ASSESSING THE ECONOMIC VALUE OF CROP PRODUCTIVITY BIODIVERSITY IN IJEBU REGION OF OGUN STATE, NIGERIA

BY

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CERTIFICATION

I hereby certify that this project was carried out by Osisanya Oluwatosin Rebecca with Matric no: 18032406001 (Biology/Geography) under my supervision in the Department of Geography.

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DEDICATION

I hereby dedicate this research work to Almighty God, for His goodness, mercy, and greatness since the beginning of this journey to the present moment. This project is also dedicated to my beloved and beautiful Mother, Mrs. I.G Osisanya for her strongly supports and advice in the cause of this Programme. May the God almighty bless her abundantly and grant her long life and prosperity in good health and wealth. Amen.

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ABSTRACT

Biological diversity involves genetic, species, and ecosystem diversity. Genetic diversity denotes the variation within species in the functional units of heredity present in any plant or animal, mic robial or other origin of living things. Species diversity encompasses the variety of species whether wild or domesticated, within a geographical area. This study assesses the economic value of crop productivity biodiversity in Ijebu Ode agricultural zone of Ogun State. The authors proposed a dynamic model of market equilibrium with vertical product differentiation that enabled us to consider the economic consequences of respondents' monthly income and species crop of three different communities. The objectives of the study are to identify the personal and socio-economic characteristics of farmers and determine the importance of biodiversity in the study area using Simpson's Index. The result showed that 52.50% were male, majority

(32.50%) were within the age range of 31 and 40 years old, 44.17% were married, 62.50% had h ousehold size of 6-10, and majority (45.83%) had secondary education while 46.67% had up to 20 years farming experience. In conclusion, the authors find that effective factors play an important role in explaining the support for biodiversity cons ervation, particularly when people do not have specific knowledge about species; while ecological-scientific considerations appear when people are well-informed.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Biodiversity denotes the wealth and variety of all living things. Naturalists have a long history of examining and classifying animals, plants, fungi, and other organisms, the term “biodiversity”, meaning the total variability of life, dates only from the 1980s. Biodiversity is considered at three levels: species diversity, genetic diversity, and ecosystem diversity (Ammann 2004). The first category refers to the variety and abundance of species in a geographical area; the number of species is the simplest and most used measure of biodiversity (Current, Lutz, and Scher 1995). Despite the tendency to focus on species, relying on species and their numbers alone does not go far enough: Each species consists of subspecies, populations, and individuals. In fact, many practical conservation decisions target subspecies and populations rather than species. The second and third categories of biodiversity, genetic and ecosystem diversity, have not garnered as much media coverage. Genetic diversity refers to variation between and within species, both among populations and among individuals within a population. Variation arises from mutations in genes, and natural selection of these characteristics is the primary mechanism of biological evolution. Ecosystem or systems diversity refers to the variation between communities and their associations with the physical environment (McNeely and Scherr 2003). Species have different functions within their communities; some can be substituted while others (key stone species) play determinant roles in the food web and cannot be removed without fundamentally altering the community itself. An example of a keystone species is the grey wolf. The cascading effects of the reintroduction of the grey wolf to Yellowstone demonstrate its disproportionate role in shaping the ecosystem. When wolves were absent, deer foraged in large numbers in riparian areas, removing vegetation and keeping areas open. The wolves’ new presence has caused deer to avoid those areas where the risk being preyed upon is greatest. Consequently, with the re-growth of vegetation, riparian habitat for birds and beavers has increased both in quality and extent (Dollacker 2006). Several plants and trees that were previously overgrazed now flourish in spot that elk and deer avoid because of the presence of wolves. The new vegetation provides food for beaver and habitat for songbirds, and their populations have increased (Siikamaki 2008). According to Singh (2000), biodiversity refers to the diversity of life in all its form and all its level of organization, not just plants, animals, and micro-organism species. At its most elemental level, biodiversity encompasses the varied assemblages of organic molecules that comprise the genetic basis of life. On the other end of the spectrum, there are biomes—the vast stretches of tundra, desert, forest, ocean, etc. For many people, the very questioning of the worth of biodiversity is illicit. They would argue that humankind has a moral obligation to conserve biodiversity, an obligation that comes with the fact that humans have the capability to destroy much of that biodiversity. Others find a religious support for such a vies, there is some stewardship responsibility on behalf of some deity. One problem with these moral views is that they often conflict with other moral views about, say, the right to earn a living, the right to have access to basic need such as food, cloth, shelter, and so on. If conserving biodiversity conflicts with those rights, then some "meta-ethical" principles are required for deciding which moral view should prevail (R. Prescott-Allen and C. Prescott-Allen 1988). One aspect of the process of changing popular perceptions about biodiversity resources is to show that the sustainable use of biodiversity has positive economic value and that this economic value will often be higher than the alternative resources use which threatens biodiversity. Biodiversity or biological diversity refers to the variety of life forms on the planet—its plants, animals, microbes, and fungi, the genes that they contain and the ecosystems of which they are a part. The term is also often used to describe the diversity of organism within a particular area or range. This "local" biodiversity is of concern when human activity encroaches on habitat and pushes species out of the area or in some circumstances causes local or complete extinction of a species. All organisms rely on other life forms for their existence. Organisms using oxygen in respiration rely on plants for its production and food that comes from plants, animals, and fungi. Any change in number of one species will affect the lives of other species (Haffmans and Smolka 2008). Habitat degradation in the form of land clearing or introduction of foreign species is the main cause for losses in biodiversity; world agricultural trade depends on biodiversity. New varieties of livestock and crops are being bred continually from their wild "cousins" in order to stay ahead of pest and disease. These are being used to breed drought resistance, to boost nutritional content or to increase crop yields. Many common pharmaceuticals were first found in wild plants and animals and major searches are continuing around the world for new therapeutic compounds in wild species (Ammann 2004). Biodiversity is important to agriculture. All modern crop varieties were originally produced using land races developed by farmers around the world from wild plants over hundreds and thousands of years. Wild relatives of these crops still represent important reservoirs of genes that are essential for improving the crops or developing new strains to keep them from being overwhelmed by stresses such as changing climate or the evolution of new pest, parasites, and disease. Primitive populations of crops and their wild relatives are an important source and often the only source of pest and disease resistance worth many millions of dollars of adaptations to difficult environments and of other agronomical valuable characteristic such as the dwarf habit in rice and wheat which has revolutionized their cultivation and led to increased yields in many parts of the world from wild plants over hundreds and thousands of years (Aju and Ezebiekwe 2010). All agricultural activities are human-made interventions and involve the modification of natural ecosystems to provide for people's needs. Through land conversion to agriculture, the original ecosystem is replaced by an unceasing series of constantly occurring interventions such as tilling, sowing monocultures, harvesting, or crop rotation. Maintaining the right balance between habitat diversity and agricultural activities is therefore often a challenge. This challenge is already being addressed in many countries, through firmly embedding conversation objectives in land—use practices which enhance productivity and profitability, and which can deliver mutual benefits to biodiversity and to productivity. Humans take what they need from nature: food, raw materials, and medicine. Nature supplies humans with clean water and provides us with services, such as the filter function of the ground or the recreational function of the ecosystems. The insidious loss of biological diversity becomes apparent later in technological societies, then in societies that live directly from nature where there is no possibility of compensating technologically for the losses resulting from damage to natural regulatory systems. For example, when fish stocks are exhausted due to over-fishing, the fishermen, their families, and whole village communities suffer from hunger. People in industrial nations only notice the dramatic change due to rising prices, but they have the choice of buying other food. With the concept of "ecosystem services", an attempt is being made to estimate the economic value of biological diversity. It has been calculated that globally, eco-systems provide important services to the value of about 26 trillion euros a year. The sum is far greater than the annual world gross social product. Despite this impressive figure, there can be no pure economic evaluation of natural systems. Biological diversity has an intrinsic value. However, as biological diversity cannot defend itself, attempts are being made by way of agreements, contracts, and action plans at international, European, and national level, to counteract the loss of biological diversity.

1.2 STATEMENT OF THE PROBLEM

Reduction in biological diversity is an inevitable outcome of economic pressures and technological innovations in the initial stages of agricultural development. As agriculture has developed, its effect on biological diversity has increased and the value of biological diversity is increasingly recognized. The effect of several economic and technical trends on agriculture suggests that incentives can be modified to reconcile continued profitability of the agricultural industry with sustaining the current biological diversity (Howitt 1995). A nation that integrates biodiversity conservation in a truly national programme of sustainable development is aimed at substantially reducing poverty, designing a secure future, and facilitating the growth of the Nigeria biodiversity for the benefit of Nigerian community and economy in line with the principles of ecological sustainability and social equity (CIA World Factbook 2010).

1.3 RESEARCH QUESTIONS

Therefore, the following research questions are fundamental to this study:

(1) What are the socio-economic characteristics of farmers?

(2) What is the importance of biological biodiversity?

(3) What is the relationship between respondent's personal/social-economic characteristic and crop productivity in the study area?

1.4 OBJECTIVES OF THE STUDY

The main objective of the study is to analyze the economic value of biological diversity on crop productivity in Ijebu Ode agricultural zone of Ogun State, Nigeria. Specific objectives are:

(1) To identify the personal and socio-economic characteristics of farmers in the study area;

(2) To determine the importance of biodiversity in the study area;

(3) To determine the relationship between respondent's personal/social-economic characteristic and crops productivity in the study area.

1.5 RESEARCH HYPOTHESIS

H_0: There is no significant relationship between the socio-economic characteristics and crops productivity biodiversity in the study area.

1.6 JUSTIFICATION OF THE STUDY

In Nigeria, poverty is directly linked to biodiversity loss. This is because rural livelihoods depend almost entirely on biodiversity. In order to address biodiversity concerns, the problem of poverty must be addressed by providing alternative livelihood options to rural communities. Natural and man-made threats, socio-cultural problems as well as direct and indirect consequences of socio-economic development have contributed to the erosion of biodiversity at all levels. Nigeria, with a population of about 160 million people constitutes nearly a quarter of the total population of sub-Saharan Africa. A population growth rate of more than 3% and increasing poverty (especially in rural areas) has put severe demand on the country's natural resources, the institutional structures, and the resources available to manage them. There has been a general institutional weakness and lack of technical capacity to effectively tackle the nation's environmental issues, including threat to biological diversity. The loss of biodiversity is particularly apparent in the sector of agro-biodiversity. The international community relies more and more on fewer species of crops to provide for basic needs and within these species the genetic spectrum is becoming increasingly limited. Now experts have come up with the term "genetic erosion" for the loss of genetic diversity within species. This applies particularly to cultivated species such as wheat, rice, or maize. Of the thousands of different varieties that humans have cultivated in history, only a handful remains today. Agro-biodiversity also decreases with the falling number of cultivated field crops. Agricultural technology, the green revolution, the increasing market domination of a few multinational seed companies, the industrial processing of agricultural goods and global trade with its standardizations are driving forces in the standardization of cultivated crops and culture species.

1.7 DEFINITION OF TERMS

Economic: relating to, or based on the production, distribution, and consumption of goods and services economic growth. b : of or relating to an economy a group of economic advisers. c : of or relating to economics economic theories

Value: is a measure of the benefit provided by a good or service to an economic agent. It is generally measured relative to units of currency, and the interpretation is therefore "what is the maximum amount of money a specific actor is willing and able to pay for the good or service"?

Crop: is a plant or animal product that can be grown and harvested extensively for profit or subsistence. Crops may refer either to the harvested parts or to the harvest in a more refined state. Most crops are cultivated in agriculture or aquaculture. A crop may include macroscopic fungus (e.g., mushrooms), or alga.

Productivity: is commonly defined as a ratio between the output volume and the volume of inputs. In other words, it measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output.

Biodiversity: is a term used to describe the enormous variety of life on Earth. It can be used more specifically to refer to all of the species in one region or ecosystem. Biodiversity refers to every living thing, including plants, bacteria, animals, and humans.

Consumers: is a person or a group who intends to order, orders, or uses purchased goods, products, or services primarily for personal, social, family, household.

CHAPTER TWO

2.1 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Agricultural biodiversity refers to the biological diversity found in crop and domesticated livestock and aquatic systems, as distinct from that of wild species of plants and animals. Supporting the maintenance of diversity on farms is one strategy for crop genetic diversity conservation. On-farm conservation is viewed as a complementary strategy to ex situ conservation strategies. Through on-farm conservation not only are materials conserved, but so also are the processes of evolution and adaptation of crops to their environment. Public policymakers and scientists have expressed renewed interest in the prospects for on-farm conservation of crop genetic resources in recent years but understanding of the economic incentives for and mechanisms through which programmes might best be implemented remains sketchy. Working through national partners, the goal of IPGRI's Global Project, 'Strengthening the Scientific Basis of In Situ Conservation of Agricultural Biodiversity On-Farm' is to strengthen the scientific basis, institutional linkages and policies that support the role of farmers in conservation and use of crop genetic diversity through the application of sound theoretical principles in an interdisciplinary context.

The current set of projects treats only crop biodiversity (livestock and aquatic biodiversity have not yet been included). Sites were selected globally based on their known importance as centres of origin or diversity for a crop and the willingness of national partners from formal and informal sectors to work together as teams with local farming communities. The earlier phases of the project resulted in formation of representative partnerships among national research and educational institutions, ministries of environment and agriculture, extension workers, nongovernment organizations and farming communities. Nesting of country case studies within a global framework is necessary in order that a unified, validated methodology framework emerge. A primary task for those concerned with supporting maintenance of agro biodiversity in general, and of crop diversity, is to understand when, where and how this will happen, who will maintain the material and how those maintaining the material can benefit. The Global In Situ Conservation On-farm project has identified four aspects where information is needed to support farmers and local communities in crop genetic diversity conservation, management and use on-farm:

1. What is the extent and distribution of the genetic diversity maintained by farmers over space and over time?

2. What are the processes used to maintain the genetic diversity on-farm?

3. Who maintains genetic diversity within farming communities (men, women, young, old, rich, poor, certain ethnic groups)?

4. What factors (market, non-market, social, environmental) influence farmer decisions on maintaining diverse cultivars? In the earlier phases of the project, research efforts focused on quantitatively answering the first three questions, with answers to the fourth question being descriptive and anecdotal in nature. This earlier research has provided a basic data set, focused on understanding the units of intraspecific crop diversity that farmers manage and the relationship of these units to genetic distinctiveness over space and time. The research has also begun to identify how these units are managed and maintained, and by whom. Among the research efforts planned for the next phase of the Global Project is the design of interdisciplinary, applied economics research that builds on the groundwork laid in the initial phase. It is envisioned that this research will help quantify answers to the fourth question and provide inputs

to the knowledge necessary for supporting the maintenance of genetic diversity while economies develop. In May 2002, IPGRI convened the first economics meeting of the Global In Situ Conservation On-farm Project, hosted by jointly by IPGRI, the Hungarian Institute for Agrobotany and the Institute for Environmental Management, St. Stephen's University (Szent István University), in Gödöllő, Hungary. The workshop, entitled 'The Economics of Conserving Crop Biodiversity on Farms: Methods, Case studies, and Future Directions for IPGRI's Global In Situ Project' brought together applied economics researchers representing different fields of inquiry and various countries. IPGRI's economics research on the Global Project is jointly undertaken with the International Food Policy Research Institute (IFPRI). As a social science discipline, economics is the study of the choices individuals and societies make about the allocation of resources available to them.

For our purposes, we define on farm conservation as the choice by farmers to continue cultivating diverse crops in their communities, in the agro ecosystems where the crops have evolved historically through processes of human and natural selection. Economics research about on-farm conservation focuses on the varieties and variety attributes that farmers recognize in their fields rather than the genetics of the crop or the crop's performance in a controlled environment. The initial objective of the economics research undertaken by IPGRI and IFPRI is to document and analyse in a systematic (as opposed to anecdotal) way the economic factors that encourage or discourage farmers from choosing to grow diverse crops, while controlling for biophysical factors. There are several fairly demanding requirements for satisfying this objective.

Clearly, a sound empirical analysis is based on tests of hypotheses using representative data sets collected for that purpose. In addition, if implications are to be derived for crop genetic resource conservation, these choices must be linked in a meaningful way to genetic analyses of the crop in the relevant production environment. Such data sets must therefore have been developed in cooperation with knowledgeable biological scientists. To better comprehend the feasibility and relative costs and benefits of conserving diversity on farms as economics develop, we also need to apply a common conceptual framework that can be applied across farming systems, crop reproduction systems, and agricultural economies at different stages of development. The goal of the economics research will be to identify solutions, and the policies that support them, that promote the maintenance of diversity even as economies develop.

This will be done through enhanced utilization of genetic resources by key actors—farmers who are consumers as well as breeders in their own right, professional plant breeders and scientists, and genebank managers. A winning solution is by definition one which meets a given conservation objective at least cost to society. To begin to identify this set of solutions for on-farm conservation, we need the empirical basis that provides the basis for comparative analyses of policy options. Three fields of economic inquiry, each of which makes its own contribution to this applied economics research process, were represented and discussed at the workshop. The first field is the theory of decision-making by the farm household, applied with econometric analysis. This microlevel research investigates the determinants of farmers' choices and links their choices to crop biodiversity measured at a local (farm and community) scale. The second involves econometric applications of methods for valuing environmental goods such as crop biodiversity, whose public value is not captured in market prices.

The third field, institutional economics, employs various approaches in order to comprehend the organizational, rather than the physical, environment within which farmers and other actors involved in biodiversity conservation make their decisions. This brief report presents a summary of the methods papers presented followed by reports of ongoing and planned studies in India, Nepal, Mexico, Burkina Faso, Morocco and Hungary. Economist partners from Peru also attended. It is hoped that further development of these methods and their applications will allow empirically based comparisons that will inform policies in a way that is not currently possible. The proceedings updates the brief section on economics analysis included in the training manual by Jarvis et al. (2000), and also presents some previews of ongoing research.

2.1.1 Biodiversity and Crop Production

Over the past two decades, approximately 20 percent of the Earth's cultivated surfaces have become less productive. According to the latest report from the United Nations Food and Agriculture Organization (FAO), land use-changes and management practices are in part impacting this decline. Now, a study by an international research team of more than one hundred researchers coordinated by the University of Würzburg and Eurac Research, reveals that agricultural fields with greater biodiversity are better protected from harmful insects, promote pollination and produce higher yields.

Ecologists and biologists compared data of about 1,500 agricultural fields around the world: from corn fields in the American plains to oilseed rape fields in southern Sweden, coffee plantations in India, mango plantations in South Africa and cereal crops in the Alps. They analyzed two ecosystem services (i.e., processes regulated by nature that are beneficial and free for humans): the pollination service provided by wild insects and biological pest control service, which is the ability of an environment to use predatory arthropods present in the ecosystem to defend itself from harmful insects.

In heterogeneous landscapes where the variation of crops, hedges, trees and meadows is greater, wild pollinators and "beneficial" insects are more abundant and diversified. Not only do pollination and biological control increase, so does the crop yield. On the other hand, monocultures are the cause of roughly a third of the negative effects on pollination that result from landscape simplification (measured by loss of ‘pollinator richness’). This effect is even greater with the control of harmful insects, where loss of ‘natural enemy richness’ represents 50 per cent of the total consequences of landscape simplification.

"Our study shows that biodiversity is essential to ensure the provision of ecosystem services and to maintain a high and stable agricultural production," explains Matteo Dainese, Senior Researcher and biologist at Eurac Research and first author of the study. "For example, a farmer can depend less on pesticides to get rid of harmful insects if natural biological controls are increased through higher agricultural biodiversity.” The researchers recommend protecting environments whose health is maintained through biodiversity, and to diversify crops and landscapes as much as possible.

"Under future conditions with ongoing global change and more frequent extreme climate events, the value of farmland biodiversity ensuring resilience against environmental disturbances will become even more important," says animal ecologist Ingolf Steffan-Dewenter from the Department of Animal Ecology and Tropical Biology at the University of Würzburg, the initiator of the study within the EU project ‘Liberation’. "Our study provides strong empirical support for the potential benefits of new pathways to sustainable agriculture that aim to reconcile the protection of biodiversity and the production of food for increasing human populations."

2.1.2 Biodiversity for Food and Agriculture

Biodiversity - the variety and variability of animals, plants and micro-organisms at the genetic, species and ecosystem levels - is necessary to sustain key functions of the ecosystem, its structure and processes. Biodiversity for food and agriculture can be managed to maintain or enhance ecosystem functions to provide options for the optimization of agricultural production, and contribute to the resilience of ecosystems for risk mitigation. Indeed, biodiversity enhances ecosystem services because those components that appear redundant at one point in time become important when changes occur.

Why is biological diversity important to agriculture? Some examples:

Crop genetic diversity has a critical role to play in increasing and sustaining production levels and nutritional diversity throughout the full range of different agroecological conditions. Diverse organisms contributing to soil biodiversity perform a number of vital functions that regulate the soil ecosystem, including: decomposition of litter and cycling of nutrients; converting atmospheric nitrogen to an organic form, and reconverting this to gaseous nitrogen; and altering soil structure. Diversity in deliberate plantings on-farm- through crop rotations, crop species mixtures, permanent soil cover crops employed in conservation agriculture or agroforestry - are oft used techniques to increase yield stability, and increase soil fertility. Grassland and pasture/crop systems that diversify and integrate ruminant livestock and crops tend to be more sustainable because they provide opportunities for rotation diversity, perennial cultivation, and greater energy efficiency. The introduction of grazing animals at certain points in farming cycles may help to break down plant material and increase nutrient availability. Predators and parasites which attack pest insects or pathogens on crops, or plant-feeding insects which attack crop weeds contribute to pest regulation. Beyond these direct trophic relationships, a web-like pattern of interactions amongst diverse life-forms on-farm can deliver additional benefits. For instance, crop production may benefit from benign micro-organisms which colonize crops and their habitats such that pathogens do not establish, or from non-crop plants which are attractive to pests and thereby reduce their numbers on crops. Taken together, this directly- and indirectly-acting biodiversity may create “pest suppressive” conditions. Greater on-farm diversity of plants, greater closeness between crop plants and thus coverage of bare ground, and more perennial cultivation may be measures lending greater resistance to invasion of farming systems by noxious species, and assist in weed management. Pollinators are essential for orchard, horticultural and forage production, and contribute to improvements in quality of both fruit and fiber crops. Healthy pollination services are best ensured by an abundance and diversity of pollinators, in large part provided by wild biodiversity.

2.1.3 Ecosystem Services and Their Importance for Agriculture

Ecosystem services are defined as “the benefits provided by ecosystems to humans”. Many key ecosystem services provided by biodiversity, such as nutrient cycling, carbon sequestration, pest regulation and pollination, sustain agricultural productivity. Promoting the healthy functioning of ecosystems ensures the resilience of agriculture as it intensifies to meet growing demands for food production. Climate change and other stresses have the potential to make major impacts on key functions, such as pollination and pest regulation services. Learning to strengthen the ecosystem linkages that promote resilience and to mitigate the forces that impede the ability of agro-ecosystems to deliver goods and services remains an important challenge.

Ecosystem services can be:

- Supporting (e.g. soil formation, nutrient cycling, primary production)
- Provisioning (e.g. food, fresh water, fuelwood, fiber, biochemicals, genetic resources)

- Regulating (e.g. climate regulation, disease regulation, water regulation, water purification, pollination)
- Cultural (e.g. spiritual and religious, recreation and ecotourism, aesthetic, inspirational, educational, sense of place, cultural heritage).

Adapted from: Ecosystems and human well-being: a framework for assessment. Millennium Ecosystem Assessment. 2003. World Resources Institute.

2.1.4 Managing Biodiversity and Ecosystem Functions for Sustainable Agricultural Production

Biodiversity is an important regulator of agro-ecosystem functions, not only in the strictly biological sense of impact on production, but also in satisfying a variety of needs of the farmer and society at large. Agroecosystem managers, including farmers, can build upon, enhance and manage the essential ecosystem services provided by biodiversity in order to work towards sustainable agricultural production. This can be achieved though good farming practices which follow ecosystem-based approaches designed to improve sustainability of production systems. They aim at meeting consumer needs for products that are of high quality, safe and produced in an environmentally and socially responsible way.

The conservation and enhancement of biodiversity in cropping systems both above and below ground (e.g. soil biodiversity) are part of the foundation of sustainable farming practices. Such measures also lead to improved biodiversity in other parts of the environment which are adjacent to but not directly part of the cropland – such as water bodies and the broader agricultural landscape. The composition and diversity of planned biodiversity (for example selected crops) strongly influences the nature of the associated diversity - plant, animal and microbial. A challenge is to integrate, through ecosystem approach strategies, the planned biodiversity that is maintained with the associated diversity (for example, wild pollinators).

Some ecosystem-based production practices

- Conservation Agriculture (CA)
- Integrated rice management systems such as the System of Rice Intensification (SRI)
- Integrated Pest Management (IPM) for plant and animal diseases
- Integrated Production and Pest Management (IPPM)
- Integrated Plant Nutrition Systems (IPNS)
- Integrated Weed Management (IWM)
    - Maintenance of biodiversity, including crop-associated biodiversity, is necessary to ensure the continued supply of goods and services such as:
    - (i) Evolution and crop improvement through breeding – the interaction between the environment, genetic resources and management practices that occurs in situ within agro-ecosystems ensures that a dynamic portfolio of biodiversity for food and agriculture (agricultural biodiversity) is maintained and adapts to changing conditions;
    - (ii) Biological support to production – support is provided by the organisms that make up the biological diversity of the agro-ecosystem. For example, soil fauna and micro-organisms, together with the roots of plants and trees, ensure nutrient cycling; pests and diseases are kept in check by predators and disease control organisms, as well as genetic resistances in crop plants themselves; and insect pollinators contribute to the cross-fertilization of outcrossing crop plants; and

- (iii) Wider ecological functions – valuable ecological processes that result from the interactions between species and between species and the environment include the maintenance of soil fertility, water quality and climate regulation.

CHAPTER THREE

3.1 METHODOLOGY

The study was carried out in Ijebu Ode zone of the OGADEP (Ogun State Agricultural Development Programme). This comprises of six local government areas. These are Isoyin, Ala, Ijebu-Igbo, Ago-Iwoye, Ijebu-Ife, Ibiade. The zone experiences both wet and dry season annually. The climate of the area favours arable crops production.

The rainy season usually starts in March and lasts till November. The dry season is usually very hot except during harmattan period when it is cold and dry. According to Nigeria population census of 2006, majority of the populace combines subsistence farming with other occupation like trading, civil service, and handicraft. Ijebu Ode has an urban population of 154,032 and it lies between latitude 6o 49’ 15” N of the equator and between 3o 55’ 15” E of the Greenwich meridian. Ijebu Ode has area landmass covering about 192 km2 and is located in the Northeastern part of Ogun State.

The vegetation of Ijebu Ode is dominated by derived savannah and agriculture is the main occupation of the people. The people are predominant Yorubas. Population, Sampling Procedure and Sample Size The populations of the study were all crop farmers in Ijebu Ode agricultural zone of Ogun State. A multi-stage sampling technique was used to select the respondents. First stage was purposive selection of two (Ijebu-Ife, Ibiade) out of the six local government in the study area because of their rurality, 10 villages were randomly selected from the two local government.

Then, a list of all the crop farmers in the chosen villages was obtained from the ADP (Agricultural Development Programme) zonal headquarters in Ijebu Ode; six crop farmers were then randomly selected from each of the selected 10 villages, which then gave a total of 120 respondents that was used for this study.

3.2 METHOD OF DATA COLLECTION

A well-structured questionnaire was used in this study to obtain some relevant and adequate data from the respondents. This was administered through a careful in-depth interview.

3.3 METHOD OF DATA ANALYSIS

Objective i. Descriptive analysis such as frequency counts, percentages, and mean was used to analyze the socio-economic characteristics of the respondents.

Objective ii. Descriptive analysis was used to determine the relationship between respondent's personal/social-economic characteristic and crop productivity in the study area. While Simpson's index was used to measure diversity, which takes into account both species richness, and an evenness of abundance among the species present. In essence, it measures the probability that two individuals selected from an area will belong to the species.

The formula for calculating D is presented as:

$$D = \frac{\sum n_i (n_i - 1)}{N (N-1)}$$

Where, ni = the total number of organisms of each individual species; N = the total number of organisms of all species. The value of D ranges from 0 to 1. With this index, 0 represents infinite diversity and 1 represents no diversity. That is, the bigger the value, the lower the diversity. Regression Model Specification The model was expressed as: $Y = b_0 + b_1X_1 + \mu i$ where:

Y = crop yield/productivity measured in naira (dependent variable) b0 = the intercept (parameter) bi = regression coefficients (parameters) that explain the relationship of respondents' selected personal/socio-economic characteristics and crop yield/productivity explanatory variables (i = 1, 2, 3 ... n) µi = error term which accounts for unexplained factors.

CHAPTER FOUR

RESULTS AND DISCUSSION

This section discusses the socio-economic characteristics of the respondents.

4.1 Distribution of Respondents by Sex

Table 1 shows the distribution of the economic value of biodiversity crops productivity according to respondents' sex in the study area. It is observed that about 47.50% of the respondents in the study area are female while 52.50% are male. Economic value of biodiversity crop productivity in the study area is dominated by male farmers.

4.2 Distribution of Respondents by Age

It was observed from Table 2 that majority (32.50%) of the respondents had their age between 31-40 years old in the study area, 25.83% of the respondents fall within the age range of 41-50 years old, 20.00% of the respondents fall within the age range of 51-60 years old while 15.00% of the respondents fall within the age range of 30 years old and below, and 6.67% of the respondents fall within the age range of 61 years old and above. The mean age of the respondent's farmers in the study area is 42.6 years old of age. This implies that most of the farmers are very active and this will enhance their production activities in order to have economic value of biodiversity on crop productivity, also can adopt new technologies if exposed to them.

4.3 Distribution of Respondents by Marital Status

Results show that about 44.17% of the respondents were married in the study area while 29.17% of them were single and 13.33% each of the respondents were separated and widowed respectively (see Table 3). This result has implications on biodiversity on crop productivity in the study area. Married men and women are likely to be relatively stable and focused in carrying on their farming activities and the livelihood that they will have more people in the household who will contribute to labour input, hence, availability of more family labour.

4.4 Distribution of Respondents by Household Size

Table 9 shows the family members represent those being fed, clothed, and housed by a farmer. This can be an important indicator of farmer's productivity on the farm if the farmer has no other occupation apart from farming. The size of the household affects the amount of farm labour, determines the food and nutritional requirement of the household, and often affects household food security. Table 4 shows the distribution of respondents according to household size. Results in the table showed that majority (62.50%) of the respondents in the study area have household sizes of about 6-10 members, followed by 35.00% of the respondents have household sizes of five members and below per family and about 2.50% of the respondents have more than 10 members per family. It is expected that the family members of a farm operator will contribute labour to farm work.

4.5 Distribution of Respondents by Level of Education

The level of education attained by a farmer is known to influence the adoption of innovation, better farming decision making including efficient use of inputs. The study showed that majority (45.83%) of the biodiversity on crop productivity farmers had secondary education, 41.67% of the respondents had no formal education while 9.17% of them had tertiary education and 3.33% of them had primary education in the study area (see Table 5). The finding implies that literacy level is moderately high among the biodiversity on crop productivity farmers as expected in the study area.

4.6 Distribution of Respondents by Years of Schooling

Forty-one-point six seven percent (41.67%) of the respondents had no formal education, 3.33% of the respondents fall between 1-6 years, while 45.83% of the respondents fall between group of 7-12 years, and 9.17% of the respondents fall between group of 13 years and above (see Table 6). The means number of years spent in school was 6.75. This implies that the majority of the respondents are educated.

4.7 Distribution of Respondents by Their Religion

Table 7 revealed that 51.67% of the respondents were Christians, while 48.33% of the respondents were Muslims. This implies that most of the respondents were practicing religion in the study area. **4.8 Distribution of the Respondents According to Their Farming Experience**

Table 8 shows that 53.33% of the respondents had experience of 20 years and below, 30.00% of the respondents had 20-40 years and the remaining 16.67% of the respondents had 41 years and above biodiversity farming experience. This implies that farmers who practiced biodiversity crop productivity were well experienced in the study area.

4.9 Distribution of Respondents by Their Average Monthly Income

The result shows that 40.83% of the respondents obtained average monthly income between N50,000-N70,000, 29.17% of the respondents cultivated average income between N71,000 and above, while 15.83% of them obtained between N31,000-N50,000 and 14.17% of them had between N30,000 and below (see Table 10).

4.10 Distribution of Respondents by the Type of Agricultural Practices

The results in Table 11 revealed that 51.67% of the respondents indicated traditional as an agricultural practice, 28.33% of them indicated conventional while 20.00% of the respondents indicated ecological as a type of agricultural practices in the study area.

4.11 Crops Planted by Respondents

Result shows that 13.33% of the respondents showed grains and legumes as type of food crops, 8.33% of them showed vegetables, 8.33% of them showed root and tubers, 35.83% of the respondents reported fruit crops as a type of food they were planting, while 25.83% of the respondents were planting cash crops and 8.33% of them indicated forage as a type of crops in the study area (see Table 12).

4.12 Simpson's Index to Measure Biodiversity

Table 13 showed three communities (Ijebu Igbo, Ago Iwoye, Ijebu Ife), each was made up of a total of 120 organisms and drawn from combinations of 10 species. From A to J, Community 1 has the highest diversity, it has the joint highest species richness (10) and each species has a similar relative abundance. Community 2 has the same species richness as community 1, but is dominated by one species (A) so that the diversity of this community is lower than community 1. Community 3 has a lower diversity than community 1, due to its lower species richness.

4.13 Actions Taken to Support the Conservation of Crop Wild Relative

The result in Table 14 shows that 64.17% of the respondents have taken action to support the conservation of crop wild relative, while 35.83% of them have not taken any action to support the conservation of crop wild relative.

4.14 Action Taken by the Government to Support the Conservation of Crop Associated Biodiversity and Wild Plants Used for Food

Table 15 shows that 70.83% of the respondents have taken action to support the conservation of crop-associated biodiversity and wild plants used for food, while 29.17% of them did not take action to support the conservation of crop-associated biodiversity and wild plants used for food.

4.15 Actions Taken by the Respondents to Support or Encourage On farm Maintenance of Traditional Varieties

Results revealed that 68.33% of the respondents have taken action to support or encourage on-farm maintenance of traditional varieties, while 31.67% of them did not take action to support or encourage on-farm maintenance of traditional varieties (see Table 16).

4.16 Action Taken by the Government to Support Crop Biodiversity

Sixteen-point six seven percent (16.67%) of the respondents reported policy as an action, 8.33% of them reported provision of incentive, 13.33% of them reported participatory plant breeding as an action, 18.33% of them reported small-scale seed production as an action, 20.83% of them reported development of markets as an action, while 9.17% of them reported farmer field schools as an action and 13.33% of them reported community seed banks as an action (see Table 17). This implies that majority of the respondents have different type of action in the study area.

4.17 Distribution of Respondents by Weather Has Effect on Crop Productivity

It was revealed that majority (100.0%) of the respondent's reported weather has effect on crop productivity (see Table 18). This implies that all the respondents are affected by weather condition on crop productivity in the study area.

4.18 Effect of Weather Condition on Crop Productivity

The results showed that 42.50% of the respondents reported heavy rain is a very severe effect of the weather condition on crop productivity, while 57.50% of them reported it is severe, 61.67% of the respondents' reported droughts as a very severe effect while 38.33% of them indicated it as severe on the effect of crop productivity, 100.0% of the respondents reported floods as a very severe effect of weather conditions on crop productivity. Majority (51.67%) of the respondents reported strong wings as very severe effect of weather conditions, while 30.83% of them indicated strong wings as severe and 17.50% of them reported it was not severe effect of weather conditions (see Table 19). This implies that majority of the respondents are severe to effect of weather conditions.

Table 1. Sex Distribution of Respondents

Sex	Frequency	Percentage (%)
Female	57	47.50
Male	63	52.50
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 2. Age Distribution of Respondents

Age	Frequency	Percentage (%)
≤ 30	18	15.00
31-40	39	32.50
41-50	31	25.83
51-60	24	20.00
≥ 61	8	6.67
Total	120	100.0

Note: Source: Field Survey Data, 2021; Mean age: 42.6.

Table 3. Distribution of Respondents by Marital Status

Marital status	Frequency	Percentage (%)
Married	53	44.17
Single	35	29.17
Separated	16	13.33
Widowed	16	13.33

Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 4. Distribution of Respondents According to Household Size

Household size	Frequency	Percentage (%)
≤ 5	42	35.00
6-10	75	62.50
≥11	3	2.50
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 5. Educational Level Distribution of Respondents

Educational level	Frequency	Percentage (%)
Non-formal	50	41.67
Primary	4	3.33
Secondary	55	45.83
Tertiary	11	9.17
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 6. Distribution of Respondent by Years of Schooling

Years of schooling	Frequency	Percentage (%)
No formal education	50	41.67
1-6	4	3.33
7-12	55	45.83

13 & above	11	9.17
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 7. Distribution of Respondents According to Their Religion

Religion	Frequency	Percentage (%)
Islam	58	48.33
Christians	62	51.67
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 8. Distribution of Respondents According to Their Years of Farming Experience

Years	Frequency	Percentage (%)
≤20	64	53.33
20-40	36	30.00
41 & above	20	16.67
Total	120	100.0

Table 9. Distribution of Respondents by Household That Are Working on the Farm

Household	Frequency	Percentage (%)
≤ 5	113	94.17
6-10	7	5.83

Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 10. Distribution of Respondents by the Average Monthly Income

Monthly income (N)	Frequency	Percentage (%)
≤30,000	17	14.17
31,000-50,000	19	15.83
50,000-70,000	49	40.83
≥71,000	35	29.17
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 11. Distribution of Respondents by the Type of Agricultural Practices

Agricultural practices	Frequency	Percentage (%)
Traditional	62	51.67
Conventional	34	28.33
Ecological	24	20.00
Total	120	100.0

Table 12. Distribution of Respondents by Crop Planted

Crop planted	Frequency	Percentage (%)
Grains and legumes	16	13.33
Root and tubers	10	8.33

Vegetables	10	8.33
Forage	10	8.33
Fruit crops	43	35.83
Cash crops	31	25.83
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 13. Species Crop of Three Different Communities Using Simpson's Index Method

Species	Ijebu Igbo (n i) Community 1	Ago Iwoye (ni-1) Community 2	Ijebu Ife [ni(ni-1)] Community 3
A = Maize	20	72	35
B = Legumes	9	6	44
C = Root and tubers	11	13	41
D = Vegetable	10	3	0
E = Forage crops	8	1	0
F = Fruit crops	12	3	0
G = Tree crops	20	4	0
H = Cash crops	11	3	0
I = Sucker crops	10	2	0
J = Beans	9	13	0
Total	120	120	120

Note: Source: Field Survey Data, 2021.

Table 14. Distribution of Respondents by Having Actions Been Taken to Support the Conservation of Crop
Wild Relative

Action	Frequency	Percentage (%)
Yes	77	64.17
No	43	35.83
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 15. Distribution of Respondents by Having Action to Support the Conservation of Crop-Associated Biodiversity and Wild Plants Used for Food

Action	Frequency	Percentage (%)
Yes	85	70.83
No	35	29.17
Total	120	100.0

Table 16. Distribution of Respondents by Having Actions Been Taken to Support or Encourage on Farm Maintenance of Traditional Varieties

Action	Frequency	Percentage (%)
Yes	82	68.33
No	38	31.67
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 17. Distribution of Respondents According to the Type of Action Taking by the Government

Type of action	Frequency	Percentage (%)
Policy/Legislation	20	16.67
Provision of incentive	10	8.33
Development of markets	25	20.83
Participatory plant breeding	16	13.33
Small-scale seed production	22	18.33

Farmer field schools	11	9.17
Community seed banks	16	13.33
Total	120	100.0

Note: Source: Field Survey Data, 2021

Table 18. Distribution of Respondents by Effect of Weather on Crops Productivity

Effect of weather	Frequency	Percentage (%)
Yes	120	100.0
Total	120	100.0

Note: Source: Field Survey Data, 2021.

Table 19. Distribution of Respondents on the Effect of Weather Condition on Crop Productivity

Weather	Very severe	Severe	Not severe
Heavy rain	51 (42.50%)	69 (57.50%)	-
Drought	74 (61.67%)	46 (38.33%)	
Floods	120 (100.0%)	-	-
Strong wings	62 (51.67%)	37 (30.83%)	21(17.50%)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

The result shows that 52.50% are male, majority (32.50%) are within the age range of 31 and 40 years old, 44.17% are married, 62.50% have household size of 6-10, and majority (45.83%) have secondary education while 46.67 have up to 20 years farming experience. In conclusion, the authors find that affective factors play an important role in explaining the support for biodiversity conservation, particularly when people do not have specific knowledge about species; while ecological-scientific considerations appear when people are well-informed. This type of study offers the possibility to define and understand the underlying factors that determine the formation of human preferences toward wildlife and, therefore, reveals useful information for environmental management decision-making.

Recommendations

(1) Society should be well informed and educated about social and ecological importance of food crops biodiversity.

(2) It is essential to raise people awareness about the value of biodiversity including less attractive species;

(3) Environmental NGOs (Non-Governmental

References

Aju, P. C. and I. O. Ezebiekwe. 2010. "Understanding and Appreciating the Need for Biodiversity Conservation in Nigeria." *Journal of Medicinal Plants Research* 4(24): 2605-2608.

Ammann, K. 2004. "Biosafety in Agriculture: Is It Justified to Compare Directly with Natural Habitats? Balancing Productions of Promise and Peril." *Ecological Society of America*. Retrieved (http/www.botanischergarten.ch/ Frontiers-Ecology/Ammann-Forum-defl-pfd).

CIA World Factbook. 2010. *Nigeria National Biodiversity Strategy and Action Plan*. Retrieved December 30 (https://www.cbd.int/doc/world/ng/ng-nbsap-01-en.pdf).

Current, D. E., E. Lutz, and S. J. Scher. 1995. "Costs, Benefits and Farmer Adoption of Agro-forestry: Project Experience in Central America and the Caribbean." *The World Bank Environment Paper Number 14*. Washington, D.C.: World Bank.

Dollacker, A. 2006. *Conserving Biodiversity Alongside Agricultural Profitability Through Integrated R&D Approaches and Responsible Use of Crop Protection Products*. Retrieved (https://www.researchgate.net/ publication/242461174_Conserving_biodiversity_alongside _agricultural_profitability_through_integrated_RD_approac hes_and_responsible_use_of_crop_protec-_tion_products).

Haffmans, S. and S. Smolka. 2008. *Biodiversity and Plant Protection Legislation*. Hamburg, Germany: Pesticide Action Network Publication.

Howitt, R. 1995. "How Economic Incentives for Growers Can Benefit Biological Diversity: Peer-Reviewed Research Article." *Clifornia Agricultural* 49(6): 28-33.

McNeely, J. A. and S. J. Scherr. 2003. *Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity*. Washington, D.C.: Island Press.

Prescott-Allen, R. and C. Prescott-Allen. 1988. *Genes from the Wild: Using Wild Genetic Resources for Food and Raw Materials*. London: Eastscan Publications.

Siikamaki, J. H. 2008. "Perspectives on Sustainable Resources in America." *Research Issue Magazine* 168.

Singh, N. 2000. "Assigning Economic Value to Biodiversity." *Millennium Issue* 66(1). Retrieved (http://isebindia. com/2000/00-01-11.html).