS, 2014). It is a deep rooted perennial weed widely distributed throughout the tropics and subtropical regions. It occurs naturally in swamps and marshy areas and also irrigation channel where it may seriously impede the flow of water during irrigation season. Cattails are among the most common and easily identified water loving plants.

Most of the communities along Hadejia River are currently embattled with proliferation of Typha grass which is colonizing most importantly irrigated lands, ponds, grazing lands, river siltation aided by the grass (Sabo *et al*., 2010). The plant produces vast quantities of long lived and persistent seeds which can rejuvenate even after some dry spans, this, re-emergence of Typha is very rapid after each removal (Gomse *et al.*, 2003).This phenomenon makes the spread of this weed fast and difficult to control. Out of the 10,000km^2 Hadejia river basin within Jigawa State, 1,000km^2 are exposed to temporary flooding and siltation with serious ecological repercussion and detrimental economic and social impact (Sabo *et al*., 2010). The course of the annual flood seem to lie on the blockage channels by typha grass, growing rapidly and taking over farm lands, fishing ponds, channels, reservoirs in Hadejia and Nguru, Yobe State (Gomse *et al*., 2003).

1.2 Problem Statement

Typha grass invasion is a serious threat to the sustainability of the whole farming household. Over 80% of the main cannal and other water distributor channels were overtaken by this type of weed, thereby blocking the free flow of water in the irrigation fields.Hadejia-Nguru Wetlands (HNWs) in Jigawa and Yobe States are currently embattled with proliferation of an invasive Typha grass which is colonizing land, river

channels and reservoirs, causing blockages, by the grass and siltation aided by the grass. The people are currently living in abject poverty and apprehension in fear of what to do next. Some communities are planning to migrate to either Niger Republic or Chad following what they regard to as the failure of the government to rescue their farm lands from invasion by Typha grass which they describe as the most dreadful threat to their resources of livelihood (Sabo *et al* 2010).

Twenty years ago, waters of the River Hadejia and Jama'are seasonally flooded by their intricate network of smaller river channels, providing fish pond and *fadama* in abundance as productive resources for fishermen, farmers and livestock rearers. It is on record that fish catches from Hadejia-Nguru wetlands contributed about 6% of the annual national income of inland fish sales in Nigeria. Today, it provides only 0.6%,cultivation of wheat, maize and vegetables brought local *fadama* farmers an average income of nearly ₦10000 per season, a decade ago, but now bring barely ₦2000, even after investment in *fadama* development technology. Rice production, which rapidly expanded in the wetlands during the mid-90s as a lucrative form of dry season recession farming, has dwindled in recent years to invisibility (Sabo *et al.,* 2010).

Hadejia-Nguru area supports about 1.5 million farmers, herders and fishermen, who also gather wild products. Flood rice, irrigated onions and pepper from the wetlands are sold in national markets. Over 300,000 cattle spend the peak of the dry season there whereas 6% of Nigeria's inland fresh water fish catch is from there. The water in the wider basin is most important for drinking and agriculture, and is shared with the Niger Republic(UNOPS, 2014).

However, the extent of Typha invasion in Hadejia-Nguru has undergone an exponential increase in the past 5-10 years, accompanied and exacerbated by increased silting of channels caused by the slow all-year-round flows. Smaller river channels and ponds have become shallower and are now blocked by Silt and/or Typha, inundating normally seasonal floodplains. This has enabled Typha to spread into prime wetlands farmlands, grazing areas and fish-ponds, impacting negatively on local agricultural production – to the extent that a sizable proportion of the local population have been forced to out-migrate seasonally or permanently to pursue their livelihoods. In addition, some villages were forced to relocate into upland areas due to Typha induced flooding. To put this in perspective, Typha invasion of the HNWs has increased from 550ha to over 200sqkm in the last 5 years(UNOPS, 2014).

Overall in the Hadejia-Nguru Wetlands (HNWs), Typha has colonised over 200sqkm. The local people view it as an extremely negative attribute of wetlands, because it diverts flows, expands floodplains, colonises farmland, grazing land and fish ponds, and harbours destructive Quelea birds and water-bourne diseases. Several communities have been clearing Typha especially in the channels that supply them with irrigation water for the past ten years. On a small scale this has been ineffective when it is uncoordinated and not based on any scientific understanding of the species. Available evidence indicates that it is better to clear it wholesale, cut it below water or dig it out, and to cultivate *fadamas* (seasonally flooded areas) abutting channels so that farmers clear it regularly along with other weeds. It also helps if the channels are kept dry for a few months every year. For the past three years the communities have facilitated and co-ordinated clearance work along the channels – manual and mechanical – based to some extent on these principles. This has been successful in partially restoring flows

and reducing inundation of floodplains, but is not sustainable without upstream water management to proportion seasonal flows and control seasonal flood patterns between channels to facilitate regular drying out and reflooding of channels.

The economy and ecology of the people living in Hadejia-Nguru wet land are threatened with proliferation of an invasive Typha grass which is colonizing most irrigated lands. People in the area are currently living in poverty, because, the presence of the weed in the area has markedly interfere with the utilization of water and land resources. This weed inhibits agricultural activities which is the primary occupation of the inhabitants. Consequently, there is loss of farm lands, fish as well as grazinglands. These invasive aquatic plants reduce the flow of water in the irrigation canals by reducing the available space and acceleration of frictional resistance to the flow, thus expediting a sedimentation process in the infrastructures. Fisheries are threatened and rice paddies, which depend on a good irrigation system is successively invaded reducing the agricultural yield (Sabo *et al*. 2010). The need to investigate the effect of this grass on the livelihood of people living in this area becomes prominent. The need to carry out this research work stems from the fact that the plant (Typha) presence in the wetland has interfered markedly with the utilization of water and land resources. This inhibits the development and expansion of agriculture which is the primary occupation of the inhabitants.

From the foregoing, it become imperative to investigate the level which this grass affect livelihood of the people of the area, because assessing the effect of this grass will give a clear understanding of the damages and constraints to wellbeing of people.Consequently this study answer the following research questions.

(i) What are the socio-economic characteristics of farmers living in the study area?

(ii) What are the livelihoods activities engaged in by the farmers?

(iii) What are the factors influencing farmers' livelihood activities?

(iv) What is the extent of land cover by Typha grass in the study area?

(v) What is the effect of Typha grass infestation on the livelihood of farmers living in the area?

(vi) What are the copping strategies employed by the farmers against Typha grass invasion?

1. 3 Objectives of the study

The broad objective of this study was to evaluate the effect of Typha grass on the livelihood of the farmers living in the study area. The specific objectives were to:

(i) describe the socio-economic characteristics of farmers living in the study area;

(ii) describe the livelihoods activities (farm and non-farm activities) engaged in by the farmers;

(iii) determine factors influencing farmers livelihood activities;

(iv) describe the extent of land cover by Typha grass in the study area;

(v) evaluate the effect of Typha grass on the livelihood of farmers living in the study area;

(vi) describe the copping strategies employed by the farmers against Typha grass invasion.

1.4 Justification of the Study

The flood-plains along Hadejia River used to produce an agricultural surplus in most years (particularly of rice and vegetables) and support a substantial population at relatively high levels of nutrition and income. Floodplains provide a vital element in the pastoral economies of Fulani who move into them in search of grazing in the dry season. The area also facilitates and supports the productive economy over an area beyond its own borders and is important elements within both the local and national economies. However, the presence of large quantities of Typha grass has posed a lot of challenge to the people of the area as it reduces their farmland and the impact of blockage caused by Typha grass has resulted in reduced flow of water in the area. This study will raise awareness on issues relating to management of this environment and in particular land and water resources amongst a variety of groups. This include the present wetland inhabitants, people living upstream of the wetlands and all levels of decision-makers ranging from local, state and Federal government.

Many households undertake unsustainable activities due to a lack of viable options and ignorance of the implications of their actions. The same applies to policy makers who influence livelihood decisions. The study will present the current level of various activities by the people living in the area which will further present the consequences of the ongoing activities, wise use options with respect to sustainability of the wetlands. It is envisaged that this study will generate useful information for the Non-Governmental Organisation (NGO's) who are currently raising awareness of the people in communal efforts towards solving this problem in the area. The study will also presents the current livelihood status of the farmers in the study area which will update the governmental agencies such as Federal Ministry of Water Resources, Hedejia River Basin

Development Authority and Jigawa State Ministry of Environment thereby stimulating their efforts towards the rescue of this area and restoring the potential opportunities for local and national economy.

Furthermore, wise use of the wetlands of the Hadejia-Nguru wetlands demands a proper understanding of the environmental and socio-economic changes that are occurring and of those that may be predicted. Understanding of the effect of Typha grass on livelihood of the people would assist in future prediction. However, without such understanding and prediction, effective planning and management may be impossible.

1.5 Research Hypotheses

The following null hypotheses were tested:

(i) There is no significant relationship between livelihood activities and socio-economic characteristics of the farmers in the study area.

(ii) Typha grass infestation has no significant effect on farmers' livelihood

CHAPTER TWO

LITERATURE REVIEW

2.1Origin and Distribution of Typha grass

Typha derives its name from a Greek word typhein; denoting to smoke or to emit smoke, or wither spikes for maintaining smoky fires or smoky brown colour of the fruiting spikes (Anon, 2005; Anon, 2006). Cat-tails as one of the species of *Typha* got their names from their brown cylindrical flower spikes which is more than 1 ft long. The *Typha* family, represented worldwide by genus *Typha.* The weed is a perennial aquatic herb with cosmopolitan distribution in freshwater habitat. It is an erect, perennial freshwater aquatic herb that can grow two or more meters in height (Bender, 2003). The *Typha* family has higher growth rate than any other aquatic plant. Growth seemed to occur by establishment of disjunctive colonies, perhaps by seed reproduction, and by expansion of existing colonies. Ninetyeight vegetative shoots and 104 crown buds are produced on single greenhouse grown cat-tail seedling in the first year. The family is characterized by having rhizomes, extensive fleshy stems, tall, leaf blades, strap-like, stifle, spiraling in top half, sheathed together at base to appear "flattened". The weed is inflorescence spike like, densely packed with tiny male flowers in top cluster, and female flowers in bottom cluster. The fruits are hairy and about 5-8mm long.

Typha plant can produce 1.7 X 107 pollen grains and 20,000-700,000 seeds (Bender, 2003). *Typha* weed is widely distributed in waterlogged areas along irrigated or drainage channels, threatening to impede the flow of water and indirectly increases water evaporation through the plant weed evapotranspiration. *Typha* was reported to be a weed that is hard to be eradicated from irrigated canals and ditches (Mahmood, 2005).

The plant is highly competitive and prolific aquatic plant with ability to quickly colonize and establish open sites. The dispersal ability of the weed increases the chances of the seed to be disseminated to newly colonized sites. When germination requirements for the weed are not favorable, the seeds remain in the seed bank for 70 years without losing viability. After germination, new plant rapidly produces large rhizomes from which ramet grows very quickly. The ability of the weed to withstand conditions unfavorable to its competitors (like saline condition) also makes it to compete favorably better than other aquatic flora**.**

Typha species have been utilized in numerous ways worldwide: leaves are used for dwellings (walls, roof thatch, and floor coverings), mats weaving, basket, and handcrafts for covering chairs, stuffing pillows, mattresses, life preservers, toys and diapers. *Typha* is valuable as habitat and food for many kinds of wildlife. *Typha* leaves and stems have been used as sources of pulp, paper and fiber (Mahmood, 2005). InMinnesota (USA), *Typha* is considered as bio-energy crop (Dubbe *et al.*, 1988).

Ointment manufacturedfrom cat- tail has also been use fortreatment of snake bites and measles.Pollen grains of *Typha spp* was attributed toposses the function of homeostasis andoften prescribed in the treatment of bleedingof various origin such as nose bleeding,haematemesis, haematuria, uterine bleedingand dysmonorrhoe as well as haemostatic.It’s also used as desiccant and vulnerary inexternal injuries in traditional Chinesemedicine.

The four species found in North America, *Typha angustifolia* L., *Typha latifolia* L., *Typha* x *glauca* Godr.,and *Typha domingensis* Pers. are all characterized by narrow, blade-like, leaves that are sheathed at the base. The leaves are often between 1-3 m in

length, with one terminal cylindrical inflorescence per shoot on which both staminate (above) and pistillate (below) flowers are found.

Inflorescence spikes are varying widths, but are generally dark brown to green, with deciduous staminate flowers. Seeds are wind dispersed and germinate on saturated soil or under shallow water. *T. angustifolia* (narrow leaved cattail) has leaves that grow to a height of 1-1.5m and are 3-8 mm wide. The leaves are often much taller than the inflorescence, and are strongly convex on the back (Beal 1977). Like all *Typha* species, it has a spike-like terminal inflorescence. However, it can be distinguished by a space of 1-8 cm between the staminate and pistillate flowers. The pistillate portion of the spike is generally 10-20 cm long and 8-15 mm thick at maturity and is dark brown to reddish brown. *T. domingensis* (southern cattail) is slightly taller than *T. angustifolia* at 2-3 m, with more numerous leaves. The leaves are generally 6-15 mm wide and are slightly convex on the back. The inflorescence is as tall as or slightly taller than the leaves. The staminate and pistillate spikes are generally separated as in *T. angustifolia,* however the pistillate flowers are lighter brown in color than *T. angustifolia* (Beal, 1977).

T. latifolia (common cattail) is characterized as having taller (2-3 m) and wider (5-24 mm) leaves than the other species. Leaves are flat and generally exceed the inflorescence in height. The staminate and pistillate spikes are contiguous. The pistillate spike is 2.5 cm thick at maturity, and ranges in height from 5 to 20 cm (Beal, 1997).*T.* x *glauca* is the hybrid of *T. angustifolia* and *T. latifolia*. It generally has intermediate morphology between both parent species. The leaves are 1-3.5 m tall, 7-10mm wide, and moderately convex on the back (Beal 1977). The staminate and pistillate flowers are usually separate, with the pistillate spike up to 50 cm long and 1.6-2 cm in diameter (Beal, 1977). Many studies have attempted to determine if *T.* x *glauca* can be readily

distinguished from *T. angustifolia* and *T. latifolia* based on morphological characteristics (McManus *et al*., 2002, Kuehn and White 1999).

However, it appears that the overlap of morphologies is such that a definitive identification cannot be made without genetic analysis (Kuehn and White, 1999). *T. latifolia* is the most common cattail in North America, and is found throughout the United States (Beal, 1977). It is confined to shallow water, generally less than 0.5 m (Grace and Wetzel, 1998), and is only found in freshwater. It is currently under debate whether or not *T. angustifolia* is native to North America or was introduced by European settlers, as has been suggested by (Stuckey and Salamon 1987), until the early 19th century *T. angustifolia* was found only in freshwater and brackish marshes of the Atlantic coastal plain (Finkelstein, 2003). Regardless of its origin it began to expand westward along with the increased development of roads and railways that occurred in the 1800's (Finkelstein 2003). It now extends across much of the United States. *T. angustifolia* is generally found in deeper water (0.5 to 1 m) than *T. latifolia* and is able to grow in both fresh and brackish water. The differentiation due to water depth between *T. angustifolia* and *T. latifolia* has been shown to persist for long periods of time, because *T. angustifolia* is unable to compete with *T. latifolia* in shallow water and is therefore relegated to deeper water (Grace and Wetzel 1998, Cronk and Fennessey 2001). *T.* x *glauca* is found in many areas where both parent species are present. It is often much less abundant than either parent species, but has been shown to out compete them in some nutrient enriched systems (Ellstrand and Schierenbeck, 2006). *T. domingensis* is found in the southern United States, and is common in the Everglades region of Florida. It was historically found in small patches throughout the Everglades

system, but in recent years has spread and now covers large portions of the Everglades (Stewart *et al.*, 1997).

Many *Typha* species have been shown to be invasive in disturbed environments.They are quick colonizers of sites that have undergone nutrient enrichment. This has been documented for *T. latifolia, T.* x *glauca,* and *T. domingensis* (Childers *et al*., 2003). The spread of *T. domingensis,* a competitive, high-nutrient status species, is thought to be related to increased nutrient enrichment due to agricultural practices within the Everglades watershed (Stewart *et al*., 1997, Richardson *et al*., 1999). The Everglades is a historically oligotrophic ecosystem characterized by *Cladium jamaicense* (Crantz) a stress tolerant low-nutrient status species, 1999); with *T. domingensis* found in small restricted patches (Childers *et al*., 2003). In a study by Miao and Sklar (1998) the life history characteristics and resource allocation in both *C. jamaicense* and *T domingensis* were analyzed. They found that *T. domingensis* is adapted to high resource availability, has high individual and population growth rates, short lifecycles, high propagule dispersal over large areas, and a rapid plastic response to changes in resource availability.

These characteristics allow it to quickly take advantage of high nutrient concentrations, allowing it to quickly establish itself during periodic pulses of high nutrient levels. This is consistent with a study showing that *T. domingensis* density increased more rapidly during typically wet years (Urban *et al*., 1993). It has been postulated that the addition of nutrients alone may not be the main factor in *T. domingensis* expansion in the Everglades, the alteration of the hydroperiod through water conservation projects may also be a major factor in allowing *T. domingensis* to expand its range (Stewart *et al*.

1997). Other *Typha* species have also been documented as invasives in nutrient enriched systems. *T.* x *glauca* has formed monotypic stands in natural wetlands previouslydominated by *Carex* (Woo and Zedler, 2002) and invaded restored prairie pothole wetlands influenced by agricultural runoff (Green and Galatowitsch, 2001). *T. Latifolia* has also been documented as an invasive in created, restored, and nutrient enriched systems (Mitsch and Gosselink, 2001). It has been shown in mesocosm experiments to outcompete *Schoenoplectus tabernaemontani* under conditions of both nitrogen and phosphorus enrichment (Svengsouk and Mitsch, 2001).

Hybridization can also facilitate invasion, as hybrids are often able to exploit environments in which neither of the parent species are able to thrive (Ellsatrand and Schierenbeck, 2000). *T.* x *glauca*, the hybrid species produced from *T. latifolia* and *T. angustifolia*, has been reported to be equal or dominant to both parent species at some sites. It seems to be able to exploit ecosystem disturbances in much the same way as the parent species. There have not to my knowledge been any studies illustrating *T.* x *glauca* directly outcompeting either parent species, however its ability to establish itself in habitats already dominated by *T. latifolia* and *T. angustifolia* indicate that it is able to compete with both parent species to some extent.

2.2 Effect of Typha Grass on Farmers Livelihoods in Hadejia-Nguru

Many researches conducted on the socio-economic impact of Typha grass have indicated that, Typha infestation prevents easy and safe withdrawal of water from the river. Such stands also provide a congenital habitat for snakes and a breeding ground for mosquito that transmit malaria. It is also the home of poisonous reptiles and quella birds; hence the local the local population is fearful of these dangers.

Sabo *et al*. (2010) in their work reported that, there is reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetables in all the areas. Many farmers in the area reported that before the emergence of Typha grass, they harvested 200bags of rice from 10ha and now only 45-55 bags are obtained from the same piece of land. Typha grass has taken over farmlands which consequently led to the reduction in harvest from farmlands.

The effect of blockage caused by Typha grass has resulted in reduced flow of water in the area. This has consequently resulted in reduction of fish catch in the area. The average fish catch per day has reduced from 3-4 basins (worth over ₦1,000 per day) to just half basin of catch per day. Also, most people in the area reported that there is reduction in fish species. Moreover, fishermen in the area revealed that, though quantity of fish catch has, the size of the fish is bigger when compared with the size before the emergence of Typha, this might probably because, Typha grass provides hiding ground for fish (Sabo *et al*., 2010).

Typha grass harbours birds, snakes and mosquitoes. More than 30% of cereal crops by the communities are consumed by quella bird. In most of the villages, many people spend the day in the farm scaring away birds. Farmers in the area reported that during 2007 season they recorded less than a quarter of the expected harvest and they attributed this to quella birds invading their farms. There are few species recongnized as prolific and invasive in the animal world, the most commonly mentioned being locusts and grasshoppers. *Quella quella* of which there have been large populations these past few years. The proliferation of this species is often associated with the development of

Typha austrails which provides them with an ideal medium for protection and reproduction. Uchytil (1992) reported that edges Typha grass areas are occasionally used for nesting habitat for snowy egrets, black crowned night herons and yellow headed black birds. Also, upland songbirds use fluff from the flowers to line their nests. A few species such as deer use the stands for escape cover. Farmers in the area are suffering from lack of irrigation water due to blockage of main channels distributing water to their farms. They are also facing serious all year round flooding during rainy season all as a result of blockage by Typha grass and siltation aided by the grass. This also similar to what was reported by Haruna (2006) that, excessive flooding caused by blockage of river channels and siltation has led to adverse consequences of flow productivity of crops particularly rice. JEWEL (2004), added that, in some cases more than 90% of lands hitherto used for cultivation an grazing have been overtaken by flood.

Typha invasive may deplete soil nitrates with resultant poor crop yields which will require the use of artificial fertilizers and pesticides. If these chemicals are added in excessive quantities, however, they percolate into the ground water supplies, flow into streams and rivers and trapped by Typha grass. This may have effects on aquatic and marine life ecosystems and may lead to public health problems when the water is used for drinking and irrigation (Sabo *et al*., 2010).

Effect of Typha grass on Farmers Livelihoods in Hadejia-Nguru

Effect of Typha grass on Farmers Livelihoods in Hadejia-Nguru

2.3 Typha Grass Control Measures

In some developing countries of the world,two major methods are used to control*Typha species*; these include mechanicaland chemical control measures. Thisfindings is in accordance with Rao (2004)that individual farmers along the drainsmake efforts to reduce the weedmechanically by slashing the weeds to cleartheir farms and main canals, which wasfound to be labour intensive**.** However themethod does not provide long term controlmeasure. This is because after clearing theirrigation canals, the *Typha* stems andseeds were left on the shoulders of thecanal through which seeds germinate andthe stems sprout and easily gets their wayinto the canal again. Some informantinterviewed also affirmed that lands aresometimes recovered from *Typha* by cuttingand at the same time flooding the area.

Cutting *Typh*a stems below water surfacewas another mechanical control methodfound to prevent oxygen transportationbetween stems, rhizome and roots. Underthis condition, the decompose *typha* plantincrease the production of ethanol whichconsequently leads to the death anddecaying of plant materials. Sharma andKushwaha (1990) further reported thatcutting *Typha* shoots decreased thebiomass of above ground organs, leaf areaand total chlorophyll content. Anothermechanical control method whereaccessible, includes employment of physicalforces to remove all the aquatic weedsincluding *typha* from the environment toavoid establishment and survival of any typeof weeds. This method include dredging,drying, mowing, manual clearing, chaining,burning, cutting and slashing when the seedhead is still green.. Repeated slashing isnecessary to maintain controlling of theweeds as single slashing will not kill the*Typha species.* Covering cat -tail with blackpolyethylene tarps have been reported as apossible measures of *Typha* control(Bender, 2003). Actively growing cat -tail tipswere killed

when completely covered withpolythene tarps for at least 60 days.Cattle rearers sometimes burn the existing*Typha* plant purposely to have access towater and this act further stimulate growth ofthe plant which is later fed by the animals.

Using Fire to control cat-tails Typha rootoffered only remedial control measurebecause fire set on Typha weed burn onlythe above ground biomass while the rootsremain underground (Bender, 2003).

Another method used in the control of Typhaweed include the use of chemicals,however, most of the respondentsexpressed doubt on the use of herbicide tocontrol *Tyhpha,* due to the fact that thewater in which the *typha* plant grows is alsoused for in feeding animals by the herdsmenand also for domestic activities. The fear ofthe respondents is also based on thepossible phytotoxic effect of the herbicideactive ingredient on the people and theiranimals.

In the chemical control method variousherbicides are recommended for differentsituations considering the intended use ofthe water before deciding which treatment touse. Dalapon and Amitrol – t is effective on*Typha species* growing on ditch banks. It isapplied at 2% concentration with sprayvolume of 1000 to 2000 L ha-1. Addition of awetting agent at 0.06% concentrationensures better control of *Typha*. Dalapon(25-30kg ha-1) in combination with 30 Ldiesel and 1kg detergent, amitrole (8kg ha-1,paraquat (1.2-1.6kg ha-1). Dalapon +amitrole (15+3kg ha-1) and amitrol + TCA(5+ 10kg ha-1) are very effective. Paraguatgives fast top kill but heavy regrowth starts2-3 month after spring. Other chemicalsapplied are (1) Glyposate, being veryeffective on rhizomatous perennial weed like*Typha spp*, *Phragmites austrails* (reed),*Lythrum spp* (100 sestrife) and weeds thatinfest banks of irrigation canals

anddrainage ditches. It is a post emergenceherbicide applied on the weeds, at 10-40mlformulation (41% ai) water, depending onthe need. Simazine or diuron used as preemergenceherbicide on ditch and drainage,channels to prevent seed germination.

Another method of controlling that gainedrecognition is the biological method thatinvolves use of fish, snails, fungi, insectsand mammals that feed on aquaticvegetation. Insectsuch *Arzama spp*(boring-moth larva) entirely eliminate *Typha*plant. Mowing of *Typha* and planting of paragrass (Brachiaria mutica) reduced *Typha*population by 94.7% (Mahmood, 2005).Para grass was found to be highlycompetitive weed specie which whenestablished completely cover *Typha* plantdisallowing it having access to solarradiation. *Typha* population was found tohave vanished 5 months after planting Paragrass in Typha populated environment.

2.2 Importance of wetland to rural livelihood

Wetlands are important especially for the biological, hydrological, economic, socio-cultural and aesthetic roles they play in the environment. Terer *et al.*(2004) observed that in the world over, rivers, lakes, seas, oceans and the plants and animals associated with them are important to every culture on earth and form an explicit or implicit part of the religious and cultural heritage of almost all human cultures. Their rich physical and biological resources are exploited for food, water, medicinal plants, fuel wood, materials for building and handcrafts (Terer *et al.,* 2004).

Interactions among wetland characteristics, structure and processes result in the performance of functions, which are not of economic nature but provide a flow of goods and services which are valued by society. Wetlands provide populations with numerous

goods and services that have a significant economic value, not only to the local population living in its periphery, but also to communities living outside the wetland area. Examples of valuable wetland goods are fish, reeds and papyrus, birds and wild animals and fresh water. The staple diet of 3 billion people, half the world's population, is rice, which grows in wetlands in many parts of the world (Schuyt and Brander, 2004). In addition, wetlands provide a nursery habitat for many commercially important fish species that are harvested outside the wetland.

Tejuoso, (2006) reported that each wetland is composed of a number of physical, biological and chemical components such as soils, water, plants and animal species, and nutrients which yields benefits, which are of direct use value to humans. Many wetlands are being directly exploited to support human livelihoods. Processes among and within these wetland components allow the wetland to perform certain functions such as flood control, shoreline stabilization, water purification, and general products such as wildlife, fisheries and forest resources. In addition, there are ecosystem scale attributes such as biological diversity and cultural uniqueness/heritage that have value, either because they induce certain uses, or because they are valued themselves.

Ecosystems have limited resilience and have a carrying capacity, which is the maximum stress that it is capable of absorbing without changing into a vastly different state. Secondly, biodiversity provides the ecosystem with its functional properties and resilience (Hulme, 2005). Thus, due to its carrying capacity and biodiversity, ecosystems change and evolve continually. One of the world's most important natural resource is consumed in an unsustainable manner to the extent that their continuous existence may not be guaranteed for the future generations (Barbier *et al.*, 1997). The

situation is not different in Nigeria as one of its most important wetland, the Hadejia-Nguru Wetlands in Jigawa and Yobe states respectively, have shrunk by as much as two-thirds in the past 30-40 years because of diversions from dams, irrigation developments and drought. Fisheries, farming and wildlife are all impacted by these hydrological changes (Idris, 2008). As people increasingly reclaim wetlands or distort the ecosystem balance, coupled with population increase, such problems are bound to worsen because the people may not be aware of the effect of their activities on the agro-ecological value of the wetland. Nevertheless, wetlands can be sustainably exploited if the dynamics of the local institutions that influence accumulation and consumption of livelihood assets are well understood and harnessed appropriately, because conversion of wetlands is influenced by households' asset position and shocks which, under an appropriate and sustainable management regime, can generate a flow of useful functions such as nutrient purification, ground water buffering and biodiversity (Gren *et al.,* 1994*)*. The life support systems that areinherent within the wetland ecosystems can provide a wide range of valuable functions tosociety if they are used in a sustainable manner, for example, by incorporating the primaryusers in the management of the wetlands within the context of societal livelihoods and localinstitutions (Folke, 1991).

The wetlands are nationally and internationally important for migratory waterfowl. The wetlands support extensive wet-season rice farming, flood-recession agriculture and dry-season irrigation. The flood plain also supports large numbers of fishing people, most of whom also farm, and is grazed by very substantial numbers of Fulani livestock, particularly cattle, which are brought in from both north and south in the dry season. There is also an important dispatch from the wetlands of fuelwood and fodder for horses. In the past, much of the rice, as well as fish and birds, was traded out of the area.

This has changed, but there is now a strong export of other agricultural products, for example peppers, wheat and fuelwood. The economic value of production from the wetlands is very large, many times greater than that of all the irrigation schemes for which the inflowing rivers are dammed, diverted and their waters used. There are natural changes, for example the impacts of drought, that have serious implications for the future of the wetlands and the sustainability of their production systems (FAO, 2014).

People increasingly reclaim wetlands for construction purposes (houses, industries roads) andalso to sustain livelihood, thus, the wetland resource is degrading at a very fast rate. Theinability to place a monetary value on wetland has been identified as one of the reasons whyboth public and government do not value the wetland. Hence, there is a need to quantify thevalue of wetlands in order to come up with strategies for income generation, food security andenvironmental sustainability (Odine *et al.*, 2011).

In Nigeria, wetland comprises inland swamp, mangrove and fresh water swamp and shallowto deep water *fadama* (Ayotade and Fagade, 1980). Assessing the spatial distribution ofNigerian wetland, Kio and Ola-adams (1986) reported that the wetlands are scattered and in packets, covering over 24,009km. The important wetlands available in Nigeria, areHydejia and kirikasama, Lake Chad, Komduge, Yobe, Kanji Lake, Baturiya, Adiami-Nguru floodplains, Matgadru-Kabok floodplains, the Niger-delta flood plains and the coaster lagoons near Lagos and D`elta of Cross river. The Coaster saline wetlands (mangrove) ofNigeria are Niger River which is 249,885. hectares, claiming 71.9% of Nigerian wetlands,Cross river estuary, Imo River and Qua Iboec

river estuary occupies 38,475.0and 14,580.0 hectares, occupying 11.09% and 4.2% of Nigerian wetland respectively. In addition to these wetlands, other un-prominent ones occupy 44,500.0 hectares. It was also reported that all Nigerian saline wetlands occupy 307,395 hectares. Moreover, The Fresh wetlands are Niger delta, Niger River, Benue River, Cross River and Imo River, Ogun-Osun River, and Lake Chad occupying 47,668.5; 3,300.9; 98,010; 101,250 and 10,530;153,900; 22,275 hectares respectively (NEST,1991) A total of 2,988,000 hectares ofNigerian lands are wetland. The freshwater swamp and mangrove portion of the wetland is estimated to be 2,130,000 and 858,000 hectares respectively put together they are yet enough (Ojekunle, 2011).

2.4 Invasive Wetland by Plants

Invasive species are populations that establish, proliferate, and persist in a new or expanded range to the detriment of the endemic community (Zedler and Kercher, 2004). Invasive species can include non-native species; hybrids, either between two native species or between a native and a non-native species; as well as native species (Mack *et al*., 2000). Invasiveness in both native and non-native wetland plants is often facilitated by anthropogenic changes in environmental conditions such as salinity, hydrologic flow, and nutrient availability (Ellstrand and Schierenbeck, 2006). Phosphorus enrichment from agricultural runoff in the Florida Everglades has lead to the expansion of *Typha domingensis* Pers. (southern cattail) dominated communities (Childers *et al*., 2003, Zedler and Kercher 2004). Hybridization can also facilitate invasion, as hybrids are often able to exploit environments in which neither of the parent species are able to thrive (Zedler and Kercher, 2004). This has been observed in many species, including *Typha* x *glauca* Godr. (cross between *Typha angustifolia* L. and *Typha latifolia* L.) (Ellstrand and Schierenbeck 2006), *Spartina angelica* C. E. Hubbard (cross between

Spartina alterniflora Loisel. and *Spartina maritima* M. A. Curtis) (Galatowitsch*et al.*, 1999), and the lineage created by the cross between *Lythrum salicaria* L. and *Lythrum alatum* Pursh (Ellstrand and Schierenbeck, 2006). Invasive plant species have the potential to alter large-scale ecological processes in wetlands (Galatowitsch *et al*., 1999). Monospecific stands of invasive plants not only decrease species richness, but can also lessen the ability of the system to filter out certain types of pollutants and nutrients (Ehrenfeld and Scott, 2001). Other ecosystem alterations include changes in geomorphological processes such as erosion and sedimentation rates, surface elevations, biogeochemical processes including nutrient mineralization and immobilization rates, and hydrological processes such as water table depth (Ehrenfeld and Scott, 2001, Engelhardt and Ritchie, 2001, Ehrenfeld, 2003). Other studies have also shown that invasive species can alter fire regimes by changing fuel properties and sometimes altering local microclimate and preventing regional successional patterns (Brooks *et al*., 2004). The impacts of invasive plant species on wetlands are often specific to the environmental conditions unique to each wetland ecosystem.

2.5 Concepts of Livelihood

According to the accepted definition originally developed by Chambers and Conway (1992): "A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with, and recover from, stresses and shocks and maintain or enhance its capabilities and assets, both now and in the future, while not undermining the natural resource base. Livelihoods are 'means of making a living', the various activities and resourcesthat allow people to live. Different people have different lifestyles and ways ofmeeting their needs. Households perform various activities to gain and maintaintheir livelihoods. The nature of these livelihood

activities depends on the availabilityof assets, resources (including climate), labour, skills, education, socialcapital, seasonality, agro-climate/agro-ecology, and gender (Pasteur, 2002; Ali, 2005;Okali, 2006; Porter *et al.*, 2007; Ogunlela and Mukthar, 2009; Akinwale, 2010).

Ellis (2000) defines livelihood as comprising the assets (natural, physical, human and socio capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household. Similarly, According to Babulo *et al*(2008), define livelihood as a set of economic activities involving self-employment, and or wage employment by using one's endowments (both human and maternal) to generate adequate resources for meeting the requirements of the self and household on a sustainable basis with dignity. The activity is usually carried out repeatedly for instance; a fisherman's livelihood depends on the availability and accessibility of fish. Chambers and Conway (1992) opined that livelihood comprises the capabilities assets activities required for means of living.

Frankenberg and McKesson (1998) viewed the concept of livelihood as the sustainable access to resources to meet basic needs including adequate access to food, portable water, health facilities, educational opportunities, housing, time for community participation and social integration. Dekker (2002) asserted that the current livelihood studies have concentrated on the actions and strategies of people trying to make a living in adverse circumstances such as economic and political adversity. He further Stated that he concept of livelihood is used mostly to address the issue of poverty that aims to be people oriented, non-sectional and grounded in multidimensional reality on daily life. This livelihood, according to Rahman *et al*. (2007) is broader than income; it includes

everything done to obtain a living from his forgoing rural livelihood could be explained as ability of rural households to judiciously utilize resources at their disposal by engaging in activities that enables them make a living. In essence, livelihood in this respect may be looked at in terms of quality of life, level of living o way of life. Key concepts that repeatedly feature in explaining rural livelihoods are further explained. These include livelihood assets (resources) livelihood activities, livelihood strategies, sustainable livelihoods and livelihood outcomes. Babulo *et al.*(2008) regarded livelihood assets as comprising both human and non-human resources upon which livelihood are built and to which people need access.

Livelihood strategies according to Babulo *et al*. (2008) can be regarded as the full portfolio of activities that people undertake in order to achieve their livelihood outcomes and objectives. Ellis (1998) in his own contribution, posited that livelihood strategy does not encompass only activities that generate income but many kind of choices, including cultural and social choices, that come together to make up the primary occupation of a household. Examples of such socio-cultural choices among rural households include migration of male heads of household in pursuit of better livelihood, reliance on remittances, and pensions by retired members of households and resorting to indecent acts of begging and prostitution.Livelihood activities on the other hand are sets of actions of activities through which households gain their means of living. Parrot *et al*. (2006) divided livelihood activities into four categories namely:

- Production activities: those activities that produce goods and services that contributes to income (the value of goods and services that are actually or potentially tradable). Production activities involve integrating the classical economic classification of production factors- land, labour, and capital.

- Reproduction activities: these are sometimes called household maintenance activities, and are activities such as child care, cooking and cleaning. These are not generally tradable but are nevertheless essential for the well-being of household members and the reproduction of the conditions through which a family survives.

- Consumption activities: These activities can be seen as satisfying material wants and needs through the provision of items such as food, clothing or medical services etc.

- Exchange activities: relates to the transfer of goods and services or information between individuals. The activities include for example, commercial trade, barter, and gift giving. They do not necessarily involve cash or reciprocity. The exchange of goods and services is very often a significant and dynamic component of rural economies.

A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base (Chambers and Conway, 1992). The sustainable livelihoods idea was first introduced by the Brundland Commission on Environment and Development, and the 1992 United Nations Conference on Environment and Development expanded the concepts, advocating for the achievement of sustainable livelihoods as a broad goal for poverty eradication (Lasse, 2001). Chambers and Conway (1992) argued that such definitions must include the ability to avoid, more usually withstanding and recovering from stresses and shocks.

2.5.1 Strategies of livelihood enhancement

Rural livelihood is composed of the activities that generate the means of household survival and longer-term well-being. Livelihood strategies (LS) may be divided into natural resources based activities (e.g. collection and gathering, cultivation, livestock-keeping, weaving) and non-natural resource based activities (e.g. trade, services, remittances.) (Ellis, 2000). Means of livelihood referred to as production strategies which include income-earning activities, remittance, gift and loans. But LS are dynamic and widespread from which rural poor people are able to respond based on changing pressures and local opportunities that could be adapted accordingly (Ellis, 2000).

However , livelihood outcomes and goals vary and they are subject to changes: for example, in peaceful and politically stable situations, livelihood goals might include increased well-being or more income; whereas in times of crisis , people s goals might become focused on such short-term objectives as personal safety, food security, reduced vulnerability and survival (UNDP,1998).

2.5.2 Determinants of livelihood

According to Chambers and Conway (1992), there are numerous initial determinants of livelihood strategies (SL).Many livelihood are largely predetermined by accident of birth. Livelihood of this sort may be ascriptive: in village India, children may be born into caste with an assigned role as potters, shepherds, or washer people. Gender as socially defined is also a pervasive ascriptive determinants of livelihood activities or not necessarily ascriptively, a person may be born, socialized and apprenticed into inherited livelihood as a cultivator With land and tools, a pastoralist with animals, a forest dweller with trees, a fisherperson with boat and tackle, or a shopkeeper with shop and

stock; and each of these may in turn create a new household or households in the same occupation (Chambers and Conway, 1992).

Many livelihoods are also less singular or predetermined. Some people improvise livelihoods with degree of desperation, what they do being largely determined by the social, economic and ecological environment in which they find themselves. A person or household may also choose a livelihood, especially through education and migration. Those who are better off usually have a wider choice than those who are worse off, and a wider choice is usually generated by economic growth. In a future of accelerating change, adaptable capabilities to exploit new opportunities may be both more needed and more prevalent (Chambers and Conway 1992).

2.5.3 Household livelihood security concept

Robert Chambers and Gordon Conway (1992) proposed the following composite definition of a household rural livelihood (HLS), which is applied most commonly at the household level. A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term. Of the various components of a livelihood, the most complex is the portfolio of assets out of which people construct their living, which includes both tangible assets and resources, and intangible assets such as claims and access.

Any definition of livelihood security, Chambers and Conway (1992) argued, has to include the ability to avoid or more usually to withstand and recover from, such stresses and shocks. More recently the Institute for Development Studies (IDS) and the British Department for International Development (DFID) have been putting into operation the SL concept and approach. Leading proponent Scoones (1998), of IDS proposed a modified definition of HLS: A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A household livelihood is sustainable when it can cope with and recover from stresses and shocks maintain or enhance its capabilities and assets, while not undermining the natural resource base.

This new definition does not include the requirement that for household livelihoods to be considered sustainable they should also contribute net benefits to their livelihoods'. With some minor changes this is also the definition adopted by DFID. The IDS team also outlined a tentative framework to analyse sustainable household rural livelihoods. It has three elements: Livelihood resources, Livelihood strategies, and Institutional processes and Organizational structures. To understand the complex and differentiated processes through which livelihoods are constructed, Scoones (1998) , points out, it is insufficient just to analyse the different aspects; one must also analyse the institutional processes and organizational structures that link these various elements together.

To do this, it is essential that HLS analyses fully involve the local people to let their knowledge, perceptions, and interests be heard. The HLS Approach There is three insights into poverty which underpin this new approach. The first is the realization that while economic growth may be essential for poverty reduction, there is not an automatic

relationship between the two since it all depends on the capabilities of the poor to take advantage of expanding economic opportunities. Secondly, there is the realization that poverty — as conceived by the poor themselves — is not just a question of low income, but also includes other dimensions such as bad health, illiteracy, lack of social services, etc., as well as state of vulnerability and feelings of powerlessness in general.

Finally, it is now recognized that the poor themselves often know their situation and needs best and must therefore be involved in the design of policies and project intended to better their lot.

2.5.4 Challenges of livelihood enhancement

The present agrarian crisis has trapped the marginal and small farmers in a cycle of disadvantages. One disadvantage inevitably leads them to other disadvantages and the farmers become the mute victims of this "clusters of disadvantage" (Chambers, 1983). According to Chambers the poor households were caught up with 'five clusters of disadvantages, i.e. poverty, physical weakness, vulnerability, isolation and powerlessness'. He has also explained as to how these clusters were interlocked among themselves. This interlocking was termed as 'deprivation traps' (Chambers 1983).this livelihood insecurity reduces their bargaining power in all spheres of their life especially in the sphere of financial institutions and markets. This reduced bargaining power exposes them to vulnerabilities like poverty, malnutrition, increased debt etc. This, in turn leads to loss of entitlements creating increased livelihood insecurity and heightened powerlessness.

2.5.5 Relationship between agriculture, environment and rural livelihood

The relationship of agricultural production environment and rural livelihoods are somehow controversial among scholars, development planners and policy makers.The livelihood strategies of resource users, and hence the links between livelihoods and the environment, are conditioned by biophysical conditions (e.g., soil quality, length of growing period, pest and disease incidence, etc.) and socioeconomic factors (e.g., access to markets, policies, institutions, etc.). Studies of livelihood strategies have revealed that while the rural poor may have limited resources, they still have considerable capacity to adapt to environmental degradation, either to mitigate its effects on their livelihoods or to rehabilitate degraded resources. A wide variety of coping mechanisms has been identified to deal with environmental stress. Some of these responses imply further impoverishment, such as reducing consumption, depleting household resources (liquidating assets or taking out credit for immediate consumption), or moving (dividing the family or migrating). Still other strategies may offset the welfare effects of resource degradation, but without improving the natural resource base, such as hoarding (accumulating land and other assets), increasing off-farm employment, exploiting common property resources, and making claims on others (borrow or receive gifts, exploit kinship and friendship ties; exploit patron/client relationships, seek state support). Finally, some strategies both improve natural resources and reduce household poverty, by protecting and preserving the asset base, diversifying and improving on-farm production systems, or taking out credit to invest in future production or resource protection (Davies, 1996).

2.5.6 Extent of land cover by Typha grass

Most of the communities along Hadejia river are currently embattled with proliferation of Typha grass which is colonising most importantly irrigated lands, ponds, grazing lands, river channels, and reservoirs, causing blockages by the grass and siltation aided by the grass. The plant produces vast quantities of long lived and persistent seeds which can rejuvenate even after some dry spans, vast re-emergence of Typha is very rapid after each removal. These phenomenons make the separate of this weed fast and difficult to control.The cost of the annual flood seems to lie on the blockage of channels by Typha grass growing rapidly and taking over farmlands, fishing ponds, canals, reservoirs in Hadejia and Nguru Yobe State (Goms *et. al*, 2003).

Most of the areas covered by Typha falls within the critical areas that are best suitable for flood rise farming and recession farming. These are the margins of lakes and swamps with slow moving water where soils do not dry out completely. The grass colonised these areas very quickly due to the wide and the efficient dispersal occupations of the inhabitants.

CHAPTER THREE

THEORETICAL FRAMEWORK

Theory construction in social sciences has several objectives namely: it provides conceptual framework to facilitate the accurate observation and reliable description of social event, it formulates laws and theories by which social phenomenon can be explained.

3.1 Structural Functionalist Theory (Evolutionary)

Socio-cultural evolution can be defined as the process by which structural reorganization is affected through time, eventually producing a form or structure which is qualitatively different from the ancestral form (Korotayev, 2004). Theory of socio cultural evolution explains the differences between coeval societies, by positing that different societies have reached different stages of development. Evolutionary theory typically provides models for understanding the relationship between technologies, social structure or the values of a society. According to Auguste Comte, Herbert Spencer, Charles Darwin and Lewis Henry Morgan, stated that societies start out in a *primitive* state and gradually become more *civilized* over time, and equated the culture and technology of Western civilization with progress (Korotayev, 2004). According to Sztompka (2002), Socio cultural evolutionism formalize social thinking along scientific lines, if organisms could develop over time then it seemed reasonable that societies could as well. Both Spencer and Comte view the society as a kind of organism subject to the process of growth—from simplicity to complexity, from chaos to order, from generalization to specialization, from flexibility to organization. They agreed that the process of societies growth can be divided into certain stages, have their beginning and eventual end, and that this growth is in fact social progress: each newer, more-evolved society is "better" (Sztompka, 2002).

Auguste Comte, formulated the law of three stages: human development progresses from the *theological stage*, in which nature was mythically conceived and man sought the explanation of natural phenomena from supernatural beings, through *metaphysical stage* in which nature was conceived of as a result of obscure forces and man sought the explanation of natural phenomena from them until the final *positive stage* in which all abstract and obscure forces are discarded, and natural phenomena are explained by their constant relationship.For Comte, it was the science-valuing society that was the highest, most developed type of human organization (Sztompka, 2002). Herbert Spencer also argued that, societies should evolve toward more individual freedom (Wikipedia, 2014). He differentiated between two phases of development as regards societies' internal regulation: the primitive military and "industrial" societies. The primitive military society has the goal of conquest and defense, is centralized, economically self-sufficient, and collectivistic, puts the good of a group over the good of an individual, uses compulsion, force and repression, rewards loyalty, obedience and discipline. The industrial society, in contrast, has a goal of production and trade, is decentralized, interconnected with other societies via economic relations, works through voluntary cooperation and individual self-restraint, treats the good of individual as of the highest value, regulates the social life via voluntary relations; and values initiative, independence and innovation. The transition process from the military to industrial society is the outcome of steady evolutionary processes within the society (Sztompka, 2002).

3.2 Dependency Theory

The major factor preventing development, according to this dependency school, is the structural phenomenon of dependence whereby “the economy of certain countries is conditioned by the development and expansion of another economy to which the former is subjected”. According to this school of thought, underdevelopment is not simply a stage that pre-dates development, as the evolutionist scheme of the modernization theory states. Rather, underdevelopment is the historical consequence of dependence: poor countries are "underdeveloped" because they have been colonized by countries whose development and further enrichment is based on the pilferage of the former (Santos, 1971). The "classical" dependence entailed not only the extraction of mineral resources or the establishment of plantation economies that not only distort the economic and cultural lifestyles of the indigenous populations, but also the exploitation of the indigenous population's labour. In contradistinction to the increasing political and economic participation of the working-class in the "developed" Western societies, the working poor remains excluded from an enjoyment of economic gains and political participation in the dependent societies. The increasing economic participation of the Western working-classes responded to the logic of the need of an expanding consumer market. Wage increases translated there in a growth of the demand for consumer products. The logic of dependence, however, is outwardly oriented and precludes the expansion of the internal market. The interest of agricultural exporting businesses is to maintain the cost of production low. Because the market is outside -in the core countries- there is no point in encouraging an expansion of the domestic market in the form of higher wages. Therefore, development is impossible for a country whose economy is dependent upon the economy of a developed -or core- country. The dependency school insisted that the only way out of the periphery is by breaking away from a structure of dependence. Since the state is controlled by the upper classes in

periphery societies, and since those classes benefit with the maintenance of the structure of dependence, the reforms Prebisch and the developmentalists recommended in the form of state intervention would do little to foster development. The only way out of this structural stagnation that limits economic growth and socio-economic development is, for the dependency school, a revolution that would bring an end to private ownership of capital, and which would foster central planning of the economy: a socialist revolution (Reyes, 2010).

The perspective demonstrates that underdevelopment is not simply a state that pre-dates development, as the evolutionist scheme of the modernization theory states. Rather, underdevelopment is the historical consequence of dependence. Farmers in the study area "underdeveloped" because they depend on *fadama* recourses and now the *fadama* have been taken over by Typha grass and this have affected the livelihood of the people. Therefore this could be seen as an element of dependency theory.

3.3 Conceptual Model

A model is a general conception of a phenomenon (Haralambos and Holborn, 2008). Burt (1993) defined a conceptual model as simply an attempt to classify the major elements of an entity or phenomenon with regards to their functions and interrelationships in order to observe more closely causal relationships. The conceptual model that was used in this study borrows from a number of frameworks that have been used in analysing vulnerability and poverty (Smith *et al*., 2005; Hoddinott and Quisumbing, 2003).

The livelihood activities of the farmers depend greatly on the environment in which the household is operating, Smith *etal* (2005) noted that in rural communities the capacity

to resist poverty and improve livelihood upon depends on the opportunities offered natural resources based production system as conditioned by wider economic institutional and political environment. In this model livelihood activities could influence how household cope with shock as a result of Typha invasion. Shock are exogenous and they pass their effect to the household by affecting their livelihood strategies as noted by Hoddinott and Quisumbing, (2003) should the stock of the assets endowment and or the return to these endowment on human activities, a set of negative effect will thus be felt such as reduced production, poor health, insecurity, loss of capital, and post-harvest losses.

Depending on the assets the people have access to which defines livelihood activity opportunities, a household will then choose a set of coping strategies. Variations in household access to assets determine different capabilities to cope with crises (Smith *et al*., 2005). The net of the gain from coping strategies and the loss due to the negative shock, i.e. Typha grass in this case, then determines the final impact of the shock on household livelihood outcomes.

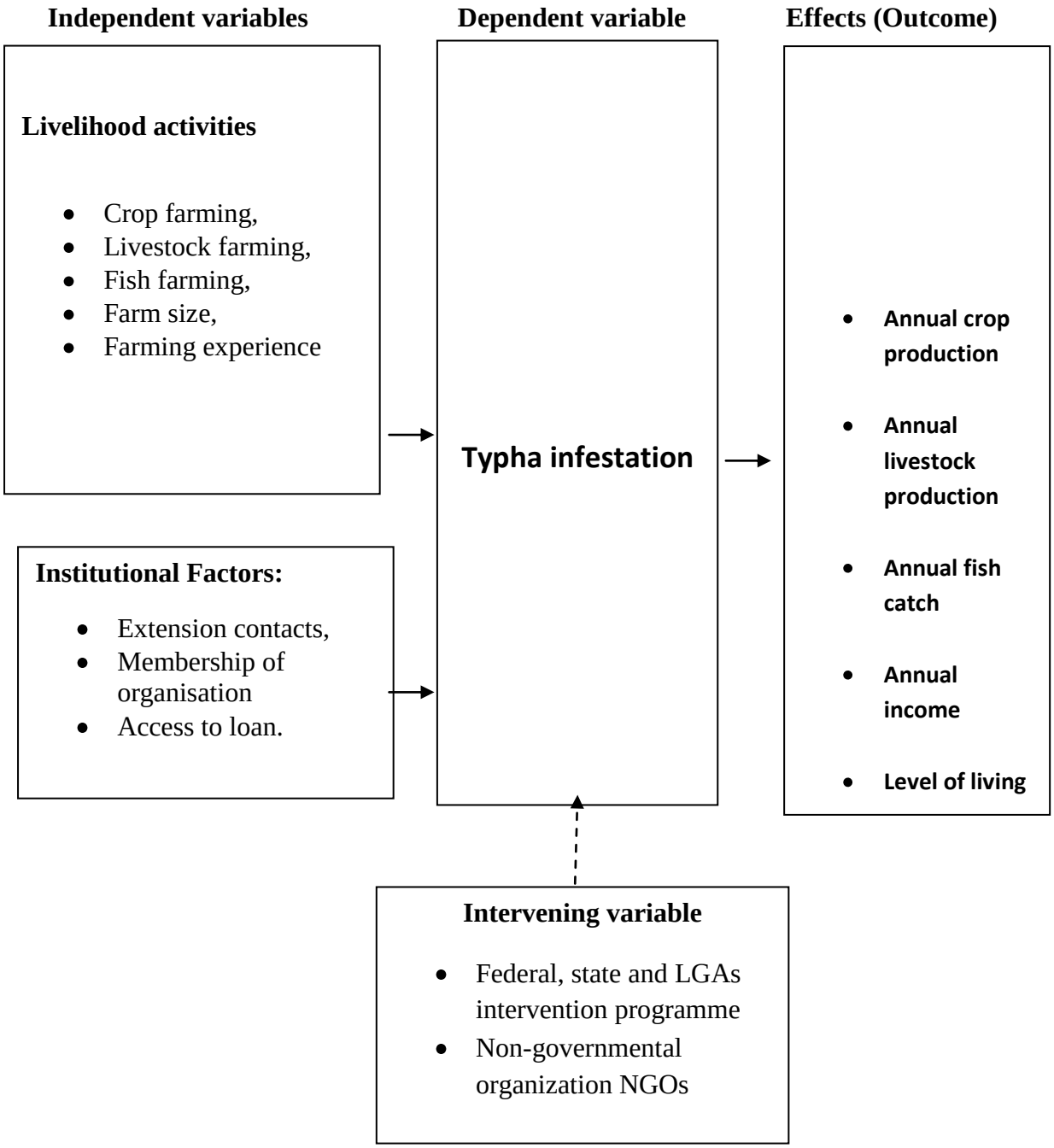

Figure 1: Conceptual model for analysing effect of Typha on livelihood of the farmers living within Hadejia-Nguru Conservation Project

CHAPTER FOUR

METHODOLOGY

4.1 Study Area

The Hadejia Nguru Wetlands (HNWs) are located in the Sahel zone of Northeastern Nigeria. Hadejia river basin is a 6,000km^2 large environment of low resilience, located between latitude 12^0 00 to 13^0 00N and longitude 10^0 00 to 10^0 35'E (Gomes *et al*., 2003). About 34% of the HNWs, comprise a component of the Chad Basin National Park. A Ramsar site and three forest/game reserves are legally protected. Laws protecting these areas are in place, but not effectively enforced. The remaining areas are under state controlled OpenArea-Protection status.

The area is a floodplain wetland comprising permanent water bodies and seasonally flooded areas. About 40% of the wetlands remain wet throughout the year, resulting in mats of *Echinochloa, Nymphae, Limnophyton* and Typha species at such sites, which constitute important feeding grounds for waterfowl(*Mitragyna spp),* Doum palm (*Hyphaene thebaica),* and Tamarinds *(Tamarindus indica*) are dominant among the larger plants of the area.

The Hadejia-Nguru Wetlands is part of the flood-plain of the Komadougou-Yobe river basin in the Lake Chad basin in the north-east of Nigeriaand are home to probably about a million people. The wetlands are formed where the waters of the Hadejia and Jama'are rivers meet the lines of ancient sand dunes aligned northeast to southwest. An area of confused drainage therefore is formed, with multiple river channels and a complex pattern of permanently and seasonally flooded land and dryland (FAO, 2014).

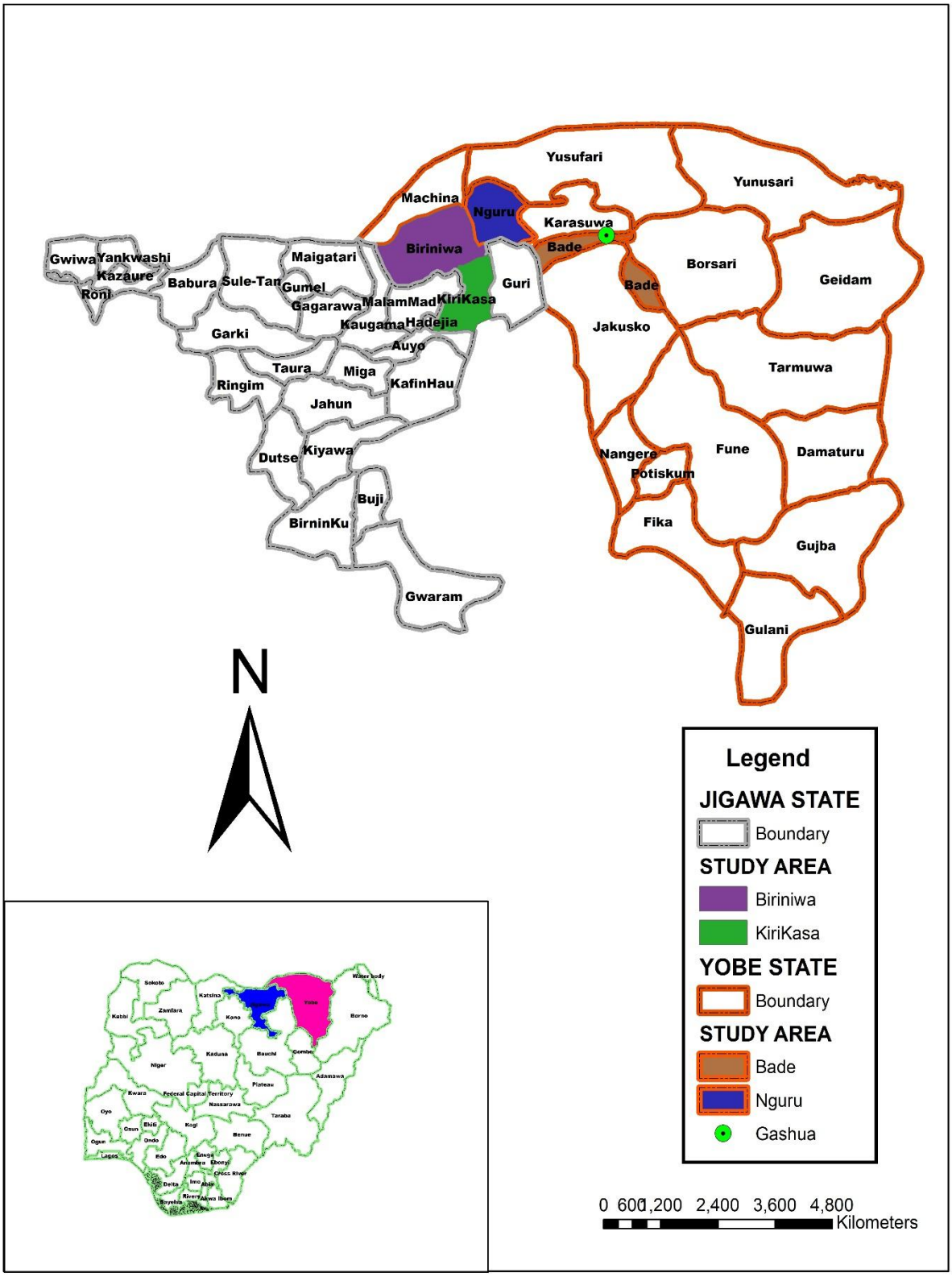

Fig. 2: Map of Jigawa and Yobe States Showing the Study Areas

Construction of a dam on the Hadejia river just above Hadejia town to provide short-term storage of water to irrigate the Hadejia Valley Project Phase 1 began, in the early 1980s, but was stopped for several years because of financial problems. The dam has created a large shallow lake upstream and it will probably have a major effect on the timing and extent of flooding in the wetlands.The 1988 flood at Hadejia was probably one of the largest for some years and it was augmented by the failure of the dam at Bagauda.The Hadejia-Nguru wetlands have long been known as a centre of fish production. Upstream hydrological developments induced by irrigation projects threaten to degrade this important resource. Studies of flood plain fisheries have shown that fish production is closely related to flood extent. The existing and planned dams upstream of the Hadejia-Nguru wetlands are likely to have a serious impact on fisheries.

The climate of the area is semi-arid which is dominated by the cyclical migration of theInter-Tropical Convergence Zone (ITCZ). It has a very heavy, intense convective storm with strong seasonal patterns of rainfall. Significant flows of water begin in late June or early July. Peak discharges characteristically occur in August. The intense nature of rainfall and the impermeability of the Basement Complex result in very rapid runoff. Therefore, hydrographs are extremely "flashy," responding to individual rainfall events. This natural pattern of runoff has been modifiedby the construction of largescale irrigation schemes and associated dams, most notably theKano River Irrigation Project (KRIP) and Tiga Dam. During the wet seasonextensive areas arecultivated with flood rice using simple bunds(*jinga* in Hausa).In the dry seasonthousands of farms usesmall pumps to irrigate lambu gardens.Lambu gardensare used to grow vegetableswhich are taken to markets far from the wetlands.The total annually cultivated area is around230,000 ha, 77,500 ha of dry season cultivation.

The area favours fishing at the beginning of the dry season when fish are returning to the areas of permanentwater, as an alternative to dry season cultivation.The intensity of fishing activity also variesbetween different water bodies.*Fadamas* may be fished intensely during the height ofthe wet season. Various fish traps are used, often in associationwith bunds especially built for the purpose.

4.2 Sampling procedure and Sample Size

A multi-stage sampling technique was used to select respondents for this study. The first stage involved random selection of four (4) Local Government Areas, two from each state by balloting. These Local Government Areas are Kirikasamma, Birniwa, Nguru, and Gashua. In the second stage two villages were randomly selected from each of the LGA. The third step involved simple random sampling of ten (10%) respondents from each of the LGAs to get a total of two hundred and fourty (240) respondents comprising of one hundred and fourty-seven Typha grass affected farmland (147) and ninety-three (93) non-affected Typha grass farmland.

Table 3.1: Distribution of sample size for the study

LGA	Villages	*Sampling frame of Typha grass area	Sample size	*Sampling frame of Non-Typha grass	Sample size
Kirikasama	Kirikasama	230	23	125	13
	Marma	170	17	108	11
Birniwa	Birniwa	195	20	122	12
	Kasabir	125	13	85	9
Nguru	Nguru	140	14	115	12
	Kakori	195	20	128	13
Gashua	Gashua	215	22	117	12
	Tagali	180	18	110	11
Total		**1470**	**147**		**93**

***Reconnaissance survey, 2014**

4.3 Method of Data collection

The study made use of primary data. Primary data were collected through the use of well-structured questionnaire administered to household heads using well trained enumerators. Focus group discussions with key informant was also conducted on the effect of Typha grass on the livelihood of the farmers. The type of information collected from respondents were paired ranked during the focus group discussion to ascertain the most critical effects of Typha. The data collected during the field survey include; socio-

economic characteristics such as age, gender, marital status, household size, farm size, income, access to credit, number of extension contacts, level of education of household heads and the household size. Also, data were collected on livelihood activities and effect of Typha grass on household livelihood.

For the focus group discussion 80 key informants were purposively selected. 20 people from each village (4 villages) comprising of 10 crop farmers and 10 fish farmers the selection was guided by study conducted by Sherraden (2001). The focus group discussion was held with farmers so that each farmer has opportunity to discuss the effect more freely and justified their importance in these villages. The focus group discussions were conducted by the researchers with the help of note takers.

Focus group discussions are an explanatory research tool a "structured group process" conducted for exploring peoples thought and feelings and obtaining the detailed information about a particular topic or issue (Sherriden, 2001). It has been shown that if focus group discussion is well managed it allows deep-seated feelings on subject to emerge naturally (Sherriden, 2001).

These method of data collection is useful as it helps the researcher to generate qualitative data (insight, into needs, expectations, attitudes, perceptions, beliefs, and feelings of participants), broaden the research field (Sherriden, 2001) surprise issues may emerge identifying key issues and providing clear expressive vignettes to support qualitative findings (Sherriden, 2001).

4.4. Analytical Techniques

Analytical tools that were used in this study are: descriptive statistics, multiple regression model and chow test statistics.

4.4.1 Descriptive statistics

Descriptive statistics such as mean, standard deviation, frequency distribution was used to achieve objectives i, ii, iv and vi of the study.

4.4.2 Multiple Regression Analysis

The regression analysis is useful in estimating the contributions of each variable to the dependent variable to determine the best variable predictive of livelihood activities by farmers and effects. This was be used to achieve objective iii of the study. Multiple regression model is specified below:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e \quad \ldots\ldots\ldots\ldots\ldots(1)$$

Where,

Y_i = Livelihood activities which was measured in Naira

X_1 = Age of household head (years)

X_2 = Education (years of formal schooling)

X_3 = Household size (number)

X_4 = Farm size (hectares)

X_5 = Membership of cooperative association (years)

X_6 = Extension contact (Number of contacts)

X_7= Types of crop grown (Number)

β_0 = constant term

β_1 - β_9 = coefficients for the respective variables in the regression model

e = error term

4.4.3 Chow test Statistic

Impact of Typha grass on crop, fishery and livestock production on output, income and livelihoods of the affected and non-affected land area was achieved using Chow-test statistic. A Chow test is a particular test for structural change; an econometric test to determine whether the coefficients in a regression model are the same in separate sub-samples. According to Chow (1960) "the standard F test for the equality of two sets of coefficients in linear regression models" is called a Chow test. Dougherty (2007) stated that chow-test statistics is often used in programme evaluation to determine whether the programme has impacts on different sub-group of the population. It requires the sum of squared residuals from three regressions, one from each sample group and one for the pooled data. If the F-chow is greater than the F-table, then there was effect of Typha grass in the study area otherwise no effect. This is expressed mathematically as:

$$F = \frac{(RSSR - SSR1 - SSR2)/\,k}{(SSR1 + SSR2)/\,n - 2k} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .. (2)$$

Where;

RSSR = the sum of squared residuals from a linear regression in which $b_1$and $b_2$are assumed to be the same, b has dimension k, and there are n observations in total.

SSR_1= the sum of squared residuals from a linear regression of sample 1.

SSR_2= the sum of squared residuals from a linear regression of sample 2.

The total number of observation is $n = n_1 + n_2$and the number of parameters is k.

4.5 Operationalization and Measurement of Variables

4.5.1 Independent variables

i. **Age:**age is believed to be capable of influencing an individual's interest, perception, views and conducts. Age has been to affect an individual interest in adoption of innovations (Sani, 2003). It is believed that younger people are adventurous, less risk shy, and therefore more favorably towards trying new things Muhammed, (1987). It was measured as the number of years the respondents has been living on earth at the time of data collection.

ii. **Farm size:** it is referred to as area available to the farmer for cultivation. Farm size was measured in hectars.

iii. **Extension contact:** the role of extension in land use was not well documented in the literature. Extension has a lot of roles to perform in creating awareness among farmers on the issue of land use (Ega, 1999). Extension contact was measured total number of times a farmer was visited by extension workers in connection with land use (Typha grass invasion).

iv. **Membership of cooperative societies:** cooperative societies are organized groups for the promotion of special interest (Kirk, 1994). They contribute to the dissemination of new ideas. Those organized for the express purpose of dissemination farm information are likely to contribute directly to that end Ndagi, (2002). Both formal and informal organizations provided opportunities and places for meeting others who have similar and problems. Formal groups, as well as their informal counterparts, provide some compulsion to act in accord

with group expectations (Tukur, 1999). Membership of cooperative societies was measured in terms of number of years a respondent belongs cooperative society.

4.5.2 The independent variables

i. **Annual crop production:** it refers to annual crop yield obtain by crop farmers. It was measured as 100kg bags in none Ttypha invasion years.

ii. **Annual livestock production:** this refers to the number of calves produced in a year. It was measured as number of calves in none Typha invasion years.

iii. **Annual income:** in this study annual income refers to total money in naira that accrues to crop farmers, fish farmers, livestock farmers as a result of sales of crop fish, and livestock respectively in none Typha invasion years.

iv. **Level of living:** Ahmed, (1984), define level of living as a measure of durable goods e.g. livestock, farm equipments, motorcycle etc. thus, for the purpose of this study, levels of living refers to all things contributing to the quality of human life. The level of living was measured as goods such as farm equipment and livestock possession of an individual farmer, tractors, and other farm implements in Typha invasion years and none Typha invasion years. Durable goods items considered are cars, motorcycles and bicycles. The livestock was cattle, goat, sheep and donkeys. Furthermore, annual expenditure on clothing, nutritional foods, housing, fuel consumption

(cooking and lightening), education of the children; type of houses was considered. In these respondents were asked to indicate the prices of each item in the questionnaire to get the realistic monetary value. The amount of all was summed-up to form an income index.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.0 Socio-Economic Characteristics of Farmers

5.1.1 Marital status of the farmers

In rural communities, marriage is a respected and prestigious institution that bestows social status and recognition on people.The result in Table 5.1. shows the distribution of the marital status of household heads in the study area. There was a high level of homogeneity in the distribution of household heads' marital status in the study area because of similarities in cultural and religious practices.

The majority 96% of the farmers were married while 4% of the farmers were single. This implies that about 96% of the farmers interviewed in the study area have family responbilities, the significance of marital status on agricultural production can be explained in terms of the supply of agricultural family labour. It is expected that family labour would be more available where the household heads are married.This finding is in line with Solomon (2008) and Banmeke (2003), which indicates that large household size assists more on farm and other household activities.

Table 5.1: Marital status ofthe respondents

Marital status	**Frequency**	**Percentage**
Single	10	4.2
Married	230	95.8
Total	240	100

5.1.2 Age distribution of the farmers

Age, in correlation with farming experience, has a significant influence on the decision making process of farmers with respect to risk aversion, adoption of improved agricultural technologies, and other production-related decisions. Age has been found to determine how active and productive the head of the household would be.

The study shows that about 46% of the respondents were found to be within the age group of 40-59 yearswhich is an active age group for meaningful agricultural production. The average age of farmers was found to be approximately 44 years with minimum of 17 years, maximum of 70 years and standard deviation of 13.1. The coefficient of variation on farmers' age was 29.8 percent which implies low inconsistency in age level among farmers' age in the study area.

This implies that, the farmers are strong, agile, and active and can participate adequately in farming activities. Age is expected to have negative influence on the respondent's farm operation. This agrees with the findings of Maurice (2004) and Yusuf (2005), this age can influence the adoption of improved agricultural practices. And the findings are also consistent with those of Nwanko *et al.* (2009) and Institute for Agricultural Research (2001), reported that the most active farmers' age group engaged in agricultural production is within 31- 50 years.

Table 5.2: Age distribution of farmers

Age (years)	Frequency	Percentage	Mean	SD	C.V
20-29	38	15.8	44	13.1	29.8
30-39	42	17.5			
40-49	79	32.9			
50-59	39	16.3			
60-69	38	15.8			
>70	4	1.7			
Total	240	100			

5.1.3 Household size of the farmers

The significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household.

Table 5.3 shows the distribution offarmers by household size. Majority of the farmers 55% had household size that ranged from 1-10 persons in their family. Thefarmers that had the family size of 11-20constituted 27% while the family size of 21 and 30 constituted only 14%. The maximum family size observed was 40 persons with a minimum of 2people and average of 11 persons (Table 5.3).The coefficient of variation on farmers' household size was 78.18 percent which implies high inconsistency in household size among farmers in the study area.

This implies that the farmers in the study area might have advantage of familylabour availability if many household members participate in farms. However, the implication of large household size is that it will increase household consumption expenditure which would compete with production for limited financial resources within the household. According to Okoruwa and Ogundele (2006) large family size does not necessarily translate to higher use of family labour because some of the young able bodied family member may prefer other jobs than farming. This finding is also in line with Solomon (2008) and Banmeke (2003), which indicates that large household size assist more on farm and other household activities.

Table 5.3: Distribution of farmers according to their household size

Householdsize	**Frequency**	**Percentage**	**Mean**	**SD**	**C.V**
1-10	132	55.4	11	8.67	78.18
11-20	65	27.0			
21-30	33	13.8			
>30	9	3.8			
Total	240	100			

5.1.4 Educational level of the farmers

The level of farmers' education is believed to influence the use of improved technology in agriculture and, hence, farm productivity. The level of education determines the level of opportunities available to improve livelihood strategies, enhance food security, and

reduce the level of poverty. It affects the level of exposure to new ideas and managerial capacity in production and the perception of the household members on how to adopt and integrate innovations into the household's survival strategies.

The result in Table 5.4revealed that about 51% of farmers had no formal education, about 14% of the respondent had only primary education, and 6% had secondary education while about 10% had tertiary education.

This indicates that the farmers' educational level is high. This finding is in line with Amaza (2000), education has a positive and significant impact on farmers' efficiency in production. Thus, literacy level will greatly influence the decision making and adoption of innovation by farmers, which may bring about increase in productivity.

Table 5.4: Distribution of farmers according to their educational status

Education (years)	**Frequency**	**Percentage**
No formal education	123	51.2
Primary education	33	13.8
Secondary education	14	5.8
Tertiary education	25	10.4
Total	240	100

5.1.5 Type of crops grown by households

The distribution of important crops grown by households was similar among all the agro-ecological zones in the study area. The most widely grown crops were cereals, of

which maize was the most important and most widely cultivated cereal in the areas. Vegetables were next to cereals in terms of relative importance, as reflected in the percentage of households growing them, especially onion and pepper. Rice is an emerging important cereal crop in the areaand on the other hand, wheat was not widely grown among the sampled farmers.

The dominance of maize in the study area may be explained by the local climate which favoured the cultivation of cereals in the study area by the fact that they are the predominant staple food crops. Fishing and livestock rearing are predominant second farming in association with cereal crops, such as fishing, cattle, goat and sheep rearing. Farmers' dual objectives of producing most of their basic food requirements and, at the same time, generating a marketable surplus explain their preference for growing these crops.

Table 5.5: Distribution of farmers according to types of crop grown

Types of crop grown	***Frequency**	**Percentage**
Maize	194	80.8
Onion	80	33.3
Pepper	80	33.3
Rice	96	40.0
Fishing	27	11.3
Cattle rearing	36	15.0
Sheep and goat	40	16.7
Total	553	

5.1.6 Amount of credit obtained byfarmers

Adequate funding is required by farmers to finance all farm activities. However, a large number of farmers face serious shortage of funds to finance their farming activities, which in turn limits their level of production. They obtained their funds through formal and informal sources as presented in table 5.6. The maximum credit obtained was ₦100,000 with a minimum of ₦20,000 and average of ₦50,000 with standard deviation of ₦1860.The coefficient of variation on credit obtainedwas 22.22 percent which implies low inconsistency in amount of credit obtained among farmersin the study area.

The results indicated that the majority 83% of farmers had no access to credit to finance their production activities while those who had access to credit ranges between ₦10,000-₦40, 000which represent about 15% of the farmers with the minimum and maximum amount of ₦10,000 and ₦120,000 respectively. This implies that the farmers were using their personal saving to purchase farm inputs andadopt farm innovation.This low access to credit could be attributed to the fact that government seldom grants financial credit to large numbers of farmer due to lack of collateral. Ekong (2003) asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity.

Table 5.6: Distribution of farmers according to credit obtained.

Variable	Frequency	Percentage	Mean	SD	C.V
No credit	198	82.5	₦6000	1860	31.00
₦10,000- ₦40,000	36	15.0			
₦40,001- ₦80,000	4	1.7			
₦80,001-₦120,000	2	0.8			
Total	**240**	**100**			

5.1.7 Farm size by farmers

Only about 36% of the farmers have farm sizes greater than 6 hectares (scattered in differnt location). Majority, 64% have farm size below 6 hectares. This is a typical agarian communities which normally are mainly dominated by smallscale farmers. About 64% of the farmers have farm size ranging from 1-5 hectares. This was closely followed by those respondent whose farm sizes are between 6-15 ha and greater than 16 ha constituting 27% and 9% of the respondents respectively. This show that majority of the farmers have small farm sizes and will not be able to enjoy economy of scale in production, similarly, small farm sizes is an impedent to agricultural mechaniztion because using farm machineries like tractor will be difficuilt. Small farm sizes might be as a result of the fact that most of the farmers got their land through inheritance.

The maximum farm size observed was 11 hectares with a minimum of 1hectare and average of 2.27 hectares with standard deviation of 1.31.The coefficient of variation on farm size was 57.7 percent which implies high inconsistency in farm size among

farmers' farm holding in the study area.However, many farm households operate smallandfragmented plots in the study area. A striking finding shown in Table 5.7 is the large disparity between the minimum and the maximum farm sizes; the minimum size was 1 ha, while the maximum was 11 ha for all areas covered in the study. In sum, the average farmer operated small fragmented plots that added up to an average of about 2.3 hectares.

Table 5.7: Distribution of the farmer according to their farm size

Farm size (hectares)	Frequency	Percentage	Mean	SD	C.V
1-3	213	88.8	2.27	1.31	57.7
4-6	25	10.4			
7-11	2	0.8			
Total	240	100			

5.1.8 Membership of cooperative society

Membership of cooperatives influences the adoption of improved technologies resulting in higher productivity and poverty alleviation.The result in Table 5.8 revealed that about 79% of farmers do not participate in any cooperative association while those who were members of cooperative society constituted 21% of the farmers with the minimum and maximum years of membership of 1and 15 respectively. The average years of membership of cooperative society was 3 years with standard deviation of 1.83.Thecoefficient of variation on farmers' membership of cooperative associationwas

61 percent which implies high inconsistency in years of membership among farmers' membership of cooperative associationin the study area.

This implies that farmers in the study area do not have opportunity of interacting with other farmers to enhance diffusion of innovations among the farmers. This finding is at variance with Odebiyi (2010) that says cooperative groups ensure that their members derive benefits fromthe groups such as they could not derive individually.According to Idiong *et al*. (2007), membership of cooperative affords the farmers opportunities of sharing information on modern agriculturalpractices.

Table 5.8: Distribution of farmers according to years spent in cooperative association

Cooperative association	**Frequency**	**Percentage**	**Mean**	**SD**	**C.V**
Non-members	190	79.2	3	1.83	61.0
1-5 years	45	18.8			
6-10 years	3	1.3			
11-15 years	2	0.8			
Total	240	100			

5.1.9 Numbers of extension contact

The ultimate aim of extension services is to enhance farmers' ability to efficiently utilize resources through the adoption of new and improved methods used in agriculturalproduction instead of using traditional methods which are inefficient, resulting to low yield.The distribution of the sampled farmers based on numbers of extension visit is presented in table 5.9.The result in Table 5.9 revealed that 82% of

farmers in the study area had no contact to extension service while 18% had contact to extension service with average of 3 times per year. This implies that there is appreciable numbers of extension contact. According to Obwona (2000), extension service is very essential to the improvement of farm productivity and efficiency among farmers.

Table 5.9: Distribution of farmers according to extension visit

Extension Contact (Numbers)	Frequency	Percentage	Mean	SD	C.V
No contact	196	81.7	3	1.27	42.3
1-3	41	17.1			
4-6	3	1.2			
Total	240	100			

5.2 Livelihood Activities Engaged In by the Farmers

Livelihood activities is a set of economic activities involving self-employment and or wage employment by using one's endowment (both human and material) to generate adequate resources for meeting the requirements of the self and household on a sustainable basis with dignity. Table 5.10 shows theconditions of living of the respondents in the study area. About 80% of the farmers are involved in trading, fishing (79.2%), expanded hectarages (89.6%), skills acquisition (96.3%), food processing (90%)while labour (77.1%) of the farmers implying that their level of living have improved as a result of Non-Typha grass. On the other hand, the low level of living in the affected farmland was due to the effect of Typha grass in the study area. About

22.5% of Typha grass affected farm indicated trading as a source of livelihood, fishing (9.6%), expanded hectares (28.7%), skill acquisition (22.9%), food processing (20.8%) and engage in labour (13.7%).

Table 5.10: Farmers Perception based on their Livelihood activities

Livelihood activities	Non-Typha grass affected farm		Typha grass affected farm	
	Yes	No	Yes	No
Trading	80.0 (192)	20.0 (48)	22.5 (39)	87.5 (201)
Fishing	79.2 (190)	20.8 (50)	9.6 (23)	90.4 (217)
Expanded Hecterages	89.6 (215)	10.4 (25)	28.7 (145)	81.3 (195)
Skill	96.3 (231)	3.7 (19)	22.9 (31)	87.1 (209)
Food processing	90.0 (216)	10.0 (24)	20.8 (50)	79.2 (190)
Labour	77.1 (185)	22.9 (55)	13.7 (33)	86.3 (207)

Numbers in parenthesis represent the frequency of the respondents.

5.3 Factors influencing livelihood activities

The influence of farmer's livelihood was determined in terms of crop output,income and level of living on crop, fishery and livestock farmers in the study area.

5.3.1.1 Factors Influencing Livelihood Activities of Crop Farmers (Output Indicator)

The result of the multiple regressions presented in Table 5.11 shows that some of the coefficients of the variables(age, household size, Types of crop grown and farm size) included in the model had positive signs while others(education, extension contact and cooperative membership) had negative signs. The result also shows that the R^2 value of 0.62 implies that 62% of variation inoutput of the farmers has been explained by the socio-economic factors of the farmer and that 38% was as a result of the random error

term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on crop output.

The coefficient of age was found to be positive and statistically significant at 10 percent level of probability. This implies that holding other factors constant, a unit increase in the age of crop farmers will increase their output by magnitude of 0.217. This result agrees with the finding of Alrwis and Francis (2003) who found that increase in farmer's age results to increase in their output. This is tenable because the older the farmers, the more the experience they acquire on best management practices of crop production and hence, enhancing and improving their livelihood.

Household size was positive and statistically influencing crop production at 5 percent level of probability. The estimated coefficient of 0.394 implies that holding all other factors constant, a unit increase in the household size of crop farmers will increase their output by magnitude of 0.394. This result agrees with the finding of Zalkuwi *et al*., (2010) who opined that there is a positive and significant relationship between household size and farmers' output in production. However, the absolute number of people in a certain family cannot be used to justify the potential for productive farm work. This is because it can be affected by some important factors namely; age, sex and health status. This shows that a reasonable number of the respondents have a large household size. Higher household size provides enough persons for family labour and less money will be needed to pay for hired labour.

Types of crop grown had a positive coefficient (2.15)and statistically significant at 1 percent level of probability. This implies that a unit increase in different crop grown in

the affected area will lead to increase on output which will invariably transfers to better livelihood.

The coefficient of farm size (28.25) had a positive and statistically significant at 1 percent level of probability. This implies that a unit increase in farm size will lead to an increase in their output by magnitude of 28.255. This result is in line with Rahman and Umar (2009) who reported that farm size was significant and had positive relationship with the output of farmers in the study on the efficiency of participation of youth in agriculture programme in Ondo State, Nigeria. However, age, household size, education, extension contact and cooperative association were negatively related to output but not statistically significant.

Table 5.11: Factors influencing livelihood activities of crop farmers (output indicator)

Variables	**Parameters**	**Coefficients**	**Std. error**	**T-Value**
Constant	Z_0	0.432	16.787	0.026
Age	Z_1	0.217	0.113	1.920*
Household size	Z_2	0.394	0.169	2.331**
Education	Z_3	-1.672	1.614	-1.036
Types of crop grown	Z_4	2.146	0.450	4.771***
Extension contact	Z_5	-2.216	3.770	-0.588
Cooperative association	Z_6	-1.270	0.941	-1.350
Farm size	Z_7	28.255	5.933	4.763***
Diagnostic Statistic				
R^2		0.69		
R^2 Adjusted		0.62		
F-value		86.45***		

***P<0.01,** P<0.05 and * P<0.10

5.3.1.2 Factors Influencing Livelihood Activities of Crop Farmers (Income Indicator)

The result of the multiple regressions presented in Table 5.12 shows that some of the coefficients of the variables(age, cooperative and farm size) included in the model had positive signs while others(household size, education, Types of crop grown and extension contact) had negative signs. The result also shows that the R^2 value of 0.58 implies that 58% of variation inincome of the farmers has been explained by the socio-economic factors of the farmer and that 42% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on income.

Household size was positive and statistically influencing crop production at 5 percent level of probability. The estimated coefficient of 1197.44 implies that holding all other factors constant, a unit increase in the household size of crop farmers will increase their income by magnitude of 1197.44. This result agrees with the finding of Zalkuwi *et al*., (2010) who opined that there is a positive and significant relationship between household size and farmers' income.

The estimated coefficient of extension contact was found to be positive statistically significant at 5% level of probability. This implies that a unit increase in extension contact will lead to an increase in their income by magnitude of 28907.23. Thisresult is in line with Asogwa *et al*. (2011) who obtained similar result in their study, found that increase in extension visit leads to increase in farms productivity, income and standard of living of maize producers.

The estimated coefficient of farm size 22715.10 had a positive and statistically significant at 10 percent level of probability. This implies that a unit increase in farm size will lead to an increase in their output by magnitude of 22715.10. This result is in line with Rahman and Umar (2009) who reported that farm size was significant and had positive relationship with the output of farmers in the study on the efficiency of participation of youth in agriculture programme in Ondo State, Nigeria. However, education, cultural management practice, and cooperative association were negatively related to income and statistically not significant.

Table 5.12: Factors influencing livelihood activities of crop farmers (income indicator)

Variables	**Parameters**	**Coefficients**	**Std. error**	**T-Value**
Constant	Z_0	125435.32	54406.81	2.306***
Age	Z_1	386.57	703.71	0.549
Household size	Z_2	1197.44	496.30	2.414**
Education	Z_3	-120.69	5231.01	-0.023
Types of crop grown	Z_4	-666.29	1457.60	-0.457
Extension contact	Z_5	28907.23	12219.07	2.366**
Cooperative association	Z_6	3565.44	3049.73	1.169
Farm size	Z_7	22715.10	12224.30	1.858*
Diagnostic Statistic				
R^2		0.81		
R^2 Adjusted		0.58		
F-value		64.75***		

***P<0.01,** P<0.05 and * P<0.10

5.3.1.3 Factors Influencing Livelihood Activities of Crop Farmers (Living Condition Indicator)

The result of the multiple regressions presented in Table 5.13 shows that some of the coefficients of the variables(age, education, extension contact and cooperative association) included in the model had positive signs while others(household size, Types of crop grown and farm size) had negative signs. The result also shows that the R^2 value of 0.42 implies that 42% of variation inlevel of living condition of the farmers has been explained by the socio-economic factors of the farmer and that 58% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on living condition. However, household size, Cultural management practice, extension contact and farm size were not statistically significant.

The estimated coefficient of age 3056.83 had a positive and statistically significant at 5 percent level of probability. This implies that a unit increase in age will lead to an increase in crop farmers' level of living by magnitude of 3056.83. A plausible justification for this is that farming experience tends to increase with age and therefore, the older the farmers in the business of crop production, the more the experience they acquire on best management practices, the better their economic efficiency in commercial crop production and hence, enhancing their standard of living. This result agrees with Begum *et al*. (2009) who found out that age influences standard of living of farmers.

Education was found to have direct relationship with level of living of the farmers and statistically significant at 10% level of probability. The estimated coefficient of 7209.47implies that the level of living of crop farmers will increase by a magnitude of 7209.47 as their level of education increases if all other factors are held constant. A plausible explanation for this is that higher educational level leads to higher rate of improved technology and techniques of production adoption. Also, educated farmers are likely to be more successful in gathering information and understanding new practices and the use of modern inputs which in turn will improvetheir level of living. This result is in line with Begum *et al*. (2009) who revealed that education had a positive influence on the standard of living of a farmer in Bangladesh.

Cooperative association was found to have direct relationship with level of living of the farmers and statistically significant at 5% level of probability. The estimated coefficient of 63267.86 implies that the level of living of crop farmers will increase by a magnitude of 63267.86 as their membership of association increases by one unit. This finding is at variance with Sikibo (2012) who reported that membership of association was not significantly influences level of living of vegetable farmers in Akwa Ibom state.

Table 5.13: Factors influencing livelihood activities of crop farmers (level of living indices)

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	Z_0	-793616.84	730779.08	-1.086
Age	Z_1	3056.83	1452.07	2.105**
Household size	Z_2	-1654.41	16083.65	-0.103
Education	Z_3	7209.47	4026.65	1.790*
Types of crop grown	Z_4	-9038.59	19578.14	-0.462
Extension contact	Z_5	91950.66	164123.53	0.560
Cooperative association	Z_6	63267.86	30963.24	2.043**
Farm size	Z_7	-3342.87	258216.15	-0.013
Diagnostic Statistic				
R^2		0.708		
R^2 Adjusted		0.42		
F-value		64.75***		

***P<0.01,** P<0.05 and * P<0.10

5.3.2.1 Factors Influencing Livelihood Activities of Fish Farmers (Output Indicator)

The result of the multiple regressions presented in Table 4.14 shows that some of the coefficients of the variables(types of crop grown and farm size) included in the model had positive signs while others(household size, education, farming experience and extension contact) had negative signs. The result also shows that the R^2 value of 0.49 implies that 49% of variation inoutput of the farmers has been explained by the socio-economic factors of the farmer and that 51% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on output.

The coefficient of age was found to be positive and statistically significant at 10 percent level of probability. This implies that holding other factors constant, a unit increase in the age of crop farmers will increase their output by magnitude of 0.219. This result agrees with the finding of Alrwis and Francis (2003) who found that increase in farmer's age results to increase in their fish output. This is tenable because the older the farmers, the more the experience they acquire on best management practices of fish production and hence, enhancing and improving their livelihood.

The estimated coefficient of extension contact was found to be positive statistically significant at 5% level of probability. This implies that a unit increase in extension contact will lead to an increase in their output by magnitude of 3.457. This result is in line with Asogwa *et al*. (2011) who obtained similar result in their study.

The coefficient of farm size 9.953 had a positive and statistically significant at 1 percent level of probability. This implies that a unit increase in farm size will lead to increase on output which will invariably transfers to better livelihood. However, age, household size, education, extension contact and cooperative association were negatively related to output but not statistically significant.

Table 5.14: Factors influencing livelihood activities of fishery farmers (output indicator)

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	Z_0	0.441	6.465	0.068
Age	Z_1	0.219	0.126	1.738*
Household size	Z_2	0.203	0.192	1.058
Education	Z_3	0.007	0.020	0.357
Types of crop grown	Z_4	-0.009	0.164	-0.059
Extension contact	Z_5	3.457	1.247	2.773***
Cooperative association	Z_6	-0.065	0.307	-0.211
Farm size	Z_7	9.953	1.154	8.624***
Diagnostic Statistic				
R^2		0.50		
R^2 Adjusted		0.49		
F-value		74.21***		

***P<0.01,** P<0.05 and * P<0.10

5.3.2.2 Factors Influencing Livelihood Activities Fishery Farmers (Income Indicator)

The result of the multiple regressions presented in Table 5.15 shows that some of the coefficients of the variables(age, cooperative and farm size) included in the model had positive signs while others(household size, education, types of crop grown and extension contact) had negative signs. The result also shows that the R^2 value of 0.36 implies that 36% of variation inincome of the farmers has been explained by the socio-economic factors of the farmer and that 67% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on income.

The coefficient of age was found to be positive and statistically significant at 5 percent level of probability. This implies that holding other factors constant, a unit increase in the age of fish farmers will increase their income by magnitude of 2005.48. This result agrees with the finding of Meller and Zeller (2002) concluded that age has overall positive effecton income, though results differsubstantially across countries and programs both in magnitude and statistical significance.

Cooperative association was found to have direct relationship with income of the farmers and statistically significant at 10% level of probability. The estimated coefficient of 4192.99 implies that the income of fish farmers will increase by a magnitude of 4192.99 as their membership of association increases by one unit. This finding is at variance with Sikibo (2012) who reported that membership of association was not significantly influences level of living of farmers.

The coefficient of farm size 12107.68 had a positive and statistically significant at 10 percent level of probability. This implies that a unit increase in farm size will lead to an increase on income of the farmers which will invariably transfers to better livelihood. However, household size, education, Cultural management practice and extension contact were negatively related to income and not statistically significant.

Table 5.15: Factors influencing livelihood activities of fishery farmers (income indicator)

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	Z_0	-26691.62	45041.89	-0.593
Age	Z_1	2005.48	949.77	2.112**
Household size	Z_2	1635.05	1338.64	1.221
Education	Z_3	56.71	144.07	0.394
Types of crop grown	Z_4	-1505.01	1145.80	-1.314
Extension contact	Z_5	2306.23	8687.65	0.265
Cooperative association	Z_6	4192.99	2138.73	1.961*
Farm size	Z_7	12107.68	7040.97	1.720*
Diagnostic Statistic				
R^2		0.41		
R^2 Adjusted		0.36		
F-value		56.99***		

***P<0.01,** P<0.05 and * P<0.10

5.3.2.3 Factors Influencing Livelihood Activities of Fishery Farmers (Living Condition Indicator)

The result of the multiple regressions presented in Table 5.16 shows that some of the coefficients of the variables(age, education, extension contact and cooperative association) included in the model had positive signs while others(household size, types of crop grown and farm size) had negative signs. The result also shows that the R^2 value of 0.42 implies that 42% of variation inlevel of living condition of the farmers has been explained by the socio-economic factors of the farmer and that 58% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on living

condition. However, household size, education and cooperative association were not statistically significant.

The estimated coefficient of age 3266.77 had a positive and statistically significant at 10 percent level of probability. This implies that a unit increase in age will lead to an increase in fishery farmers' level of living by magnitude of 3266.77. A plausible justification for this is that farming experience tends to increase with age and therefore, the older the farmers in the business of fishery production, the more the experience they acquire on best management practices, the better their economic efficiency in commercial fishery production and hence, enhancing their standard of living. This result agrees with Begum *et al*. (2009) who found out that age influences standard of living of farmers.

Types of crop grown had a negative coefficient -6031.66and statistically significant at 5 percent level of probability. This implies that a unit increase in crop grown in the study area will lead to decrease on level of living of fishery farmers.

The estimated coefficient of extension contact was found to be positive statistically significant at 5% level of probability. This implies that a unit increase in extension contact will lead to an increase in their level of living by magnitude of 38384.83. This result is in line with Asogwa *et al*. (2011) who obtained similar result in their study.

The coefficient of farm size 61627.40 had a positive and statistically significant at 1 percent level of probability. This implies that a unit increase in farm size will lead to an increase in their output by magnitude of 28.255. This result is in line with Rahman and

Umar (2009) who reported that farm size was significant and had positive relationship with the level of living of farmers in the study on the efficiency of participation of youth in agriculture programme in Ondo State, Nigeria. However, age, household size, education, extension contact and cooperative association were negatively related to output but not statistically significant.

Table 5.16:Factors influencing livelihood activities of fishery farmers (level of living indices)

Variables	**Parameters**	**Coefficients**	**Std. error**	**T-Value**
Constant	Z_0	25070.70	98998.00	0.253
Age	Z_1	3266.77	1887.51	1.731*
Household size	Z_2	726.64	2942.51	0.247
Education	Z_3	-228.64	316.65	-0.722
Types of crop grown	Z_4	-6031.66	2518.36	-2.395**
Extension contact	Z_5	38384.83	19094.67	2.010**
Cooperative association	Z_6	-5912.67	4700.73	-1.258
Farm size	Z_7	61627.40	17673.33	3.487***
Diagnostic Statistic				
R^2		0.67		
R^2 Adjusted		0.42		
F-value		91.55***		

***P<0.01,** P<0.05 and * P<0.10

5.3.3.1 Factors Influencing Livelihood Activities of Livestock Farmers (Output Indicator)

The result of the multiple regressions presented in Table 5.17 shows that some of the coefficients of the variables(age, household size, extension contact and farm

size)included in the model had positive signs while others(education, types of crop grown and cooperative association) had negative signs. The result also shows that the R^2 value of 0.67 implies that 67% of variation inoutput of the farmers has been explained by the socio-economic factors of the farmer and that 33% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on output.

Education was found to have inverse relationship with output of livestock farmers and statistically significant at 1% level of probability. The estimated coefficient of -3.132 implies that the output of livestock farmers will decrease by a magnitude of -3.132. This result is at variance with Begum *et al*. (2009) who revealed that education had a positive influence on output of livestock farmer in Bangladesh.

Types of crop grown had a negative coefficient -0.494and statistically significant at 1 percent level of probability. This implies that a unit increase in crop grown in the study area will lead to decrease on output of livestock farmers.

The coefficient of farm size 14.501 had a positive and statistically significant at 1 percent level of probability. This implies that a unit increase in farm size will lead to increase on output which will invariably transfers to better livelihood. However, age, household size, education, extension contact and cooperative association were negatively related to output but not statistically significant.

Table 5.17: Factors influencing livelihood activities of livestock farmers (output indicator)

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	Z_0	1.567	6.963	0.225
Age	Z_1	0.175	0.145	1.212
Household size	Z_2	0.148	0.159	0.928
Education	Z_3	-3.132	1.036	-3.026***
Types of crop grown	Z_4	-0.494	0.171	-2.879***
Extension contact	Z_5	2.804	0.898	3.120***
Cooperative association	Z_6	-0.803	0.271	-0.313
Farm size	Z_7	14.501	1.452	9.989***
Diagnostic Statistic				
R^2		0.79		
R^2 Adjusted		0.67		
F-value		113.26***		

***P<0.01,** P<0.05 and * P<0.10

5.3.3.2 Factors Influencing Livelihood Activities of Livestock Farmers (Income Indicator)

The result of the multiple regressions presented in Table 5.18 shows that some of the coefficients of the variables(age, household, cooperative and farm size) included in the model had positive signs while others(education, Cultural management practiceand extension contact) had negative signs. The result also shows that the R^2 value of 0.56 implies that 56% of variation inincome of the farmers has been explained by the socio-economic factors of the farmer and that 44% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on income.

Household size was positive and statistically influencing crop production at 10 percent level of probability. The estimated coefficient of 11598.15 implies that holding all other factors constant, a unit increase in the household size of livestock farmers will increase their income by magnitude of 11598.15. This result agrees with the finding of Zalkuwi *et al*., (2010) who opined that there is a positive and significant relationship between household size and farmers' income.

Cooperative association was found to have direct relationship with income of the farmers and statistically significant at 1% level of probability. The estimated coefficient of 15676.25 implies that the income of livestock farmers will increase by a magnitude of 4192.99 as their membership of association increases by one unit. This finding is at variance with Sikibo (2012) who reported that membership of association was not significantly influences level of living of farmers.

The coefficient of farm size 36793.09 had a positive and statistically significant at 5 percent level of probability. This implies that a unit increase in farm size will lead to an increase on income of the farmers which will invariably transfers to better livelihood. However, age,education, Cultural management practice and extension contact was not statistically significant.

Table 5.18: Factors influencing livelihood activities of livestock farmers (income indicator)

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	Z_0	-2020300.80	74764.70	-2.706
Age	Z_1	4582.42	1553.03	2.951
Household size	Z_2	11598.15	6122.01	1.895*
Education	Z_3	-1195.94	1840.63	-0.650
Types of crop grown	Z_4	-666.291	1457.601	-0.457
Extension contact	Z_5	2478.52	9646.95	0.256
Cooperative association	Z_6	15676.25	2915.77	5.376***
Farm size	Z_7	36793.09	15587.36	2.360**
Diagnostic Statistic				
R^2		0.59		
R^2 Adjusted		0.56		
F-value		98.61***		

***P<0.01,** P<0.05 and * P<0.10

5.3.3.3 Factors Influencing Livelihood Activities of Livestock Farmers (Living Condition Indicator)

The result of the multiple regressions presented in Table 5.19 shows that some of the coefficients of the variables(age, education, household size, extension contact, cooperative association and farm size) included in the model had positive signs while (types of crop grown) had negative signs. The result also shows that the R^2 value of 0.39 implies that 39% of variation inlevel of living condition of the farmers has been explained by the socio-economic factors of the farmer and that 61% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of the farmers had a relative influence on living

condition. However, household size, education, farming experience, extension contact andcooperative association were not statistically significant.

The estimated coefficient of age 6900.88 had a positive and statistically significant at 1 percent level of probability. This implies that a unit increase in age will lead to an increase in livestock farmers' level of living by magnitude of 6900.88. A plausible justification for this is that farming experience tends to increase with age and therefore, the older the farmers in the business of livestock production, the more the experience they acquire on best management practices, the better their economic efficiency in commercial livestock production and hence, enhancing their standard of living. This result also agrees with Begum *et al*. (2009) who found out that age influences standard of living of farmers.

The coefficient of farm size 125562.42 had a positive and statistically significant at 1 percent level of probability. This implies that a unit increase in farm size will lead to an increase in their level of living by magnitude of 125562.42. This result is in line with Rahman and Umar (2009) who reported that farm size was significant and had positive relationship with the level of living of farmers in the study on the efficiency of participation of youth in agriculture programme in Ondo State, Nigeria. However, household size, education, extension contact and cooperative association were not statistically significant.

Table 5.19: Factors influencing livelihood activities of livestock(level of living indices)

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	Z_0	-352317.80	152526.22	-2.310***
Age	Z_1	6900.88	3168.31	2.178***
Household size	Z_2	1625.19	3498.95	0.464
Education	Z_3	10362.77	22689.83	0.457
Types of crop grown	Z_4	-3898.74	3755.04	-1.038
Extension contact	Z_5	21419.60	19680.59	1.088
Cooperative association	Z_6	1964.66	5948.42	0.330
Farm size	Z_7	125562.42	31799.52	3.949***
Diagnostic Statistic				
R^2		0.43		
R^2 Adjusted		0.39		
F-value		57.91***		

***P<0.01,** P<0.05 and * P<0.10

5.4 Extent of land covers by Typha grass

The results in Table 5.20 revealed that about 63.6% of the farmers have farm sizes (0.1-0.5 hectares) covered with typha grass scattered in differnt location. Many farmers in the area reported that before the emergence of Typha grass, they harvested 200bags of rice from 10ha and now only 45-55 bags are obtained from the same piece of land. Typha grass has taken over farmlands which consequently led to the reduction in harvest from farmlands.this implies that majority of the farmers in the study area experienced decline in their output, income and their level of living as a result Typha weed. This finding is in line with Sabo *et al*. (2010) in their work reported that, there is

reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetables in all the areas.

This was closely followed by those respondent whose farm sizes covered by Typha grass are between 0.6-1.0 hectares and 1.1-1.5 hectares constituting 27.3% and 9.1% of the respondents respectively. This show that majority of the farmers have small farm sizes and will not be able to enjoy economy of scale in production.The impact of blockage caused by Typha grass has resulted in reduced flow of water in the area. This has consequently resulted in reduction of fish catch in the area. Moreover, fishermen in the area revealed that, though quantity of fish catch is bigger when compared with the size before the emergence of Typha, this might probably because, Typha grass provides hiding ground for fish (Sabo *et al*., 2010).

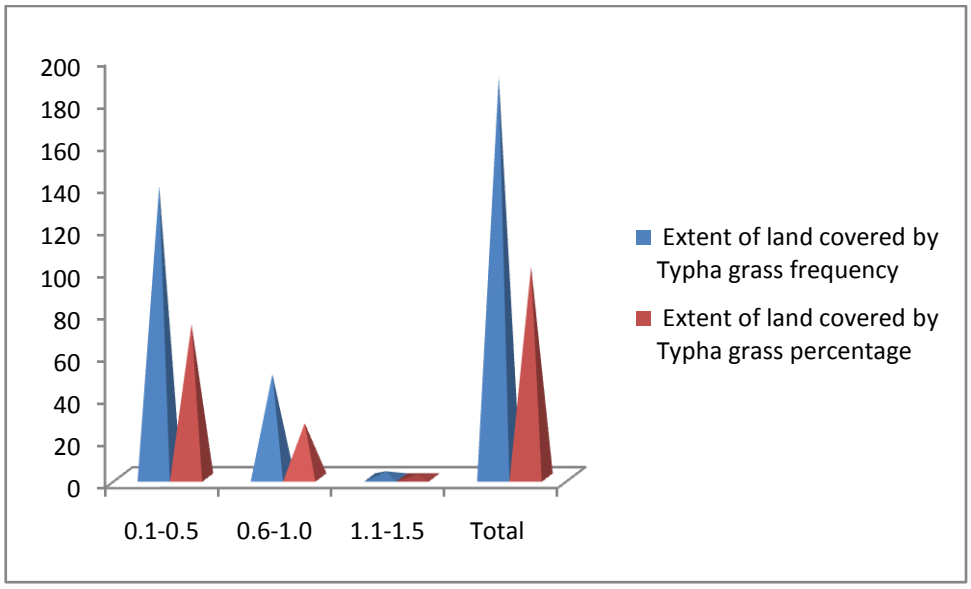

Figure 2: Extent of land cover by Typha grass

5.5 Effect of Typha grass on livelihood of farmers

5.5.1 Effect of typha grass on output of crop farmers

The effect of Typha grass on the crop output of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The Chow Test is a test that determines if the coefficients from two regression analyses are the same. However, three different linear regressions were carried out comprising of the pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on crop production and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of crop output, if otherwise there is no impact of Typha grass in the study area.

Table 5.21: Effect of Typha grass on crop output of farmers

Group Sample	**R^2**	**Residual sum of square**	**N**	**K**	**F-cal**	**F-tab**
Pooled Samples	0.13	4.856141E+12	240	6	15.58	2.80
Affected	0.12	2.050848 E+12	145			
Non-affected	0.59	1.247981 E+12	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.21 revealed that the Chow F calculated was 15.58, while F table value at 6 degree of freedom with sample size of 240 was 2.80 at 5% level of

probability implying a significant impact of Typha grass on the output in the study area since the F calculated was greater than the F table. This finding is in line with Sabo *et al.,* (2010) who reported that there is reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetable in all the areas.

5.5.1.1.1 *Hypothesis I*

Effect of Typha grass on crop output of farmers

The null hypothesis (H_o) which stated that there is no significant effect of Typha grass on crop output in the study area was tested using the result of a t-test presented in Table 5.22. From the result in the table, calculated t-value was 1.88 and less than the critical value (t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has impact on output.

Table 5.22: Effect of Typha-grass on crop output of farmers

Group of farmer	Mean	Sample size	Std. error	t-cal	t-critical
Typha grass affected area	42.182	240	1494.364	1.88	2.23
Non-Typha grass affected area	18.636	240	122.455		

5.5.1.2 Effect of Typha grass on income of crop farmers

The impact of Typha grass on income of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The Chow Test is a test that determines if the coefficients from two regression analyses are the same. However, three different linear regressions were carried out comprising of the

pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on income and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of income, if otherwise there is no impact of Typha grass in the study area.

Table 5.23: Effectof Typha grass on income of crop farmers

Group Sample	**R^2**	**Residual sum of square**	**N**	**K**	**F-cal**	**F-tab**
Pooled Samples	0.40	100035.5	240	6	4.61	2.80
Affected	0.31	76959.54	145			
Non-affected	0.79	10824.95	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.23 revealed that the Chow F calculated was 4.61, while F table value at 6 degree of freedom with sample size of 240 was 2.80 at 5% level of probability implying a significant impact of Typha grass on income in the study area since the F calculated was greater than the F table. This finding is in line with Sabo *et al.,* (2010) who reported that there is reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetable in all the areas which consequently reduces their income.

5.5.1.1.2 ***Hypothesis II***

The effect of Typha grass on income of farmer

The null hypothesis (H_o) which stated that there is no significant impact of Typha grass on income farmers in the study area was tested using the result of a t-test presented in Table 5.24. From the result in the table, calculated t-value was 0.87 and less than the critical value (t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has impact on income of the farmers.

Table 5.24: Effect of Typha-grass on Income of farmers

Group of farmer	Mean	Sample size	Std. error	t-cal	t-critical
Typha grass affected area	64090.91	240	526890909.1	0.87	2.23
Non-Typha grass affected area	53727.27	240	1705618182		

5.5.1.3 Effect of Typha grass on level of living of the farmers

The impact of Typha grass on level of living of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The Chow Test is a test that determines if the coefficients from two regression analyses are the same. However, three different linear regressions were carried out comprising of the pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on crop

and animal production and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of crop output, if otherwise there is no effect of Typha grass in the study area.

Table 5.25: Effect of Typha grass on level of living of farmers

Group Sample	**R^2**	**Residual sum of square**	**N**	**K**	**F-cal**	**F-tab**
Pooled Samples	0.13	4.856141E+12	240	6	13.28	2.80
Affected	0.12	2.050848 E+12	145			
Non-affected	0.59	1.247981 E+12	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.25 revealed that the Chow F calculated was 13.28, while F table value at 6 degree of freedom with sample size of 240 was 2.80 at 5% level of probability implying a significant impact of Typha grass on level of living of the participants in the study area since the F-calculated was greater than the F-table.

5.5.1.1.3 Hypothesis III

Effect of Typha grass on living condition of farmer

The null hypothesis (H_o) which stated that there is no significant effect of Typha grass on living condition in the study area was tested using the result of a t-test presented in Table 21. From the result in the table, calculated t-value was 1.69 and less than the critical value (t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has impact on living condition of the farmers.

Table 5.26: Effect of Typha-grass on living condition of farmers

Group of farmer	Mean	Sample size	Std error	t-cal	t-critical
Typha grass affected area	134895.36	240	5614560	1.69	2.23
Non-Typha grass affected area	13159.09	240	192507.1		

5.5.2 Effect of Typha grass on livelihood of farmers

5.5.2.1 Effect of Typha grass on output of fish farmers

The impact of Typha grass on the fish output of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The Chow Test is a test that determines if the coefficients from two regression analyses are the same. However, three different linear regressions were carried out comprising of the pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on crop and animal production and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of crop output, if otherwise there is no impact of Typha grass in the study area.

Table 5.27: Effect of Typha grass on output of fish farmers

Group Sample	R^2	Residual sum of square	N	K	F-cal	F-tab
Pooled Samples	56.05	0.48883E+10	240	6	16.65	1.86
Affected	26.76	0.35991E+10	145			
Non-affected	06.84	0.650446E+9	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.27 revealed that the Chow F calculated was 16.65, while F table value at 6 degree of freedom with sample size of 240 was 1.86 at 5% level of probability implying a significant impact of Typha grass on the output in the study area since the F calculated was greater than the F table. This finding is in line with Sabo *et al.,* (2010) reported that there is reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetable in all the areas. According to Jewel (2004), who reported that, in some cases more than 90% of lands hitherto used for cultivation and grazing have been overtaken by Typha grass causing reduction in animal and crop output in the study area.

5.5.1.1 Hypothesis I

Effect of Typha grass on output of fish farmer

The null hypothesis (H_o) which stated that there is no significant impact of Typha grass on output in the study area was tested using the result of a t-test presented in Table 5.28. From the result in the table, calculated t-value was 1.88 and less than the critical value

(t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has impact on output.

Table 5.28: Effect of Typha-grass on output of farmers

Group of farmer	Mean	Sample size	Std. error	t-cal	t-critical
Typha grass affected area	42.182	240	1494.364	1.88	2.23
Non-Typha grass affected area	18.636	240	122.455		

5.5.2.2 Effect of Typha grass on income of fish farmers

The effect of Typha grass on income of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The Chow Test is a test that determines if the coefficients from two regression analyses are the same. However, three different linear regressions were carried out comprising of the pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is effectt of Typha grass on income and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of income, if otherwise there is no effect of Typha grass in the study area.

Table 5.29: Effect of Typha grass on income of farmers

Group Sample	R^2	Residual sum of square	N	K	F-cal	F-tab
Pooled Samples	28.49	0.2872046E+12	240	6	21.06	1.86
Affected	25.94	0.9114868E+11	145			
Non-affected	08.74	0.4120071E+11	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.29 revealed that the Chow F calculated was 15.58, while F table value at 6 degree of freedom with sample size of 240 was 1.86 at 5% level of probability implying a significant impact of Typha grass on income in the study area since the F calculated was greater than the F table. This finding is in line with Sabo *et al.,* (2010) reported that there is reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetable in all the areas which consequently reduces their income.

5.5.1.1.2 Hypothesis II

The Effect of Typha grass on income of farmer

The null hypothesis (H_o) which stated that there is no significant impact of Typha grass on income farmers in the study area was tested using the result of a t-test presented in Table 31. From the result in the table, calculated t-value was 0.87 and less than the critical value (t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has impact on income of the farmers.

Table 5.30: Effect of Typha-grass on Income of farmers

Group of farmer	Mean	Sample size	Std error	t-cal	t-critical
Typha grass affected area	64090.91	240	526890909.1	0.87	2.23
Non-Typha grass affected area	53727.27	240	1705618182		

5.5.2.3 Effect of Typha grass on level of living of the fish farmers

The effect of Typha grass on level of living of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The Chow Test is a test that determines if the coefficients from two regression analyses are the same. However, three different linear regressions were carried out comprising of the pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on crop and animal production and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of crop output, if otherwise there is no impact of Typha grass in the study area.

Table 5.31: Effect of Typha grass on level of living of farmers

Group Sample	R^2	Residual sum of square	N	K	F-cal	F-tab
Pooled Samples	11.13	0.1576053E+14	240	6	28.01	1.86
Affected	25.94	0.4194792E+13	145			
Non-affected	08.74	0.4194792E+13	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.31 revealed that the Chow F calculated was 28.01, while F table value at 6 degree of freedom with sample size of 240 was 1.86 at 5% level of probability implying a significant effect of Typha grass on level of living of the participants in the study area since the F-calculated was greater than the F-table.

5.5.1.3 Hypothesis III

Effect of Typha grass on living condition of farmer

The null hypothesis (H_o) which stated that there is no significant impact of Typha grass on living condition in the study area was tested using the result of a t-test presented in Table 33. From the result in the table, calculated t-value was 1.69 and less than the critical value (t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has effect on living condition of the farmers.

Table 5.32: Effect of Typha-grass on living condition of farmers

Group of farmer	Mean	Sample size	Std error	t-cal	t-critical
Typha grass affected area	13489.36	240	5614560	1.69	2.23
Non-Typha grass affected area	13159.09	240	192507.1		

5.5.3 Effect of Typha grass on livelihood of farmers

5.5.1 Effect of Typha grass on output of livestock farmers

The effect of Typha grass on the livestock output of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The Chow Test is a test that determines if the coefficients from two regression analyses are the same. However, three different linear regressions were carried out comprising of the pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on crop and animal production and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of crop output, if otherwise there is no effect of Typha grass in the study area.

Table 5.33: Impact of Typha grass on output of livestock farmers

Group Sample	R^2	Residual sum of square	N	K	F-cal	F-tab
Pooled Samples	0.13	3.856141E+12	240	6	4.97	1.96
Affected	0.12	9.050848 E+11	145			
Non-affected	0.59	1.247981 E+12	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.33 revealed that the Chow F calculated was 4.97, while F table value at 6 degree of freedom with sample size of 240 was 1.96 at 5% level of probability implying a significant impact of Typha grass on the output in the study area since the F calculated was greater than the F table. This finding is in line with Sabo *et al.,* (2010) reported that there is reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetable in all the areas. It is also in conformity with Jewel (2004), added that, in some cases more than 90% of lands hitherto used for cultivation and grazing have been overtaken by Typha grass causing reduction in animal and crop output in the study area.

5.5.1.1 Hypothesis I

Effect of Typha grass on output of livestock farmer

The null hypothesis (H_o) which stated that there is no significant impact of Typha grass on output in the study area was tested using the result of a t-test presented in Table 5.34. From the result in the table, calculated t-value was 1.88 and less than the critical value

(t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has impact on output.

Table 5.34: Effect of Typha-grass on output of livestock farmers

Group of farmer	Mean	Sample size	Std. error	t-cal	t-critical
Typha grass affected area	42.182	240	1494.364	1.88	2.23
Non-Typha grass affected area	18.636	240	122.455		

5.5.2 Effect of Typha grass on income of farmers

The effect of Typha grass on income of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on income and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of income, if otherwise there is no effect of Typha grass in the study area.

Table 4.35: Effect of Typha grass on income of livestock farmers

Group Sample	R^2	Residual sum of square	N	K	F-cal	F-tab
Pooled Samples	0.13	3.856141E+13	240	6	4.58	1.96
Affected	0.12	1.050848 E+13	145			
Non-affected	0.59	1.247981 E+13	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 4.35 revealed that the Chow F calculated was 4.58, while F table value at 6 degree of freedom with sample size of 240 was 1.96 at 5% level of probability implying a significant impact of Typha grass on income in the study area since the F calculated was greater than the F table. This finding is in line with Sabo *et al.,* (2010) reported that there is reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetable in all the areas which consequently reduces their income.

5.5.1.2 Hypothesis II

The Effect of Typha grass on income of farmer

The null hypothesis (H_o) which stated that there is no significant impact of Typha grass on income farmers in the study area was tested using the result of a t-test presented in Table 37. From the result in the table, calculated t-value was 0.87 and less than the critical value (t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of

significance. The result of the analysis indicates that Typha grass has effect on income of the farmers.

Table 5.36: Effect of Typha-grass on Income of livestock farmers

Group of farmer	Mean	Sample size	Std. error	t-cal	t-critical
Typha grass affected area	64090.91	240	526890.1	0.87	2.23
Non-Typha grass affected area	53727.27	240	1705612		

5.4.1 Effect of Typha grass on level of living of livestock farmers

The effect of Typha grass on the crop output of the affected farm holding and non-Typha grass affected farm holding in the study area was achieved using chow test statistics. However, three different linear regressions were carried out comprising of the pooled samples of Typha grass and non-Typha grass affected farm holding, and separate linear regression for Typha grass affected farm holding and non-Typha grass affected farm holding respectively. The residual sum of square of each of the three regressions was used to compute the chow test. The decision rule was that if Chow F-statistics is greater than that of F-table, there is impact of Typha grass on crop and animal production and structural differences between Typha grass affected farm holding and non-Typha grass affected farm holding in terms of crop output, if otherwise there is no impact of Typha grass in the study area.

Table 5.37: Effect of Typha grass on level of living of farmers

Group Sample	R^2	Residual sum of square	N	K	F-cal	F-tab
Pooled Samples	0.17	2.345909E+13	240	6	2.94	1.96
Affected	0.14	1.576267 E+13	145			
Non-affected	0.43	5.194023 E+12	95			

R^2 = regression coefficient, N = numbers of observation and K = numbers of parameters

The result from Table 5.37 revealed that the Chow F calculated was 2.94, while F table value at 6 degree of freedom with sample size of 240 was 1.96 at 5% level of probability implying a significant impact of Typha grass on level of living of the livestock farmers in the study area since the F-calculated was greater than the F-table.

5.5.1.3 Hypothesis III

Effect of Typha grass on living condition of farmer

The null hypothesis (H_o) which stated that there is no significant impact of Typha grass on living condition in the study area was tested using the result of a t-test presented in Table 5.38. From the result in the table, calculated t-value was 1.69 and less than the critical value (t-critical two tail) of 2.23, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that Typha grass has effect on living condition of the farmers.

Table 5.38: Effect of Typha-grass on living condition of farmers

Group of farmer	Mean	Sample size	Standard error	t-cal	t-critical
Typha grass affected area	134895.3	240	56145600606	1.69	2.23
Non-Typha grass affected area	13159.1	240	192507409.1		

5.6 Coping strategies employed against Typha grass invasion

The result in Table 40 revealed the majority of the farmers 56% employed method of cutting and at the same time flooding the area to avoid seed germination and stem sprouting. About 36% of the farmers use mechanical clearing method by slashing the weed. This finding is in accordance with Rao (2004) that individual farmers along the drains make efforts to reduce the weed mechanically by slashing the weeds to clear their farms and main canals while about 9% of the farmers use chemical method as a strategy to reduce the weed. According to Solberge and Higgins (1993) reported that applying glyphosate to actively growing Typha leaf reduced its stand by 99.7% a year without any harmful effect on mammals.

Table 5.39: Coping strategies employed by farmers against Typha grass invasion

Coping strategy	*Frequency	Percentages	Rank
Cutting and flooding	164	84.1	1st
Mechanical clearing	126	64.6	2nd
Use of chemical	115	59.0	3rd
Total	405		

***** Multiple responses was allowed

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

This study evaluateimpact of Typha grass on the livelihood of the crop, fishery and livestock farmers in selected areas of Yobe and Jigawa states, Nigeria. A multi-stage sampling technique was used to select respondents for this study. The first stage involved random selection of four (4) Local Government Areas, two from each state by balloting. These LGAs are Kirikasamma, Birniwa, Nguru,and Gashua. In the second stage two villages were randomly selected from each of the LGA. The third step involved simple random sampling of twenty (20%) respondents from each of the LGAs to get a total of two hundred and fourty (240) respondents comprising of one hundred and fourty-five Typha grass affected farmland (145) and ninety-five (95) non-affected Typha grass farmland.Primary data were collected from 240 respondents with the aid of structured questionnaire. The statistical tools used to analyze the data were descriptive statistics, regression analysis, chow test statistics and t-test.

The results of the socio-economic analysis shows that 96% of the farmers were married, about (46%) of the respondents fall within the age range of 40-59years, the majority of the farmers (51%) had no formal education. The majority of farmers operate farm size ranging from 1-3 hectares, about 82% of the respondents do not had access to extension services. The household size ranged from1-10 persons with 58%. Majority of the farmers, (79%) were not members of a cooperative society.

From the regression on factors influencing livelihood activities on crop, fishery and livestock using output, income and level of living as indices, the value of coefficient of determination of crop output, income and level of living, were 0.62, 0.58 and 0.42 respectively meaning that about 62%, 58%, 42% of the variation in the Typha grass area

was explained by the independent variables in the regression model. Chow test statistics was to assess the impact of Typha grass on the output, income and level of living for crop, fishery and livestock farmers. Chow test F-calculated for crop output, income and level of living was 15.58, 4.61and 13.28respectively while that of F-tabulated value for 6 degree of freedom with sample size of 240 was 2.80, at 5% level of probability, hence there is significant impact of Typha grass on crop, output, income and level of living on crop production in the study area. In terms of fishery output, income and level of living, Chow test F-calculated was 16.65, 21.06 and 28.01, while the F-tabulated value for 6 degree of freedom with sample size of 240 was 1.86 at 5% level of probability, hence significant impact of Typha grass on fish output, income and level of living. More also, Chow test F-calculated for livestock output, income and level of living was 4.96. 4.58 and 2.94 respectively, while that of F-tabulated value for 6 degree of freedom with sample size of 240 was 1.96 at 5% level of probability, hence there is significant impact of Typha grass on output, income and level of living of livestock farmers in the study area. The hypotheses that there is no significant impact of Typha grass crop fisheryand livestock farmers livelihood in terms of their output, income and level of living was rejected while the alternative hypotheses were accepted.

About63.6% of the farmers have farm sizes (0.1-0.5 hectares) covered with typha grass scattered in differnt location. This was closely followed by those respondent whose farm sizes covered by Typha grass are between 0.6-1.0 hectares and 1.1-1.5 hectares constituting 27.3% and 9.1% of the respondents respectively.

Finally, the majority of the farmers 56% employed method of cutting and at the same time flooding the area to avoid seed germination and stem sprouting. About 36% of the

farmers use mechanical clearing method by slashing the weed while about 9% of the farmers use chemical method as a strategy to reduce the weed.

6.2 Conclusion

Based on the findings of this study, it could be concluded that there was impact of Typha grass on the livelihood of farmers through reduced or complete loss of cultivation of some crops, particularly irrigated crops such as maize, wheat, rice and vegetable and fish farming in all the areas.In overall, there was significant impact of Typha grass on crop, fishery and livestock output, incomeand level of living of the affected farm land compared to the non-affected farm land in the study area. Finally, for the farmers to achieve better livelihood, they should employ the coping strategy adopted by the best practiced farmer.

6.3 Contributions to Knowledge

The results of this study have contributed to knowledge in the following ways:

i. The results of this study revealed there is significant effect of Typha grass on fishery farmers output (32.5%), income (48.6%) and level of living (26.5%) in the study area as shown by the Chow-test.

ii. The results revealed there is significant effect of Typha grass on crop farmers output (37.4%), income (29%) and level of living (55.1%) in the study area as shown by the Chow-test.

iii. The results also revealed there is significant effect of Typha grass on livestock farmers output (44.9%), income (57.7%) and level of living (23.6%) in the study area as shown by the Chow-test.

iv. It is evident that no study has been conducted to assess the impact of Typha grass on this two states together, hence the results emanating from this study will assist in future programme designs and evaluation.

6.4 Recommendations

From the findings of this study, the following recommendations are made:

i. The results of this study revealed there is significant impact of Typha grass on farmers output, income and level of living as 16.65, 21.06 and 28.01 respectively in the study area as shown by the Chow-test. Therefore, it will be of help to the Government of Yobe and Jigawa States through the ADP to intensify their campaign on effect of Typha grass on farmers' livelihood and also educated them on coping strategy to adopt.

ii. The most severe problems encountered in crop and animal production in the study areais weed.This constraint constitute serious impediments toproduction and need to be addressed adequately before crop, fishery and livestock production can be improved in the study area. It is recommended that agro based industries andnon-governmentalorganization should be encouraged by the local government to support research on this weed.

iii. Age, education, household size and farm size were found to influence livelihood of the farmers; it is therefore recommended that Government and Non-Governmental Organizations (NGOs) should provide basic amenities that will improve the socio-economic status of the farmers especially in the study area.

REFERENCES

Addo, A. (2005). "Improving the Nutrition of the Nigerian Child ThroughDietary Modifications "Paper presented at a seminar on Child Nutrition by West Africa Milk Company (Nig) PLC. 221-224

Ahmed, B. (1984): Economic analysis of fertilizer used in maize production in the Northern Guinea Savannah of Nigeria. Unpublished Ph.D Thesis, Department of Agric. Economics and Rural Sociology, Ahmadu Bello University, Zaria: Nigeria.

Ajakaiye, O. and Adeyeye, V.A. (2001). *The Nature of Poverty in Nigeria*. NISER NISER Ibadan.*Monograph Series.*13: 1-6

Akinsola, A. O. (2000). An assessment of Typha Specie: Problems in the Hadejia-Nguru Wetlands Area, IUCN- Hadejia-Nguru Wetlands Conservation Project. 250 Pp

Akinwale, A.A. (2010). Livelihood and Environmental Challenges in Coastal Communitiesof Nigeria. *Journal of Sustainable Development in Africa*, 12(8): 79-88.

Alli, A. (2005). Livelihood and Food Security in Rural Banglesh: The Role of Social Capital *and Environment Nexus in Sub-Saharan Africa*, World Bank, Washington, DC. Pp 143

Amaza, P.S. (2000). Resource-use Efficiency in Food Production in Gombe State, Nigeria. An Unpublished PhD; dissertation submitted to the Department of Agricultural Economics, University of Ibadan

Annon, L.(2006). Little known animals with promising economic future (micro-livestock), Boardof Science and Technology for International Development, National Academy Press, Washington D.C. pp 147 – 155.

Anon, L. (2005). Rice: A success story for some. CTA Spore 115**,** pp. 4-5.

Asfaw, S. and Bekele, S. (2010).Agricultural Technology Adoption and Rural Poverty: Application of an Endogenous Switching Regression for Selected East African Countries. Poster presentation at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010. pp 1 – 29.

Asogwa, B.C., Ihemeje, J.C. and Ezihe, J.A.C. (2011). Technical and Allocative Efficiency Analysis of Nigerian Rural Farmers: Implication for Poverty Reduction, *Agricultural Journal,* 6(5): 243-251

Ayotade, K. A. and Fagade, A.A. (1980). Nigerian's Programme on Wetland Rice Production and Rice Research. In Juo, A. S. R., and Owe J. A. L (eds). The Wetlands and Rice in Sub- Sahara Africa, IITA. Ibadan.

Babulo, B., Muys, B., Nega, F., Tollens, E., Nyssen, J., Deckers, J., and Mathiys E. (2008). Household Livelihood Strategies and Forest Dependence in the Highlands of Tigral, Northern Ethiopia. *Agricultural systems* 98: 147-155

Bandabia, T. (2005). Comparative Study of Statistical Distribution and Efficiency of some Poverty Estimators in Ibadan Northeast Local Government Area, Oyo State, Nigeria. M.Sc. Thesis. Department of Mathematics Sciences. College of Natural Sciences, University of Agriculture, Abeokuta. 91PP.

Barbier, E. B.; Adams, W. M. and Kimmage, K. (1993). An Economic Valuation of Wetland Benefits. In: Hollis, G. E.; Adams, W. M.; Aminu-Kano, M. (eds.) *Environment, Economy and Sustainable Development of a SahelianFloodplain Wetland*. Pp 191-209.

Banmeke, R. (2003). Evaluating Contextual Variables Affecting Productivity using Data Envelopment Analysis. *Operations Research* ,56: 48-58.

Beal, E. O. (1977). A Manual of Marsh and Aquatic Vascular Plants of North Carolina with Habitat Data. Technical Bulletin. Pp 298.

Bender, D. A., and A. E. Bender. (2003). *A Dictionary of Food and Nutrition*. New York: Oxford University Press. ISBN 0198609612.

Begum, I. A., Alam, M. J., Buysse,J., Frija A. and Van Huylenbroeck,G. (2009). Contract farmer and poultry farm efficiency in Bangladesh: a data envelopment analysis. *Applied Economics*, 44(28): 3737-3747.

Bevan, P. and Joireman, S. F. (1997). The Perils of Measuring Poverty: Identifying the Poor in Rural Ethiopia. *Oxford Development Studies*25(3): 315–337.

Blank, R. M. (1997). *It Takes a Nation: A New Agenda for Fighting Poverty*. Princeton University Press. New jersey, USA. Pp 304

Bogale, A., Hagedorn, K.and Korf, B. (2005). Determinants of poverty in rural Ethiopia. *Quarterly Journal of International Agriculture* 44 (2): 101-120.

Bradshaw, T.K. (2006). Theories of Poverty and Anti-Poverty Programs in Community Development. RPRC Working Paper No. 06-05. February, 2006.

Brooks, M. L.,. D'Antonio,C. M; Richardson, D. M., Grace, J. B., Keeley,J. E.DiTomaso,J. M., Hobbs,R. J.Pellant, M.and Pyke.D. (2004). Effects of invasive alienplants on fire regimes. *BioScience*. 54:677-688.

Chambers, R. and Conway, R. (1992). Sustainable Rural Livelihoods: Practical Concepts for the 21st century. Institute of Development Studies Discussion Paper 296. Brighton: IDS.

Chambers, R. and Conway, G.R. (1983) Sustainable Rural Livelihoods: Practical Concepts for the 21st Century, IDS Discussion Paper No. 296, Brighton, U.K.

Chikoye, D., Ajeigbe, H.A., and Abdoulaye, T. (2012) Legume and cereal seed production for improved crop yields in Nigeria, Proceedings of the Training Workshop on Production of Legume and Cereal Seeds 24th January–10th February International Institute of Tropical Agriculture, Kano Station Kano, Nigeria.

Childers, D. L., Doren, R. F., Jones, R., Noe, G. B., Rugge M.and Scinto, L. J. (2003). Decadal change in vegetation and soil phosphorus patterns across the Everglades landscape. *Journal of Environmental Quality*32(1): 344-362.

Chitamber, J.B. (1973). Introductory Rural Sociology. Wiley Eastern Limited.

Cleaver, K.M. and Schreiber, G.A. (1994) *Reversing the Spiral: The Population, Agriculture,Consequences.* In Jazairy, M. Alamgir and T. Panuccio (eds). New York: New York

Darby, M. R. (1996). Facing and Reducing Poverty:In Darby, M. R. (ed), Reducing Poverty in America: Views and Approaches Pp. 3-12.

Davies, S.(1996). Adaptable Livelihoods: Coping with Food Security in the Malian Sahel. Macmillan Press, New York. Pp 221-226

Dekker M. (2002). "Resettlement and Livelihood; Support Network and Crises Situation" Paper presented at Albany Summer School, U.S.A. Pp 1-9

Della, F. L (1974). "The Culture of Poverty Revisited: A Strategy for Research. *Social Problems* 21:609-621.

Dercon, S. and P. Krishnan, (1998). "Changes in Poverty in Rural Ethiopia 1989–1995: Measurement Robustness Test and Decomposition".Centre for the Study of African Economics Working Paper Series.

Dontsop-Nguezet, P. M., Diagne, A., Okoruwa, V. O. and Ojehomon, V. (2011).Impact of improved rice technology on income andpoverty among rice farming household in Nigeria:A Local Average Treatment Effect (LATE) Approach. Paper presented for the 25th conference of the Centre for the Studies of African Economies (CSAE). St Catherine College, University of Oxford, UK. 20th – 22nd March 2011. pp. 1 – 31.

Dourgherty, C. (2007). *Introduction to Econometrics.* New York, Oxford University Press, Pp 194.

Ega, L. A (1999) "Land holding patterns and related problems of Agriculture and related problems of agricultural development in Zaria villages. *Samaru Journal of Agricultural Research, 14 (1&2)*

Ehrenfeld, J. G. (2003). Effects of Exotic Plant Invasions on Soil Nutrient Cycling Processes. *Ecosystems*. 6:503-523.

Ehrenfeld, J. G., and N. Scott. (2001). Invasive Species and the Soil: Effects on Organisms and Ecosystem Processes. *Ecological Applications*. 11:1259-1260.

Ekong, E.E.(2005). *Introduction to Rural Sociology.* An Introduction and Analysis of Rural livelihood and poverty alleviation in Nigeria, Pp 20-29

Ekong E. E. (2003) Rural Sociology: *An Introduction and Analysis of Rural Nigeria,* Uyo: Dove Educational Publication.

Ellis, F. (1998). Household Strategies and Rural Livelihood Diversification. *The Journal of Development Studies* 35(1): 1-38.

Ellis, F. (2000). *Rural Livelihoods and Diversity in Developing Countries.* Oxford: Oxford Pp 489

Ellstrand, N. C., and Schierenbeck, K. A. (2002). Hybridization as a stimulus for the evolution of invasiveness in plants? Euphytica. 148:35-46.

Engelhardt, K. A., and Ritchie, M. E. (2001). Effects of plant diversity on wetland ecosystem function and services. Nature. 410:687-689.

Etim N. A. and Patrick, I. V. (2010). Estimating the Determinants of Poverty among Fishing Households in Akwa Ibom State, Nigeria.*Journal of Agriculture and Social Sciences*. 6 (3): 61-63.

Etim, N.A. and V.A. Solomon (2010). Determinant of Rural Poverty among Broiler Farmers in Uyo, Nigeria: Implications for Rural Household Food Security. *Journal of Agricand Social Sciences*, 6: 24–28

Etim, N.A., Edet, G.E. and Esu,B.B. (2009). Determinants of Poverty Among Man-Urban Tepera Occidentals farmers in Uyo, Nigeria. *J. Agric Social Science*, 5: 49-51.

FAO (2014). *Global pig number*- World Hog Population. Retrieved 16.02.2012 from http://www.thepigsite.com.

Federal Office of Statistics (FOS) (1999). Poverty and Agricultural in Nigeria. Federal Office of Statistics, Abuja, Nigeria. Pp 357

Folke, C. (1991): "Socio-economic dependence on the life-supporting environment. In: Folke C, Kabeger T (eds) Linking the natural environment and the economy: essays from the ecoecogroup. Kluwer, Dordrecht, pp 77–94

Frankenberg, T.R. and McKesson, M.K. (1988). Household Livelihood Security Care, USA.

Gomes, H., Alves, E., Dau, M. A. (2003). Dealing with Flooding and Ponding Regime in Jigawa State.

Grace, J. B., and R. G. Wetzel. (1998). Long-term dynamics of *Typha* populations. Aquatic. Pp 234

Greene, W.H. (2000). *Econometric Analysis*. Fourth edition, Prentice-Hall, Inc. United States of America. Pp 1005.

Gujarati, D. (2004). *Basic Econometrics*.4th Edition, McGraw-Hill, New York.

Gujarati, D.N. (2003). *Basic Econometrics*. 4th Edition. McGraw-Hill, Inc. 1002p.

Haruna, B., Kyiogwam, U. B. I., Senchi, D. and Singh, A. (2006). Resource Use Efficiency in Cotton Production in Selected Local Government Areas of Zamfara State. In *Sustaining Agricultural Growth to Meet National Economic Development Goal*. Proceedings of the 23rd Annual Conference of the Farm Management Association of Nigeria, FAMAN.

Hoddinott J. and Quisumbing, A.(2003). Methods for micro-econometric risk and vulnerability assessments. Social Protection Discussion Paper No. 0324. The World Bank

Hulme, P. E (2005): "Adapting to climate change: is there scope for ecological management in the face of a global threat?" *journal of Applied Ecolology* 42: 784–794

Ibrahim, H. and Umar, H.S., (2008). Determinants of Poverty among Farming Households in Nasarawa State, Nigeria. *Journal of Production Agriculture Technology.* 4 (1): 11-21

Idiong, C. I., Onyenweaku, E.C., Domian, I. A. and Susan, B. O. (2007) A stochastic frontier analysis of technical efficiency in swamp and upland rice production system in Cross River State Nigeria Medwell Agricultural Journal 2(2): 299 –305.

Idris, M. (2008): "Damming Nigeria's wetlands People: Communities Work Together to Restore Lives and Livelihoods" World Rivers Review: Legacy Issue.
IDS.

IFAD (1992) *The State of World Rural Poverty: An Inquiry into Its Causes and*

International Fund for Agricultural Development (IFAD) (2007). *Rural Poverty in Nigeria.* Retrieved March 14, 2014, from http://www.ruralpovertyportal.org/web/ guest/ country/

Iyangbe, C.O. and Onowa, S.I. (2009). "Determinants of Daily protein intake among rural and low-income urban Households in Nigeria" *Journal of American-Eurasian ScientificResearch* 4 (4): 290-301, 2009.

Jewel (2003). Poverty and Livelihoods Issues Relating to Crops in the Hadejia-Nguru Wetlands. A Report to the JEWL Project.

Jewel (2007). Wetland Management: The problems is Typha grass

Jibowo, A.A. (2000). Essentials of Rural Sociology (second Impression). Gbemi Sodipo Press Ltd., Abeokuta, Nigeria, Pp 249.

Johnston, J., and Dinardo, J. (1997). Econometric Methods. Fourth edition, University ofCalifornia, Irvine. Pp 496.

Kassie, M., Shiferaw, B. and Muricho, G.(2010). Adoption and Impact of Improved Groundnut Varieties on Rural Poverty: Evidence from Rural Uganda. *Environment for Development,* Discussion Paper Series, Pp 1 – 30.

Kio, P.R.O .and Ola –Adams B.A.(1986). Utilization and Development of wetlands. In Nigerian Wetlands. Akpata, V.I .and Okalo D.U.U (Eds.).Man and Biosphere.

Kirk, Michael and Diethard, M. (1999). Socio-economic Differentiation in Animal keeping societies: Anin Research and Development Vol.27, pp.205 -216.

Kirkley, J.E., Squires, D. and Strand, I.E. (1994) Assessing Technical Efficiency in Commercial Fisheries: The Mid-Atlantic Sea Scallop Fishery. *American Journal of Agricultural Economics* 20: 31-34.

Korotayev, A. (2004). *World Religions and Social Evolution of the Old World Civilizations: A Cross-cultural Perspective* (First ed.). Lewiston, New York: Edwin Mellen Press:1-8.

Kuehn, M. M., White, B.N. (1999). Morphological analysis of genetically identified cattails *Typha latifolia*, *Typha angustifolia*, and *Typha x glauca*. *Canadian Journal of Sciences.* 13:2245-2251

Lasse, K. (2001). The sustainable Livelihood approach to Poverty Reduction. IDS Working Paper 90, IDS, Brighton, UK

Liao, T.F. (1994). *Interpreting Probability Models: Logit, Probit, and Other Generalized Linear Models*. Series: on Qualitative Applications in the Social Sciences. 39: 123-127

Long, N. (1977). An introduction to the Sociology of Rural Development. Tavistock Publications Ltd., London.

Mack, R. N., Simberloff, D.,Lonsdale, W. M. Evans, H., Clout, M. and Bazzaz, F. A. (2000). Biotic Invasions: Causes, Epidemiology, Global Consequences, and Control. Ecological Applications 10(3): 689-710.

Mahmood, Y. Y. (2005). Agricultural Inputs Constitute the most critical constraint in Agricultural Production and Economic Growth in Nigeria. Lead Paper presented at the 20th National Conference of the Nigerian Association of Agricultural Economists (NAAE) held at the Abubakar Tafawa Balewa University, Bauchi. 6th – 9th November. Pp 215 - 227

Martins, M. F.O. and Fernandes, J. M (2008). The Determinant of Poverty in Cape Verde: An Economic Approach. Http: www.CBS.org .

Maurice, D.C. (2004). Resource productivity in cereal crops production among fadama farmers in Adamawa state, Nigeria. Unpublished M.sc. Thesis submitted to the department of agricultural economic and extension, University of Maiduguri, Nigeria. Pp 25

McManus H. A., Seago, J. L. and Marsh, L. C.(2002). Epiflourescent and histochcemical aspects of shoot anatomy of *Typha latifolia* L., *Typha angustifolia* L. and *Typha glauca* Godr. *Annals of Botany*. 90: 489-493.

Miao, S. L., and F. H. Sklar. (1998). Biomass and nutrient allocation of sawgrass and cattail along an environmental gradient in Florida Everglades. *Wetlands Ecology and Management*. 5:245-264.

Mitsch, W. J. and J. G. Gosselink (2001). Wetlands, 3rd ed. John Wiley & Sons, Inc. NewYork. Pp 205

Mohammed, T.A. (1987). Pastoral Fulbe Economics and Society in Contemporary Nigeria: The Political Economy of Agricultural and Livestock Development Policy Programmes, Unpublished Ph.D. Thesis, University Of Missouri, Columbia.

Ndagi, J. O. (1999): Land Conflict Resolution: Case Studies in the Philippines. Ini FAO Land Reform. NOP Website.

National Bureau of Statistics. (2005). National Living Standard Survey, National Bureau Oaks. Landon, New Delhi. Pp 88

Nigeria environmental study/action team (NEST) (1991). Nigeria's threatened environment a national profile. NEST, Ibadan, pp 4 - 287.

Obwona, M. (2000) Determinant of technical efficiency among small and medium scale farmers in Uganda: A case of tobacco growers. Final Report at the AERC Biannual Research Workshop, Nairobi, Kenya.

Odine A. T., Shittu A. M., Ayinde I. A. and Olubanjo O. O. (2011). Assessment of the Economic Value of Selected Wetlands in Southwest, Nigeria Proceedings of the Environmental Management Conference, Federal University of Agriculture, Abeokuta, Nigeria Pp 86-96.

Ogunlela, Y.I. and Mukhtar, A.A. (2009). "Gender issues in agriculture and rural development in Nigeria: The role of women." *Humanity and Social Sciences Journal*, 4(1) :19-30.

Ojekunle Z. O., Li Roupu, Zhao Lin, Tan Xin and Hamza Bangura (2011). Ameliorating Water Crisis Through Suatainable Wastewater Reuse. *Journal of America Water Works Association.*101 :71-79.

Okali, C. (2006). Linking livelihood and gender analysis for achieving gender transformative change. Livelihood Support Programme (LSP) Working Paper, 41. Pp 381

Okoruwa, V. O. and Ogundele, O. O. (2006). Technical efficiency differentials in rice production technologist in Nigeria. African Economic Research Consortium, Research paper No.154.

Olayemi, J. K. (1995). A Survey of Approaches to Poverty Alleviation. Paper Presented at the NCEMA National Workshop on Integration of Poverty Alleviation Strategies into Plans and Programmes in Nigeria NCEMA Ibadan. Pp 23-27

Olubanjo, O.O., Akinleye, S.O. and Soremekun, W.A. (2010). Poverty determinant among Farmer in Ogun State, Nigeria. A Research Paper. Department of AgriculturalEconomics,Olabisi Olabanjo University, Yewa Campus Ayetoro. Ogun State. Pp 25

Omilola, B.(2009).Estimating the Impact of Agricultural Technology on Poverty Reduction in Rural Nigeria. IFPRI Discussion Paper 00901. pp1 – 30.

Omonona, B. (2010). Quantitative Analysis of Rural Poverty in Nigeria. Nigeria Strategy Support Program. Brief.17: 1-5

Omonona, B. T. (2001). Poverty and Its Correlates among Rural Farming Households in Kogi State, Nigeria" Unpublished Ph.D Thesis, Department of Agricultural Economics University of Ibadan, Nigeria. Pp 25

Pasteur, K. (2002). Gender Analysis for Sustainable Livelihoods Framework, Tools and Links to Other Sources. Eldis Document Store, www.eldvis.com,. Accessed February, 2012. Pp 139.

Porter, G., Blaufuss, K., Owusu A and Cheampong, F.(2007). Youth, Mobility and Rural Livelihoods in Sub-Saharan Africa: Perspectives from Ghana and Nigeria". *AfricaInsight* 37(3): 420-43.

Rahman, S. A., Ibrahim, H. and Ibrahim H. (2007) Socio-Economic Study of Gender Role in farm production in Nasarawa State of Nigeria. Asia Pacific Journal of Rural Development. 17(1):57-58.

Rahman, S. A. and Umar H.S. (2009). Measurement of Technical Efficiency and its Determinants in Crop Production in Lafia Local Government Area of Nasarawa State, Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension.* 8(2):90-96

Rao, M.R., Talley rand, H., Anatole, E.M. and Ndikawa, R. (2004). Agronomic research on sorghum in the traditional cropping systems of the semi-arid northern Cameroon. Experimental Agriculture 16: 105-16.

Ravallion, M. (1991) Measuring Changes in Poverty: A Methodological Case Study of Indonesia during an Adjustment Period. *The World Bank Economic Review*, 5 (1) :57-84.

Reyes, G. E. (2010). Four main Theories of Development: Modernization, Dependency, World-System and Globalization. *Revista Critica De Ciencias Sociales Juridicals*. 4 - 8

Sabo, B. B., Karaye, A. K. And Badamasi, M. M. (2010) Typha Grass Militating against Agricultural Productivity along Hadejia, Jigawa State, Nigeria. Proceedings of the 21st Annual National Conference of Farm Management Association of Nigeria, 11th -14th October 2010.Pp 234-254

Sani A. S. (2012). Repositioning Agriculture for Sustainable Economic Development in Nigeria. *Humanity and Social Sciences Journal*, 4(1) : 1 - 7.

Sani, M. (2003), Tenure Issues Fadama Area Phase Of Hadejia Valley Project Area Phase I Jigawa State Unpublished M.Sc. Thesis Geography Department, Bayero University, Kano Nigeria.

Santos, D.T. (1971). The Structure of Dependence. Boston: Extending Horizons.

Scoones, I. (1998). *Sustainable Rural Livelihoods. A Framework for Analysis*. IDS Working Paper 72.

Sen, A. (1997) Editorial: Human Capital and Human Capability. World Development 25(12): 1959-1961.

Sharp, K. and Devereux, S. (2004). Destitution in Wollo (Ethiopia): chronic poverty as a crisis of household and community livelihoods. *Journal of Human Development* 5 (2): 227-247.

Sharma K.R. and Kushwata, H.M. (1990). Technical, Allocative and Economic Efficiencies in Swine Production in Hawaii: A Comparison of Parametric and Nonparametric Approaches. *Agricultural. Economics. 20 (I), 23-35.*

Smith, L. E. D., Nguyen Khoa, S. and Lorenzen, K. (2005). Livelihood functions of Inland Fisheries: *policy implications in developing countries*. *Water Policy* 7: 359-383.

Smith, R., and Smith. T. (2001). Ecology and Field Biology, 6th Edition, edition. Benjamin Cummings, New York. Pp 771.

Solomon, O. (2008). Identification of training needs of oil palm (Elaeisguinensisjocq) Farmers in Rainforest Zone of south western Nigeria. Unpublished Ph.D Thesis. Pakistan Journal of Nutrition (5).

Stewart, H., S. L. Miao, M. Colbert and C. E. Carraher (1997). Seed germination of two cattail (*Typha*) species as a function of Everglades's nutrient levels. Wetlands 17(1): 116-122.

Stuckey, R. L., and D. P. Salamon. (1987). *Typha angustifolia* in North America: a foreigner masquerading as a native. *American Journal of Botany*. 74:75 - 77.

Sunday,J. (2009). Approaches to improving the Natural Resource use for Agriculture in the Sahelian West Africa USAID and Care New York.

Sztompka, P. (2002). *Socjologia*, Znak, ISBN 83-240-0218-9 :1-500.

Tejuoso, O. J. (2006). "Wetland uses/dynamics for agricultural purposes and its health implications in lower Ogun river basin, Lagos, Nigeria" A technical report summated to International Development Research Centre (IDRC) (Ecosystem Approach to Human Health Team) Pp 20-22

Terer T., Ndiritu G. and Gichuki N. (2004): "Socio-economic values and traditional strategies of managing wetland resources in Lower Tana River, Kenya" *Journal of Hydrobiologia*527: 3–14.

Tukur, A. (1999): An Overview Of Pastorialists Farmers Conflicts: Causes, Consequences and Control Mechanism: Working Paper, Global Livestock and Agro Services Limited, Kaduna Nigeria.

Uchytil, R. J. (1992). Phragmites austrails. In U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Fire Effect Information System. Pp 976

United Nation Office for Project Services (UNOPS) (2014) Demonstration Project Document-Wings Over Wetlands,*wow.wetlands.org/Portals/1/.../demo_project_document_*

United Nations Development Programme (1998). Urban Agriculture; Food, Jobs and Sustainable Cities. New York UNDP. World Health Organization (WHO) (2006). Guidelines for The Safe Use of Wastewater, Excreta and Greywater: Wastewater Use in Agriculture (Volume II). Retrieved from

persistent URL: http://www.who.int/water_sanitation_health/wastewater/gsuweg2/en/index.html. On 02-02-2012

Urban, N. H., Davis, S. M.and Aumen. N. G. (1993). Fluctuations in Sawgrass and Cattail Densities in Everglades Water Conservation Area 2 A under varying Nutrient, Hydrologic and Fire Regimes. *Aquatic Botany*. 46:203-223.

Weir, S., Knight, J. (2004). Externality Effects of Education: Dynamics of the Adoption and Diffusion of an Innovation in Rural Ethiopia. *Economic Development and Cultural Change* 53: 93–113.

Wikipedia encyclopedia on sociocultural evolution Retrieved April, 2014

World Bank (2001). World Development Report 2000/2001 Washington D.C.

Yusuf, N. (2005). Poverty and Nigeria Development: A Sociological Analysis. i*Journal of Development Studies*, 2 (1&2) : 198-204.

Zalkuwi, J. W. Dia, Y.Z. and Dia, R.Z.(2010). Analysis of Economic Efficiency of Maize Production in Ganye Local Government Area Adamawa state, Nigeria, *Report and Opinion,* 2 (7) http//www.sciencepub.net/report, retrieved 18th June, 2013

Zedler, J. B. and S. Kercher (2004). Causes and consequences of invasive plants in wetlands: Opportunities, opportunists, and outcomes. *Critical Reviews in Plant.* 4: 28-36

DEPARTMENT OF AGRIC ECONOMICS AND RURAL SOCIOLOGY
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY, ZARIA
QUESTIONNAIRE

I am a student of the above mentioned institution conducting a research on analysis of the effects of Typha grass on the livelihood of the farmers living within Hadejia-Nguru conservation project. Kindly respond to the following questions.

SECTION A: BACKGROUND INFORMATION

Name of enumerator……..

L.G.A…….

Name of village…….

Type of respondent crop farmer ( ) Fish farmer ( ) Pastoralist ( ) Trader ( )

SECTION B: SOCIO-ECONOMIC CHARACTERIRSTICS OF THE RESOPONDENT

1. Age ……
2. Tribe ……..
3. Length of residence in the village ……
4. Level of education…….
5. Non formal
6. Qur'anic school (years):…….
7. Less than first school leaving certificate (year):……..
8. Primary school (years)…….
9. WAEC/equivalent (years)……..
10. Marital status: single ( ) married ( )
11. House hold size……..……
12. Farm size……

    (i) ‹- 1 hectare

    (ii) 1-2.5 hectares

    (iii) 2.6-3 hectares

    (iv) ›-hectares

13. How many years do you spent in farming?
14. How many bags of crops do you produce before the invasion of typhagrass?
15. How many bags of crops do you produce with invasion of the typhagrass?
16. How many calves do your animal produce before the invasion of typha years? .....
17. How many calves do your animal produce in typha invasion years? .....
18. Indicate the number of cattles you posess....

AGE	NUMBER	WEIGHT	COST (₦)
0 – 5 Months 6 Months – 1 year $1^{1/2}$ year – 2 years 2 ½ years – 3 years 3 ½ years – 4 years 5 ½ years – above			

19. Indicate the number of sheeps you possess before the invasion of typha years....

AGE	NUMBER	WEIGHT	COST (₦)
0 – 5 Months 6 Months – 1 year $1^{1/2}$ year – 2 years 2 ½ years – 3 years 3 ½ years – 4 years 5 ½ years – above			

20. Indicate the number of sheeps you possess after the invasion of typha years....

AGE	NUMBER	WEIGHT	COST (₦)
0 – 5 Months 6 Months – 1 year 11/2 year – 2 years 2 ½ years – 3 years 3 ½ years – 4 years 5 ½ years – above			

21. Indicate the number of goats you possess before the invasion of typha years....

AGE	NUMBER	WEIGHT	COST (₦)
0 – 5 Month 6 Months – 1 year $1^{1/2}$ year – 2 years 2 ½ years – 3 years 3 ½ years – 4 years 5 ½ years – above			

22. Indicate the number of goats you possess after the invasion of typha years....

AGE	NUMBER	WEIGHT	COST (₦)
0 – 5 Months 6 Months – 1 year $1^{1/2}$ year – 2 years 2 ½ years – 3 years 3 ½ years – 4 years 5 ½ years – above			

23. What are the coping strategies adopted against typha grass invasion...

24. Suggest ways in which effects of typha grass can be reduce in this area...

S/N	CROPS	OUT PUT IN 100Kg bags
i.	Maize	
ii.	Beans	
iii.	Rice	
iv.	G/corn	
v.	Other specify	

25. How much do you earned from the sales of fish before typha invasion _____ _ _

26. How much do earned from the sales of fish with typhagass invasion

SECTION C: LIVELIHOOD ACTIVITIES ENGAGED IN by FARMERS.

27. What are the livelihood activities engaged in by the farmers?

(a) Crop farming _ Yes ( ) no ( )

(b) Fish farming _ Yes ( ) No( )

(c) Livestock farming – yes ( ) no ( )

(d) Trading yes ( ) no ( )

(e) Craftwork yes ( ) no ( )

SECTION D: Factors influencing farmer's livelihood activities.

28. What are the factors influencing farmers' livelihood in your area?

(i) Availability of farm land

(ii) Availability of water for irrigation

(iii) Grazing reserves for livestock

(iv) Availability Fish Species

(v) In migration of people from neighboring states

SECTION E. the extent of land covers by typha

29. What is the extent of land cover by typha grass in your areas?

(i)<-1hecter

(ii) 1-2.5hecter

(iii) 2.6-3 hectare

(iv) 3 hectare.

(v) Others

(specify):----------

SECTION F: effects of typha grass on the livelihood of farmers.

30. What is the major effect of typha on crop production?

(i) Drop in yield

(ii) Destruction of the whole crop

(iii) Poor soil fertility

(iv) others

(specify):----------

---

31. What are the effects of typha grass on livestock production in your area?

10. Low productivity
11. Drop in milk production
12. Lost of grazing reserve
13. Others

(specify):----------

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32. What are the effects of typha grass on fish production?

14. Low productivity
15. Drop in fish catch
16. Reduction in fish species

17. Others:(specify):----------

SECTION G: Cropping strategies employed by the traders against typha grass invasion.

33. What are cropping strategies employed by farmers in your area?

(i) Dry season farming

(ii) Cultivation of upland rice

(iii) Vegetables production

(specify):----------

