COMPARATIVE ASSESSMENT OF PLANT BIODIVERSITY AMONG DIFFERENT *TAUNGYA* AGROFORESTRY PRACTICES IN ONDO STATE.

AKINBISOYE, OLADAPO SUNDAY

2012

COMPARATIVE ASSESSMENT OF PLANT BIODIVERSITY AMONG DIFFERENT *TAUNGYA* AGROFORESTRY PRACTICES IN ONDO STATE.

BY

AKINBISOYE OLADAPO SUNDAY

B.Sc. (Ed) Biology ACE, Ondo

SCP09/10/H/1287

A THESIS SUBMITTED TO THE INSTITUTE OF ECOLOGY AND EVIRONMENTAL STUDIES, FACULTY OF SCIENCE, OBAFEMI AWOLOWO UNIVERSITY ILE IFE, IN PARTIAL FULFILMENT OF THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (M.Sc.) IN ENVIRONMENTAL CONTROL AND MANAGEMENT

2012

CERTIFICATION

We certify that this project was carried out by AKINBISOYE Oladapo Sunday of the Institute of Ecology and Environmental Studies in partial fulfilment of the requirements for the award of M.Sc. Degree in Environmental Control and Management of the Obafemi Awolowo University, Ile-Ife.

…… ……..

Dr. S.O. Oke **Date**

(Supervisor)

…… ……..

Prof. I. E. Ofoezie **Date**

Director,

Institute of Ecology and Environmental Studies

(Chief Examiner)

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE

HEZEKIAH OLUWASANMI LIBRARY

POSTGRADUATE THESIS

AUTHORIZATION TO COPY

AUTHOR: AKINBISOYE Oladapo Sunday

TITLE: Comparative Assessment of Plant Biodiversity Among Different *Taungya* Agroforestry Practices in Ondo State.

DEGREE: M.Sc. (Environmental Control and Management)

YEAR: 2012

I, AKINBISOYE Oladapo Sunday, hereby authorize the Hezekiah Oluwasanmi Library to copy my thesis in parts or in whole in response to request from individuals and /or organizations for the purpose of private study or research.

Date: ---------- **Signature:** ----------

DEDICATION

This work is dedicated to the almighty God and to my Grandmother Mrs O. Omotosho, you are a rare gem.

ACKNOWLEDGEMENTS

I am indeed grateful to the Almighty God for His grace that saw me through this programme. I am highly indebted to my supervisor, Dr S.O. Oke, who painstakingly examined and criticised this write up, when necessary, in order to produce a good work. May God bless you Sir, Amen. I am also grateful to the Director of the Institute of Ecology and Environmental Studies Prof. I.E Ofoezie, who led the drive for the success of this work, May God bless your home Sir. My appreciations also go to the following personalities: Prof. I.F. Adeniyi, Dr. O.O.Awotoye, Dr. A.C Achudume, Dr. M.A. Adewole, Dr.(Mrs) O.O.Okoya and all the non-teaching staff in the Institute of Ecology and Environmental studies of Obafemi Awolowo University, Ile-Ife. I also wish to appreciate the efforts of my elder sister Mrs. F.O Obisesan, may God bless you Ma. My special thanks also go to my parents Mr and Mrs J.O Akinbisoye for their parental care, moral, spiritual and commitment towards the success of this study. Thank you and God bless. The contributions of the following during the field work are appreciated: Mr F.O Aloba Director of Forest Regeneration Ondo State Ministry of Natural Resources, Mrs A. Akinsulie of Biology Department ACE, Ondo, Mr Gabriel Ibhanesebhor and Mr Bernald Omomoh of O.A.U Herbarium curator, Mr. Samuel Adebola, Mr. Isaac Agbede, Mr. Bankole Akinyele, Mr. Babalola Akinpelumi, Mr. Idris Raimi, Mrs. Busola Popoola and my other colleagues in the Institute of Ecology and Environmental Studies of Obafemi Awolowo University, Ile-Ife. My prayer for all of you is that God will help you in every areas of your life Amen.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figures **Pages**

ABSTRACT

This study examined the floristic composition of the standing vegetation of four different *Taungya* agroforestry sites and a natural regrowth forest in Ondo State, Southwestern Nigeria. Also, the soil physico-chemical properties in the sites were determined. This was with a view to assessing the impact of this agroforestry practice on the biodiversity status and species diversity in the study areas.

Two sample plots of 25 m x 25 m each were selected in each of the five study sites. All the plants were enumerated and identified to species level. The vegetation parameters such as, the height, the girth at breast height and basal area were determined in each site. Each plant was classified into either a tree, shrub, perennial herb, scrambling shrub, epiphyte or a climber while their families were also identified. Species diversity, similarity and contribution of each species to the total abundance were also well determined. Five soil samples were randomly collected from each plot of agroforest and natural regrowth forest at depths of 0-15 cm and 15-30 cm using a soil auger to give a total of one hundred soil samples which were air-dried and sieved using 2.0 mm sieve. Standard laboratory methods were employed for the determination of the particle size distribution, organic carbon, total nitrogen, pH, available phosphorus, water holding capacity, exchangeable acidity and exchangeable cations in all the sampled soils. Duncan Multiple Range Test was used to compare the means of soil parameters in all the sites examined, while Shannon-Weiner diversity index and Simpson index of similarity were used to compare the plant species diversity.

The natural regrowth forest had the highest species diversity index (3.43), number of individual species (54) and families (28). Comparatively, the species diversity index, number of individual species and species families for the agroforestry sites respectively were: Owo 1.58, 19, 11; Ore 1.43, 8, 7; Idanre 1.49, 11, 10 and

Aponmu 1.27, 11, 9. Species density gradually reduced from 1392 ha^{-1} in natural regrowth forest to 1192 ha^{-1}, 848 ha^{-1}, 664 $ha^{-1}$and 432 ha^{-1} in Owo, Idanre, Ore, and Aponmu *Taungya* agroforests respectively. More climber species were encountered in natural regrowth forest compared to the four *Taungya* agroforest sites. Eight epiphytes were encountered in both Idanre and Owo agroforest sites but were absent in the other study sites. Shrubs species recorded were higher in most of the *Taungya* sites compared to natural regrowth forest. The soil texture of all sites, except Owo *Taungya* was sandy clay loam at the two soil depths. The soil pH ranged from 5.3 to 7.1 for the top soil and from 4.0 to 7.0 for the sub soil. Ore *Taungya* site gave significantly ($p < 0.05$) highest soil organic carbon (2.46 g/kg) and total nitrogen (0.20 g/kg) when compared with other agroforestry sites. The cation exchangeable capacity (6.77 cmol/kg) was highest at Aponmu site. These values however, decreased with depths.

This study concluded that *Taungya* agroforest enhanced plant biodiversity conservation and improved the soil quality of the study area.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The environment within which man live continues to experience changes the world over. Man has caused profound environmental changes in his search for survival and development. The changes have been crucial to the growth of human population, security and quality of life. On the other hand, it has also caused negative environmental changes manifested in soil erosion, loss of cropland, pollution, deforestation and destruction of biological diversity among others. These events have led to loss of lives, crops and properties, rising levels of food scarcity and hunger, in fact our savannah dry regions are exposed to changing rainfall patterns, desertification and droughts.

Among the human activities that have striking effect on the earth's environment is deforestation, which is a progressive removal of forest cover. Nearly 50% of the earth's land surface has been transformed by direct human action, with significant consequences on biodiversity, soil and climate.

Given that agricultural activities diminish biodiversity by displacing or replacing natural environments, the major challenge for conservationists and agriculturists in biodiversity hotspots is how to balance the economically driven agricultural expansion with strategies necessary for conserving natural resources, and maintaining ecosystem integrity and species viability (Pimentel *et al*., 1992; Perfecto, 1997: Parish *et al.,* 1998).

Across Africa, there is urgent need to plant and grow more trees. We must replace the forests we have cut down before it is too late. There is an urgent need to stem down the

current rate of deforestation in Nigeria as Bandy (1994) has observed that a continuous trend will result in diminishing the remaining tropical forest by the end of the 21st century. Sustainable afforestation programme and tree planting in Nigeria is highly imperative. Planting of trees bring a lot of benefits to humans, although the operation has a whole lot of challenges.

Generally, the planet's biodiversity has declined, and population sizes and ranges of the majority of species across many taxonomic groups are currently declining. In fact, one of the most fundamental and known characteristics of tropical forests is the great species richness, or large number of plant species per hectare (Peters, 1996). It was calculated that humans may have increased the extinction rate to as much as 1,000 times over the background extinction rates. The degradation of ecosystems could become significantly worse if policies and practices are not changed, with negative effects on the gains from ecosystem services (e.g. fresh water, food, air, regulation of climate and pests, and aesthetical and spiritual services) for future generations.

Biodiversity in the sense of species richness may play a crucial role for maintaining ecosystem processes and therefore also for maintaining biodiversity itself, but evidence for this is poor (Loreau, 2002). Decreased levels of biodiversity in an ecosystem may have a negative effect on the stability of that ecosystem and may decrease the productivity of vegetation (Lehman and Tilman 2000; Tilman *et al.* 2001), affect food web structure (McCann 2000; Dunne *et al.* 2002), and lower the resistance to (harmful) species invasions (Kennedy *et al.* 2002).

The traditional farming system in African (shifting cultivation and bush fallow) was formerly sustainable (Lundgren, 1982 and 1987). As populations have continued to increase, these methods of farming have become unsustainable. There is more demand for food, leading to

more pressure on forestlands and forest products. Moreover, recent increase in urbanization and infrastructural development has further increased pressure on forestland. As a result, fallow periods are shortened; there is reduction in productive capacity of the soil and decrease in crop yields (Lundgren, 1982 and 1987).

Hence agroforestry which is a practice where by woody perennials (trees, shrubs, bamboo) are deliberately grown in combination with agricultural crops to replace the long fallow (Lundgren, 1982 and 1987) was introduced in some form of spatial arrangement or temporal sequence.

The closest the agroforest is to a natural forest (-a source of seeds and a home for animals), the faster the process will be. Therefore, agroforests established along forest margins are more likely to hold high biodiversity levels than those established in degraded areas, but even in the middle of true agricultural lands, agroforests may exhibit fairly high levels of biodiversity.

Apart from providing wood, food and/or animal products, the integration of trees in the farming system could go a long way to help ameliorate environmental problems: specifically by creating microclimates favourable for crop growth, and enhancing the recycling of minerals to provide a more complete ground cover which could help to protect the soil from erosion and moderate extreme temperatures (Adedire,1999). The goal of sustainable food production and environmental conservation could be achieved with more widespread adoption of agroforestry. In this respect, Leakey (1996) suggested a more a dynamic, ecologically-based and natural resource management system type of agroforestry. It is based on this background that this study aimed at examining the possible comparative assessment of plant diversity among different *taungya* agroforestry sites in Ondo State of Nigeria.

1.2 Justification for the Study

In recent year, increasing pressure on land in tropical countries has resulted in massive deforestation, with consequent erosion and reduction in soil fertility as well as serious shortages of fuel-wood. Much deforestation has occurred in the last 40 years. This has been due to the rapid population increase which has not been coupled with parallel economic and technological development. Adedire (2003) reported that the following activities have