



ISSN: 0975-833X

RESEARCH ARTICLE

THE CHALLENGES OF AGRICULTURAL BIODIVERSITY DEGRADATION IN NIGER DELTA
REGION OF NIGERIA

¹*Camilus Bassey Ben and ²Lawrence Ikpi Eni

¹Department of Vocational and Special Education University of Calabar, Calabar, Nigeria

²Faculty of Agriculture, Cross River University of Technology, Obubra Campus, Nigeria

ARTICLE INFO

Article History:

Received 29th September, 2013
Received in revised form
08th October, 2013
Accepted 05th December, 2013
Published online 26th January, 2014

Key words:

Agricultural biodiversity,
Agrobiodiversity degradation,
Agrobiodiversity loss,
Biodiversity conservation.

ABSTRACT

This study was designed to appraise the challenges of agrobiodiversity degradation in Niger Delta region of Nigeria. One research question and one hypothesis were formulated to guide the study. A total of 552 respondents comprising rural farmers, and forestry officers were involved in the study. Respondents were drawn from all Niger Delta States in Nigeria. These included, Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, and Rivers States. The data were obtained through a structured questionnaire and analyzed with the use of percentage and chi-square as statistical tools. The findings of the study ascertained the basic challenges of agrobiodiversity degradation in the region to include intensive resource exploitation and extensive alteration of habitats, neglect of agrobiodiversity conservation practices, blueprint approach to development whereby monoculture systems and uniform technologies are promoted, quest for the transnational corporations that market agricultural inputs and process food and fibres for commercial profits and uncontrolled over-production, inequitable access to and control over land, water, trees and genetic resources of the part of local people, market pressures, under-valuation of agricultural biodiversity, pests and disease invasion, population pressure, deforestation, flooding, poverty and oil spillage among others. It was recommended among others that the governments of Niger Delta states should develop innovative funding mechanisms to support agrobiodiversity conservation programmes in the region by collecting special taxes on agricultural resources such as timber extraction, wood trading, trade in crop and livestock products, and other activities connected with the sector.

Copyright © Camilus Bassey Ben and Lawrence Ikpi Eni. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The conservation of biodiversity is one aspect of environment, which has recently received global attention. Biodiversity refers to the variety and variability among living organisms and the ecological complexes in which they occur (Board of Science and Technology for International Development (BOSTID), 2002). It is essentially synonymous with life on the earth. Biodiversity is usually considered at three different levels: generic diversity, species diversity and ecosystem diversity. Generic diversity is the sum total of genetic characteristics of individual plants, animals and other living organisms inhabiting the earth. Such characteristics may include rapid growth, high yields, diseases and pests resistance, and environmental adaptation. Species diversity refers to the variety of living organisms on earth, while ecosystem diversity refers to the variety of habitats, biotic communities and ecological processes in the biosphere as well as the tremendous diversity within ecosystems in terms of habitats differences and the variety of ecological processes. The concept of agricultural biodiversity or agrobiodiversity as it is sometimes referred is restricted to plants and animals used in commerce or having potential use (Srivastava, Smith and Ferno, 2001). It is the

diversity of genetic resources (varieties, breeds, species, cultivated, reared or wild) used directly for food and agriculture; the diversity of species that support production (soil biota, pollinators, predators .etc.) and those in the wider environment that support agroecosystems (agricultural, pastoral, forest and aquatic), as well as the diversity of agroecosystems themselves (FAO, 2008). Agroecosystems are those ecosystems that are used for agriculture, and comprise polycultures, monocultures and mixed systems including crop-livestock systems (rice-fish), agroforestry, agrosilvo-pastoral systems, aquaculture as well as rangelands, pastures and fallow lands (Pimbert, 2009).

Agricultural biodiversity is of immense benefit to humanity. Man depends on various livestock and crop species for food, fuels, fibre, medicine, drugs and raw materials for a host of manufacturing technologies and purposes. The productivity of agricultural system is as a continuous alteration of once wild plant and animal germplasms. Also genetic engineering especially in the pharmaceutical and food processing industries uses agro-genetic resources from sources worldwide. Besides these direct values, agricultural biodiversities holds indirect non-consumptive values. It is an important part of the processes that regulate the earth's atmospheric, climatic, hydrologic and biochemical cycles. It also provides local

*Corresponding author: Camilus Bassey Ben, Department of Vocational and Special Education University of Calabar, Calabar, Nigeria.

ecological services including the protection of watersheds, cycling of nutrients, combating erosion, enriching soil, regulating water flow, trapping sediments, mitigating erosion and controlling pest population (Ehrenfeld, 2008). Furthermore, agrobiodiversity holds ethical and aesthetical values and also forms the basis for sustainable rural development and resource management. In most rural areas of Niger Delta Region, the diversity of local plants and animals is being harnessed for sustainable economic development. Locally adapted traditional animal breeds (sheep, goats, and cattle), crop varieties (fruit trees, fodder plants and cereals) and 'wild' foods are being explored to generate local products, jobs, income and environmental care. In spite of these enormous potentialities of agrobiodiversity in retaining plants, animals, soils and water as well as serving as the foundation of sustainable development, most of the environmental discussions in this regard draw attention to its being increasingly subjected to devastation and loss. The degradation of agrobiodiversity is a relative phenomenon. Agrobiodiversity is degraded when it suffers a reduction in intrinsic qualities or a decline in its capabilities or complete extinction resulting from a causative factor or a combination of factor which reduce its physical, chemical or biological status hence restricting its productive capacity. It also involves a loss of potential utility or the reduction, loss or change of features or extinction of agro-species which could not be replaced (Dumsday, 2007). In the last few years a number of conservation actions have been undertaken by the federal and state governments, the non-governmental organizations and the rural farmers aimed at addressing the multifarious and complex challenges of agrobiodiversity degradation in the region. Some of these actions bordered on policy changes, integrated land management, agrospecies protection and pollution control.

In the pre-colonial Niger Delta for instance, religious beliefs and practices played important roles in the conservation of agrobiodiversity. Sacred animal and plant habitats were not exploited by people and so they remained in their pristine state. Traditional methods of conserving agrobiodiversity such as reserving certain areas for religious purposes, prohibiting firewood collection from certain areas and on certain days, stipulating only seasonal collections of natural products and maintenance of herbarium were largely in vogue. Rural farmers have made invaluable contributions in the conservation of agricultural biodiversity in the region. They play dual roles of cultivators and conservationists. Their roles on this direction could be identified in various conservation activities channeled at the domestication of livestock and cultivation of a number of varieties of crops besides the maintenance of herbaria, rangelands and diverse agroecosystems. They also embark on selective exploration of forest species, adoption of beneficial farming systems, protection of natural habitats and adoption of legislation based on traditions and customs.

Statement of the problem

Niger Delta Region occupies one of the geographical zones located in the rainforest belt of Nigeria. The zone is known for the preponderance of agro-genetic diversity. Because of its enormous potentials of agrobiodiversity, frantic efforts at conserving this vital resource in the region have been made by the government, environmental based NGOs and rural farmers.

These efforts notwithstanding, the loss of agrobiodiversity in Niger Delta region of Nigeria still prevails. The diversity of agroecosystem is being rapidly eroded. Local indigenous and adapted livestock breeds, landraces, other crop species, and agroecosystem are disappearing by dilution and replacement leading to the loss of agrogenetic resources of great value. These accelerated degradations which could be attributed to a number of challenges could be checked thereby securing the conservation of agrobiodiversity, their habitats, agroecosystem and man's future options for their utilization in the zone. The conscious appraisal of the challenges of agrobiodiversity loss in the region with the ultimate aim of devising concrete measures for its conservation is imperative. This was the crux of this study.

Purpose of the study

This study was generally aimed at appraising the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria.

Research question

This study was guided by this question. What are the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria?

Hypothesis

This study was guided by this hypothesis. There is no significant difference in the opinions of rural farmers and forestry officers on the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria?

Literature review

Concept of loss of Agrobiodiversity and degradation

Agricultural biodiversity (agrobiodiversity) is an alloy term coined from the concepts, agriculture and biodiversity. Conceptually, it refers to the diversity of agrogenetic resources (varieties, breeds, species, cultivated, reared or wild) used directly for food and agriculture; the diversity of species that support agroecosystems (agriculture, pastoral, forest and aquatic) as well as the diversity of agroecosystem themselves (FAO, 2008). According to Srivastava, Smith and Ferno (2001), agrobiodiversity is restricted to plants and animals used in commerce or having potential use. Agrobiodiversity is considered in three levels, diversity of genetic resources of agro-species, diversity of agro-specie and the diversity of agroecosystem. Diversity of genetic resources refers to the genetically transmitted characteristics of organisms, which are of actual or potential value. Such characteristic may include rapid growth, high yield, diseases and pest resistance and environmental adaptation (WCWC, 2002). Agroecosystems diversity or agroecodiversity as is being succinctly referred, is the variation and variability if these ecosystems that are used for agriculture. They comprise polycultures, monocultures, and mixed systems including crop-livestock systems (rice-fish), agroforestry, agro-silvo-pastoral systems, aquaculture as well as rangeland, pasture and fallow lands (Pimbert, 2009). The degradation of agrobiodiversity is a relative phenomenon and is synonymous to agrobiodiversity loss. Blaide and Brookfield

(2007) maintain that agrobiodiversity is lost when it suffers a reduction in intrinsic qualities or a decline in its capabilities or complete extinction. Loss of agrobiodiversity according to Barrow (2002) could be defined as a loss of utility or potential utility or the reduction loss or change of features or extinction of agro-species which could not be replaced. In this view, it implies (i) degradation, that is, a reduction in rank or status of specie, for example, a degradation and/or loss of organism similar to the simpler flora/faunal composition or a substitution of one organic form for lower organic form.

Challenges of Agrobiodiversity degradation

The challenges associated with degradation of agrobiodiversity as pointed out by Dumsday (2007) is not as a one way street, but as a result of forces or the production of an equation in which both human and natural forces find a place. Therefore, agrobiodiversity loss can result from a causative factors or a combination of factors, which reduce the physical, chemical or biological status of agrobiodiversity, which may restrict its productive capacity. In the broadest sense, the degradation of agrobiodiversity occurs when the population cannot persist in the face of environmental change (Copper 2009). This change can be physical (unusual weather, pollution, soil erosion habitat destruction or biological (the addition or elimination of competitors, predators, parasites. prey. or symbiont). Extinction is one of the three reactions a population can give to changes in conditions. Alternatively, a population may migrate to areas where the environment is not changing or it may adapt to the changing conditions (Ehrenfeld, p.48). Many statements about the causes and indicators of loss of agrobiodiversity in the literature abound. However these statements are either weakly connected (shopping list of "causes" unrelated to one another) or unduly hypothetical (plausible arguments not supported by case specific data). Barrow (2002) presents the documentary from the environmental development literature of 1960-1989 the categories of theories and explanations put forward to explain why loss of agrobiodiversity occurs. These include Neo-Malthusian Theory, Neo-Marxist Theory, and Ethical Stance Theory. Neo-Malthusians argue that domestic pressures lead to over use or misuse of agrobiodiversity especially marginal ones. Arguing from the economic theory perspective, the Tragedy of the Common School of Thought posits that irrational resource use and loss of biodiversity can be understood through analysis of issues associated with the economies of production - particularly faulty property relationships and difficulty in managing common resources. Externalities School also based on identical perspective is of the view that population increase leads to destruction of common resources as individuals acting to maximize their benefit harm society as a whole. They explain that in developing countries, increased state ownership has reduced community control yet failed to replace it with effective state control. Individuals react by taking what they can from common resources before anyone else does.

From the dependency perspective, it is posited that external factors affect population and resource use in developing countries leading to loss of agrobiodiversity. These factors include inappropriate technology transfer, promotion of inappropriate agriculture strategy, trade and aid relationships. In the light of faculty economic thoughts, economists tend to

see earth's resources as limitless and have been willing to pursue a bargain, whereby short-term are traded for long-term, unknown, unforeseen costs. Neo-Marxist theory based its assertion on the belief that wealth of the more advanced countries has been achieved by transfer of resources from the world's poor countries. In so doing poor countries are impoverished and this leads to loss of agrobiodiversity. Ethical explanation to the causes of resources loss has it that man has seen himself as above nature and separate from it in control, but not obliged to manage it (act as a steward). Elliot (1986) also advanced the following categories of arguments to explain the challenges and indicators of agrobiodiversity: (i) Natural causes - agrobiodiversity loss is held to be primarily due to physical events drought/climatic change, pest or diseases outbreak; (ii) human causes - loss of agro biological resources is blamed on the growth of human population and/of livestock population; (iii) structural arguments - social and economic structures and relations (patterns of ownership, rights of use and control of resources) are held to blame; (iv) Political and economic causes arguments - political/economic factors which may be local or non-local (terms of trade, third world debt etc.) are to be blamed; (v) human fallibility arguments - loss of agrobiodiversity results from stupidity, greed, ignorance, short-sightedness of local and/or non-local protagonists peasants/herdsmen, governments, developers, inappropriate technology or approaches; (vi) resource exploitation - people are attracted into exploitation of vegetation or crops/animals; (vii) there are situations where agrobiodiversity are degraded for other reasons, e.g. nuclear weapon testing, mineral exploitation etc.

According to Norton (2008) there seems to be broad agreement that the following factors increase likelihood of endangerment or extinction: (a) Rarity: either sparse distribution over a wide range or confinement. (b) Large individual size. (c) Relative light in tropical level (d) natural evolution.(e) Specialization of *habitats*.(f)Involvement in mutualisms and co-evolutionary arrangements.(g) Existence in ecosystems of high diversity. Loss of agrobiodiversity is assumed by some schools of thought to be a normal evolutionary and ecological process. Norton (2008), maintain that extinction has occurred before and will again ever in the world free of anthropogenic perturbations. In order words, the degradation of agrobiodiversity has occurred before and will again, even under the best of social systems. Here agrobiodiversity is the act of God that has predestined every fauna and, flora to live and later die. In the same vein, Ehrenfeld (2002) views the loss of, biodiversity as one kind of death, which imperatively affects all subspecies and species. He explained that there 'is obviously a genetic programme for death of species but its mechanisms varies among organisms. The death of organism occurs either because vital cells die or vital organs are irreparably damaged. When recurrent and predictable environmental events make living impossible, death may be programmed into the developmental pattern of the organisms. He explained further that animal and crops are programmed to die after setting seeds and most animals also die after breeding. There underlie the inevitability of biodiversity loss. He concluded that the inevitability of these deaths is not predictable on the ground of biochemistry or cellular biology, except in an ecological and evolutionary context. To Ehrenfeld, the loss of biodiversity comes about from senescence.

Commenting on the disposal of nature as a cause of loss of agrobiodiversity, Devos (2005) pointed out that plants/animals often exist near the limit of tolerance; vegetation patterns for instance may form where topography concentrates runoff and collects precipitation or where plants are able to reach moisture. With vegetation and animals existing so close to the limits, even slight changes in environment can lead to species losses or change, specie degradation. Closely associated with the natural challenge is the natural hazard as cause of specie degradation. According to Barrow (2002), some environments are less stable than others or are more likely to suffer disruptions. Areas with steep slope, regions where rainfall is intense, drought-risk areas where rainfall is mainly due to air mass movement, parts of the earth where hurricanes or similar storms occur, areas prone to sudden frosts or cold wind, areas with earthquake or volcanic eruption and areas subject to periodic invasion by destructive insects are predisposed to degradation of agrobiodiversity.

The most remarkable challenge of agrobiodiversity degradation is the loss and fragmentation of natural habitats due to human influence. A study in 2000 by the IUCN cited by Olivier (2001) found that 65 % of the original agroecosystems of the earth have been subjected to major ecological disturbance and that 67% of natural habitat has been lost. The impact of human influence on natural evolutionary process is so severe that biologists are referring to the current crises not only as leading to the death of species, but also as leading to an end of birth (Shepherd, 2002). On the loss of agrobiodiversity of crop plant sources, Hawkes (2008) noted that genetic erosion or the loss of genetic diversity, of the world's food plants is an issue of serious concern with implications for the long-term maintenance of global food supplies. At a time when more genetic diversity is needed in crop breeding programmes to increase food production this diversity is rapidly disappearing or has already been lost. According to him, various factors contribute to genetic erosion and attributed the worldwide threats to agro species to habitat destruction and modification. He noted further that habitat destruction is having a direct effect on, for example, wild form of cocoa: a large part of the centre of genetic diversity of *Theobroma cacao* in Africa has been destroyed as a result of petroleum exploration and exploitation and by agricultural expansion. Similarly about 90% of the tropical rainforest which harbour wild coffee *arabica* have been destroyed. The extent of genetic erosion differs from various crops. In general, the wild relatives of cereals are widespread, weedy, and thrive in undisturbed ground. There is some evidence of genetic erosion of wild relatives of rice, wheat, and maize (F.A.O., 2008).

The loss of local landraces for these major cereals has been a particularly serious problem in various parts of the tropics. About 80% of the native varieties of maize and rice have been lost over 40 years (Davies, 2007). The wild relatives of root crops are also suffering loss of genetic diversity. More than half the wild species in the genera *Solanum* (potato) and *Manihot* (cassava) are also subject to loss (F.A .O, 2008). Potato diversity is also facing threats of extinction as some species have already become extinct. Diversity of natural populations of *Manihot* species is declining owing to conversion of their habitats to pasture and elimination of the plants which are poisonous to grazing animals (Davies, 2007).

Valdes (2001) also pointed out that all the wild relatives of tomato (*Lycopersicon esulentum*) have limited natural distributions and that clearance of habitats for agriculture, housing and industry has led to loss of wild populations of the species *Lycopersicon hirsutum*, and *L. Peruvianum*.

On the losses of agrobiodiversity of animal source, Mason (2008) presents the most authoritative world list of loss of animal agrobiodiversity. He listed a total of 3,237 extinct breeds of ass, buffalo, cattle, sheep, goat, horse and pig. Some 474 of extant breeds can be regarded as rare. A further 617 have become extinct since 1892. For example, out of 1,259 cattle breeds listed, 242 are indicated as extinct of which 20 were in Africa. In analysis of extant breeds in Africa, Nigeria recorded eleven, nine, five, one and six extant breeds of cattle, goat, horse, pig and sheep respectively. In confirmation, Soule *et al.* (2002) said that the direct destruction, conversion, or degradation of agroecosystems results in the loss of entire assemblages of species. He added that over exploitation, habitat disturbance, pollution, and the introduction of exotic species accelerate the loss of individual species within communities or ecosystems. He maintained that the presence of chemical toxins or regional climatic change may eliminate some genetically distinct parts of a population. As genetic variability is lost, however the species as a whole may become more vulnerable to other challenges, and more susceptible to problem of inbreeding, and less adaptable to environmental change. Population increase has been one of the most frequently cited causes of agrobiodiversity losses since Malthus drew attention to it. The Malthusian or more recently Neo Malthusian view is that increasing demographic pressure results in over-use of reasonable quantity of agrobiodiversity and/or the misuse of marginal often easily degraded resources. If population increase has effect, the impact is double edged: a simultaneous increase in demand made upon the environment in order to support growing number of people, and a destruction of resource base (Clark and Muna, 2006). Agricultural researchers, urban planners, sociologists, and psychologists seem to endorse a common thread of agreement: expanding human populations consume food, commodities, space and destroy agro-habitats and communities (Ehrenfeld, 2008). By implication, the correlation between population expansion and loss of resources appears to be simple and direct. Also the growth of human societies has been accomplished by a parallel increase in the cultivation and settlement of land, with displacement of natural communities including agrobiodiversity as a result.

Degradation of agrobiodiversity could also be explained as a consequence of the economics of production. Barrow (2002) argues that private exploitation of agrobiodiversity or other resources can cause agrobiodiversity degradation. External factors acting on the production system can cause or contribute to agro-resource degradation. Such factors include: world market forces, neo colonialism, the action of multinational/transnational corporations (Dumsday, 2007). The term of international trade are seen by many economists as having caused increased economic dependency and indebtedness of developing countries including Nigeria. He explained further that many foreign entrepreneurs tend to maximize profits in the short term, possibly incurring degradation, and then invest part or all of the profits elsewhere.

Mobility of capital makes it possible for the exploiter to avoid the long-term economic consequences of resource degradation. According to BOSTID (2000) many developing countries now spend much of their revenue servicing foreign debts and consequently are less able to afford necessary agrobiodiversity management inputs and of her conservation practices and have in all probability adopted industrial and agricultural strategies which demand them. The result is that the modern sector of agriculture and industrialization which have taken so much of investment in recent years break down. Besides, conservation is underfunded, and the agricultural resources are ruthlessly exploited to try and generate desperately needed foreign exchange. These ultimately resulted in resource degradation (Pain, 2008). The loss of agricultural biodiversity is also attributed to poverty. Poor people generally have no choice but to opt for immediate benefit, very often at the expense of long term sustainability. Poverty induces loss of agrobiodiversity which in turn, reinforces poverty leading to further degradation and so on (World Rainforest Movement (WRM) (2001).

Loss of agrobiodiversity is attributable to land tenure problem. Where land is publicly owned, Plucknett (2006) pointed out that it might be possible to control its usage and associated resources by regulations or by pricing measures. Where the land is under private ownership but there is no security, farmers and other users, given the choice will tend to seek short-term profits rather than risk waiting for uncertain future benefits. He explained that where land or fuel wood or grazing rights on land is a common property resource, that is, not owned exclusively by any person or company, but is subject to use by a number of people, degradation is often a problem. He noted that in seeking to maximize his/her individual utility, each user of a common resource incrementally adds to the costs of resource use and what seems a trifling or reasonable demand to individuals cumulatively becomes resource degradation. The challenge of agrobiodiversity degradation is also associated with political instability and maladministration. Harison (2007) noted that seventy percent of Africa has experienced serious conflict since the mid 1950s and that Africa, with about 10% of the world's total population, has half the world's total refugees. Unrest, he concluded, must in large part, be the cause of African agrobiodiversity degradation. Besides, administrators are often out of touch with the peasantry and their traditional ways of regulating land/resources use. Edicts may be passed which are inappropriate and/or unsuitable, regional or local officers may be appointed which cause rural people to abandon satisfactory management, possibly scorn and suspect authority and so resist any innovation that might aid them and counter loss of agrobiodiversity (Griffiths and Binns, 2008).

The socio-economic and political causes of biodiversity loss vary from region to region. According to Gray (2001), in recent times they can be linked to governmental and international support for industrial forestry, agriculture and energy programme over and above traditional usage patterns. As he put it, "the roots of the problem of deforestation and the waste of agroresources are located in the industrialized countries where most of agricultural resources such as timber, oil fibre and latex end up" The rich nations with one quarter of the world's population consume one fifth of the world's agro resources. Such so-called progress has simply led to the destruction and despair. He also pointed out that development

assistance plays a central role in loss of agrobiodiversity due to the development models that are offered, and to the fact that donor countries spend the majority of their assistance finding business from their own country. He likened developed assistance to the AIDS virus; a pathogen that destroys the ability of the host country to resist the invasion of a foreign socio-economic system. He explained further that throughout the third world, the result of large scale AIDS has been the displacement of traditional cultures and sustainable pattern of land use, along with the rapid liquidation of forests and agricultural lands for the benefits of the industrial elite. The most important single factor affecting the fate of agrobiodiversity on earth is the accelerated rate of habitat fragmentation, particularly in the tropical forests. Haries (2004) and Sanders (2001) explained this as follows: When an area of forest is cut and the land is converted to intensified use, most of the species living in it cannot survive in the replacement system, be it an agricultural field, pasture, or plantation forest. When any habitat type is reduced to small patches, the organisms that depend on it are in greater danger of extinction as their populations are reduced in number, isolated and subject of the highly altered impacts of sun, wind, water, soil conditions other organisms and human beings. These and other factors enter selectively into small patches habitat, severely reducing the diversity of life in that locale.

Agrobiodiversity loss is also blamed on agricultural practice. Agriculture has become like traditional manufacturing industries with many of the same environmental risks and waste disposal problems including pollution, depletion, loss of biodiversity, contamination, poisoning among its side effects. Soule and Piper (2004) pointed out explicitly that one of the dominant themes of modern agricultural development has been reduction in diversity. This is seen in crop and livestock breeding where the genetically narrow varieties and breeds that now dominate agriculture have replaced a multitude of locally adapted strains. It is also apparent in cropping system as the acreage in continuous monoculture has increased at the expense of acreage in rotation and mixed culture, even at the global landscape level. Conversion of diverse agroecosystems to modern style monoculture reduces the genetic diversity of the earth. Declining genetic and species (agrobiotic) diversity threatens the sustainability of agriculture and the resiliency of the ecosphere. Agrobiodiversity is threatened by the on-going replacement of tropical rainforests with modern monoculture-style agriculture. As explained by Wilson and Peter (2008), despite the lush appearance of tropical rainforests their soils are usually poor and thin, and are often undergoing a natural process known as "laterization" on exposure. In this process, silica and some of the organic materials are leached downward and most of the remaining organic materials are oxidized. If the thin topsoil is eroded away in an area of laterization, this exposes a layer of aluminum and iron oxides can form a hard, impermeable, red crust laterite. Once formed, this crust appears to be relatively permanent, and will not support the existence of much of agrobiodiversity except edaphic climax vegetation of widely spaced low herbaceous shrubs. In addition to the danger of producing laterite soils, deforestation can modify climate and this subsequently affects the existence of agrobiodiversity (Ehrenfeld, 2000). Steinlin (2002) identify expansion of small scale and recently large scale commercial agriculture as one of the main challenges associated with

degradation of agrobiodiversity especially in the rainforest belt of Nigeria. He laid much of the blame on shifting cultivation as the single greatest threat to the conservation of agrobiological entities of the tropical forests. He estimated that roughly 70 % of rainforest is cut down through shifting cultivation and monoculture-type agriculture. Large areas of Nigeria have been cleared to grow export crops like cocoa, oil palm, groundnut, tobacco, rubber, etc. and other food crops such as cassava, maize (NEST, 2001) Associated with this is the risk of homogenization of landscapes by modern agriculture. Srivastava *et al* (2001:45) explains: "By relying on fewer crops, and only a handful of varieties for each crop, modern farms do not come close to matching the higher levels of species diversity and genetic variation within species found among many traditional agricultural systems. Modern livestock operations also tend to bottleneck agrobiodiversity as they streamline their activities by concentrating on a few highly productive breeds or strains. Genetic erosion is thus underway among both crops and livestock. In a related comment, they said that agriculture is following a trend in which more productive systems tend to have fewer species, the higher the degree of genetic simplification the higher the species elimination". According to them, when farmers adopt hybrids and other modern technologies, much indigenous agrobiodiversity is typically lost. Besides, monocultures replace an intricate guild of traditional varieties and patches of mixed crops. Igbozurike (2007) in analytical contrast of polycultural and monocultural farms in southern Nigeria confirmed that agro species diversity is high in mixed cropping while none exists at all in sole cropping arrangement. He concluded that the effect of monoculture, which he described as "bulldozer effect", is particularly acute when these farming techniques penetrate centres of crop diversity. Putting it succinctly, the unrestricted expansion of agriculture into forests and marginal lands combined with overgrazing, urban and industrial growth, the spread of monocropping and changes in crop rotation pattern and pest management strategies contribute to the 'hemorrhage' of agrobiodiversity (Igbozurike, p. 32).

Loss of agrobiodiversity is also associated with increased biotechnology development efforts aimed at higher productivity. According to the dominant paradigm of production, diversity goes against productivity, which creates an imperative for uniformity and monocultures. Commenting on the effects of biotechnology on biodiversity, Shiva (2001) pointed out that "though the capacity to move materials between species is a means for introducing additional variation, it is also a means for engineering genetic uniformity across species. Explaining the adverse effect of this, he maintains that the very building blocks on which the technology depends. Most forestry development schemes in Nigeria is known to introduce monocultures of industrial species such as *Eucalyptus* and push into extinction the diversity of local forest species, which fulfils local needs. Agricultural modernization schemes introduce new and uniform crops into farmer's fields and destroy the diversity of local varieties. In the opinion of Wilkes (2004), this is analogous to taking stones from the foundation of a building in order to repair the roof. This strategy of basing product increase on the destruction of diversity is dangerous and unnecessary as it inevitably leads to the destruction of agrobiodiversity. Soule and Piper (2002) abhor monoculture on

the ground that it is ecologically unstable and that reason alone should be enough to view it as non-essential to production. Monoculture is indicted as being responsible for inviting diseases and pests, as was experienced in 1970-71 in the U. S. with corn blight epidemic, which laid waste 15 % of the nation's crop because of genetic uniformity. Eighty per cent of hybrid corn in U.S. in 1970 was planted with corn which contained T-cytoplasm which made the corn plants vulnerable to corn blight fungus, *H. Maydis*. It had been used by plant breeders and seed companies to foster quick and profitable production of high yielding hybrid corn seed, but the introduced cytoplasm was vulnerable to corn blight. Soule and Piper also cited a report of a study in National Academy of Sciences on genetic vulnerability of major crops: "The corn crop fell victim to the epidemic because of a quirk in technology that had designed the corn plants, until in one sense, they had become as a like of an identical twins. Whatever made one plant susceptible makes them all susceptible". The technology for breeding high yield varieties is therefore, a technology which breeds uniformity and threatens a collapse in yield and agrobiodiversity.

In his contribution on homogenization as a cause of loss of agrobiodiversity, Kloppenbing (2008) noted that in agriculture, forestry, in fisheries and in animal husbandry, production is being incessantly pushed in the direction of diversity destruction, and production based on uniformity thus becomes the primary threat to agrobiodiversity conservation and to sustainability. He illustrated the loss in biodiversity in the monoculture seeds which he described as commoditised seeds. The commoditised seed as; pointed out by him is ecologically incomplete and ruptured at two levels: (i) It does not reproduce itself, while by definition, seed is generative resource; (ii) it does not reproduce by itself. It needs the help of inputs to produce (chemicals added externally or internally). In this shift from the ecological processes of reproduction to the technologies processes of production underlies the losses of diversity as biotechnology development thus translates into Agrobiodiversity erosion. Soule and Piper (2002) opined that all systems of sustainable agriculture and forestry work lies on the basis of perennial principles of diversity and reciprocity. Diversity gives rise to the ecological space for give and take, for mutuality and reciprocity. He linked destruction of diversity to the creation of monocultures. With the creation of monoculture, he explained, the self-regulation and decentred organization of diverse system gives way to external inputs and external centralized control. Sustainability and diversity are ecologically linked because diversity offers the multiplicity of interactions, which can heal ecological disturbance to the part of the system. Non-sustainability and uniformity means that a disturbance to one part is translated into a disturbance to all the other parts. Instead of being contained, ecological destabilization tends to be amplified.

Closely linked to the issue of diversity and uniformity is that of loss of agrobiodiversity as a consequence of plant and animal invasions, introduction of exotic species and ecological explosions. A plant or animal species may spread by natural dispersal and by deliberate or inadvertent human introduction to areas where it was previously absent. The newly dispersed alien species may cause no problems and become an additional exotic component of the flora or fauna, or it may cause

problems immediately, or after a delay, possibly of many years. Whatever the manner of its arrival, to survive, the invading species must find a suitable vacant niche; it will have to compete with indigenous species and come off best (Drake, 2009). Also in some areas, there has been extensive ploughing of the native vegetation and replacement with improved pasture species. In some areas of Africa, grasses and legumes are being spread to improve the rangelands. The introduction of exotic (foreign) plants and animals is usually a bad thing. If the exotic survives the damage ranges from the loss, of a few native competitive species to total collapse of entire communities (Ehrenfeld, 2008). The introduction of foreign species into new habitats, usually done inadvertently, has produced population explosions that have threatened or eliminated other species through removal of key species. In this regard, Ehrenfeld (2008) explains that some animals and plants hold central positions in the network of interrelationships that form a community, if these species are selectively removed, the community structure begins to collapse leading to loss of a number of species.

The challenge of agrobiodiversity degradation is also associated with a range of pollution related threats. These include: green house effect, industrial pollution, unwanted side effects of agro-chemical use, nuclear war, and disturbance of crucial biogeophysical or bio-geochemical cycles. While identifying the causes of loss of biodiversity as the consequence of green house effect, Pain (2008) and Parsons (2009) said that tropical species, already under stress through habitat destruction are subjected to further pressures from green house and related climatic change. They noted that there have been considerable changes in climate before man began to affect natural systems, and in the future the change is likely to be faster than natural climatic changes in the past. They pointed out that agrobiodiversity of livestock source are degraded nowadays because they are less able to adapt to environmental change. Some crop varieties are also unable to withstand the change. Barrow (2002) pointed out that there are always changes in flora and fauna as climate alters. Some of these changes connote problems. Livestock and plant varieties may suffer as new species colonize, and that warmer conditions could allow it to displace native species. The degradation of agrobiodiversity is also associated with stratospheric ozone depletion. An ozone layer is maintained, by natural process in the stratosphere. Human activity is upsetting the maintenance of this ozone layer thereby leading to the reduction of ozone concentration (Barrow, 2002). According to NEST (2001), the depletion of ozone layer is attributed to the effect of chlorofluorocarbons (CFCs) substance which is widely used as refrigerant aerosol propellants, foam-blowing agents and solvents. CFCs which drift upward to the stratosphere where they remain relatively unaffected by ultraviolet light for decades react chemically with and destroy the layer of ozone that shields plants and animals from ultraviolet radiation (UV - B). Where this happens, more ultra violet radiation particularly UV -B reaches the earth's surface. Increased exposure to UV -B rays have the following effects on agrobiodiversity which may ultimately lead to its degradation: (1) reduced plant metabolism and depression, in terrestrial crop; (2) increased mutagenesis in plants and animals; (3) possible impact on nitrogen fixation by bacteria/algae resulting in lowered crops and reduced sustainability (Barrow, 2002). Some

agrobiodiversity of crop source are known to be especially sensitive to UV -B. These include tobacco, soya, citrus, forests and pasture crops. Perennial crops also suffer from dieback disease and livestock also undergo more mutagenesis. This portend more variation of existing plant and animal, which may possibly give rise to new forms of livestock and crops. Also, animal immune systems become less resistant to diseases as UV-B increases (Pain, 2008).

Degradation of agrobiodiversity is also blamed on acid rain. Acid rain is a term used to describe acid pollutants deposited gradually or suddenly. Pollutants acidify the moisture that has trapped, and/or the ground water they are deposited on. Acid deposition can be 'wet' rain, snow, mist, cloud droplets hail or "dry" gas, dust/particulate matter, fine aerosol, and smog. The effect of acid deposition is acidification, a change towards more acid conditions that is lower soil pH (McCormick, 2008). Sulphur dioxide (SO₂) emissions are a major cause of acid deposition. Acid deposition can cause loss of agrobiodiversity in a number of ways. These include: (i) damage to plants/or animals; (ii) direct alteration of plant/livestock anatomy; (iii) alteration of metabolism or species diversity plants/livestock (Barrow, 2002). For instance, acid rain (peroxyacetyl nitrate) although short lived, is very toxic to plants and animals. They are also very damaging to organisms when present in sufficient concentration (Parson, 2009). Acid deposition mobilizes compounds, which stress vegetation and makes it vulnerable to frost, drought and disease. Acidification of ground and surface waters may damage crops if used to irrigate or may injure livestock if feed to it. Acid deposition also hinders photosynthesis. Crops such as rice, vegetables, barley, oat, wheat, tomato, apples and pears are most vulnerable (McCormicks, 2008). Directly associated with acid rain as a challenge to degradation of agrobiodiversity is the pollution associated with oil spillage. Without doubt, the greatest single environmental problem connected with petroleum exploitation in Niger Delta region of Nigeria is oil spillage at both onshore and offshore settings. The rate of spillage in Nigeria has been rising with the increasing tempo of petroleum exploration. In the 20-years period (1993-2003), a total of 1,681 oil spills involving nearly two million barrels of oil, were reported in Nigeria. Expectedly, the spillages have occurred primarily in the main oil producing states of Niger Delta. The impacts of oil spillage on agrobiodiversity as outlined by NEST (2001) include loss of fish, crustaceans, and other aquatic and terrestrial animals; devegetation and other forms of ecological damage, emigration of landraces and wild-agro livestock species. Re-establishing vegetation on the restored spill site or the abandoned, under-restored spill site presents a problem. There may no longer be plants to re-seed the site and difficulty in establishing vegetation. Soil is damaged with vital fungi and bacteria may have been lost. There is a high toxic level of various elements plus a crude oil laden soil which may provide unfavourable condition for species survival (James, 2006). Associated with oil spillage is the natural gas which escapes from wells drilled for oil. Gas flaring has major adverse effects on agrobiodiversity. These include: destruction of vegetation and associated livestock and damage to soil and crops by heat (NEST, 2001).

Agrobiodiversity loss is also attributed to the deforestation of forest. The loss of forest is by no means new but the

deforestation has reached a point where it threatens the extinction of many agro-species and other organisms and the long term well being of mankind (Barrow, 2002). Deforestation is a much used term ill-defined and imprecise term that tends to be used to imply quantitative loss of woody vegetation. There can also be qualitative changes from say, specie-diverse tropical forest to single-specie plantation or to less species-rich secondary (regrowth) forest (Myers, 2009). There are varying degrees of forest degradation ranging from almost imperceptible reductions in vigour and/or species diversity or a decline in regeneration which may be a spread over decades or even centuries making their recognition difficult to clearly apparent changes: changed species diversity, thinning, altered regeneration or resistance to pests/diseases and invasion of undesirable "exotic" species (Harrison, 2007). It has been estimated that tropical Africa is being deforested at a rate of 0.6% per year (Barrow, 2002). NEST (2001) pointed out that vegetation untouched by human activity probably no longer exists in Nigeria. The Nigerian Conservation Foundation (NCF) (2004) revealed that despite having already lost more than ninety five percent of her original forest and its rich agrobiodiversity resource, cover due to uncontrolled urbanization, indiscriminate logging and unsustainable farming practices; Nigeria has continued to record a loss of more than 35,000 ha of forest cover annually with attendant consequences of disappearance of various species of plants and animals. Commenting on the causes of deforestation and its effects on agrobiodiversity, NEST (2001) pointed out that farming, logging, grazing, hunting, exploitation for a variety of products urbanization and infrastructural development, all heightened by burgeoning human and livestock populations have reduced our plant cover to a patchwork of farmlands, plantations, and secondary vegetation at various stages of growth and maturity Loss of vegetation. NEST noted also means loss of livestock habitats which consequent in erosion of gene resources and loss of plants and animal species that play important roles in perpetuation of generations.

Fire is another agent of agrobiodiversity destruction. Flora and fauna are also directly and indirectly affected by fire (Barrow, 2002). Besides, overgrazing also adversely affects vegetation. Pigs, goats to a lesser and cattle to a larger extent remove seedlings and browse trees. There is also a chance that new plant species may be introduced in animal droppings or as seeds adhering to the hair of grazing stock and these might upset the natural vegetation and consequent by loss of some plant species. During grazing, plants may be selectively grazed. Less palatable, spiny or obnoxious plants are discriminated against and they tend to survive while those palatable to the animal tend to decrease. Also excessive grazing leads to alteration of plants. Some shrubs/trees or forest may be prevented from regenerating. Some trees may be vulnerable to seedling damage through excessive grazing (Pain, 2008). Degradation of agricultural biodiversity is attributed to the effects of pesticides. Pesticides are chemical substances used by man to control those living organisms which are inimical, or are believed to be inimical to his interest (Moore, 2003). Most pesticides are poisonous insofar as the target species are concerned. Pesticides are associated principally with agriculture, horticulture, food storage, protection of wood, wool and other fibres, control of vectors of diseases and in forestry. The most commonly used pesticides today are synthetic organic substances, and many of these are fairly

selective. According to Moore (2003), pesticides affect agrobiodiversity in the field both directly and indirectly. Direct effects are those due to lethal or sub lethal toxicity of the pesticide to the organism itself. Indirect effects are due to the toxicity of the pesticide to other species in the ecosystem, which affect the organism, notably competitors, predators, and prey on their contribution to the adverse effect of pesticides or agrobiodiversity in Nigeria. NEST (2001) pointed out that one of the invisible but almost ubiquitous and particularly insidious and infamous destroyers of agrobiodiversity in Nigeria is a group of biocides known as chlorinated hydrocarbon pesticides. Led by DDT, these pesticides are widely used in the country in crop protection in the field, forestry operations, granaries and warehouses where various commodities are stored. They added that pesticide which is widely recognized as a chemical of species extinction is also seen as an environmental poison a vicious destroyer of livestock and crop plants and its action is non-specific for particular organisms. It attacks and destroys many more than the target organisms.

MATERIALS AND METHODS

Research design

This study was carried out using a survey design.

Area of the study

The area of the study was Niger Delta Region of Nigeria. It comprised the following States: Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, and Rivers States.

Population of the study

The target population for the study was 6,240. This comprised rural farmers and forestry officers serving in the eight Niger Delta States of Nigeria.

Sampling technique and sample

The technique of proportionate stratified sampling was used to draw up a total sample size of 552 comprising 289 rural farmers and 263 forestry officers drawn from the eight Niger Delta States of Nigeria

Instrument for data collection

A structured questionnaire was used to generate data for the study. It was divided into two main parts, 1 and 2. Items in part 1 were structured to obtain demographic information on the characteristics of respondents while that of Part 2 focused on the challenges of agricultural biodiversity degradation.

RESULTS

Research question

What are the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria?

To answer this research question, respondents were presented with a checklist of plethora of challenges associated with agrobiodiversity degradation in Niger Delta Region of Nigeria for them to bear their views. Their responses were analyzed using frequency count and percentage. The result is presented in Table 1.

Table 1. Percentage analysis of the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria

Item No.	Challenges of agrobiodiversity degradation	Yes		No		Remark
		F	%	F	%	
1	Pests and disease invasion	351	63.5	201	36.5	*
2	Climate change	154	27.8	401	72.2	**
3	Population pressure	372	66.96	180	33.04	*
4	Drought	308	55.44	2144	44.56	*
5	Deforestation	391	70.38	161	29.62	*
6	Flood	384	69.12	168	30.88	*
7	Excess drainage of the land	174	31.32	378	68.68	**
8	Poaching	367	66.06	185	33.94	*
9	Over exploitation of plant and animal resources	400	72.00	152	28.00	*
10	Poverty	395	71.64	157	28.36	*
11	Political instability	237	43.74	315	57.34	**
12	Maladministration of government	243	42.48	309	56.26	**
13	Practice of continuous monoculture	236	43.92	316	57.52	**
14	Increased commercial agriculture	244	54.18	308	56.08	**
15	Introduction of exotic species of plants and animals	301	74.37	251	45.82	*
16	Increased used of agrochemicals	413	62.82	139	25.66	*
17	Oil spillage	349	64.48	173	37.18	*
18	Increased urbanization	136	69.84	416	75.52	**
19	Bush burning	388	99.84	164	30.16	*
20	Over grazing	241	43.38	311	56.62	**

N = 552; * = Challenge; ** = Non challenge; F= Frequency

Table 2. Chi-square analysis of the opinions of rural farmers and forestry officers on the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria

Item No.	Challenges of agrobiodiversity degradation	Rural farmers (N_1)		Forestry officers (N_2)		X ² Cal.	Rmk
		Yes	No	Yes	No		
1	Pest and disease invasion	186	103	165	98	0.156	NS*
2	Climatic change	81	208	77	186	0.106	NS*
3	Population pressure	197	92	175	88	0.144	NS*
4	Drought	163	126	145	118	0.087	NS*
5	Deforestation	207	82	184	79	0.185	NS*
6	Flood	204	85	180	83	0.299	NS*
7	Excess drainage	92	197	82	181	0.036	NS*
8	Poaching	194	95	173	90	0.092	NS*
9	Over exploitation of plant and animal resource	212	77	188	75	0.438	NS*
10	Poverty	209	80	186	77	0.171	NS*
11	Political instability	126	163	111	152	0.108	NS*
12	Maladministration by the government	128	161	115	148	0.092	NS*
13	Practice of continuous monoculture	125	164	112	151	0.023	NS*
14	Increase commercial agriculture	129	160	114	149	0.092	NS*
15	Introduction of exotic species of crops and animals	160	129	149	122	0.132	NS*
16	Increase use of agro chemicals	219	70	194	69	0.294	NS*
17	Oil spillage	185	104	164	99	0.161	NS*
18	Increase urbanization	72	217	64	199	0.022	NS*
19	Bush burning	206	83	182	81	0.644	NS*
20	Over grazing	128	163	113	150	0.021	NS*

$N_1 = 289$; $N_2 = 263$; tab $X^2 = 3.48$; $df = 24$; $\alpha = 0.05$; NS = Non Significant; S = Significant. * = Accepted; **=Rejected.

Table 1 presents the result on the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria. The respondents identified the following as challenges of agrobiodiversity degradation in the region: pest and disease invasion, population pressure, drought, deforestation, flood, poaching, poverty, introduction of exotic species of crops and livestock, increase use of agrochemicals, oil spillage and bush burning (% score >50%). Respondents considered the following as non-challenges to agrobiodiversity in the region: climate change, excess drainage of the land, urbanization and over grazing (% score <50%).

Hypothesis

There is no significant difference in the opinions of rural farmers and forestry officers on the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria. This hypothesis was tested with the use of chi-square (X^2) statistic. The result is presented in Table 2. The data in Table 2 presents summary of chi-square analysis on the opinions of

rural farmers and forestry officers on the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria. The analysis of the data revealed that the calculated X^2 values of all the considered items were less than the table X^2 value of 3.84 at 24 df and probability level of 0.05. The null hypothesis of no significant difference in the opinions of rural farmers and forestry officers on the challenges of agrobiodiversity degradation in Niger Delta Region of Nigeria was therefore upheld.

DISCUSSION OF FINDINGS

Challenges of Agricultural Biodiversity in Niger Delta Region of Nigeria

The findings on this aspect of the study indicated that most respondents identified a number of causes of agrobiodiversity loss in the Niger Delta Region of Nigeria. The findings are confirmed by the works of Myer (2009) and McNeely (2009)

which revealed that local indigenous arid adapted agro-species are disappearing by dilution and replacement and that farmers and foresters are aware of the problem. Often they are also aware that something of great local value is being lost but that as individuals they cannot swim against the tide. The problem of agrobiodiversity degradation is age long in the region. Farmers and foresters, the result of the study has shown, have a vast wealth of knowledge about agricultural resources of the region. These knowledge transverse the utilitarian values of different agricultural biodiversity of plants and livestock sources, their agro ecosystem and the cases of their depletion. Hence they had since been tenaciously involved in developing complex management patterns for agrobiodiversity. Most respondents, the result indicated, related common causes of agrobiodiversity loss directly to one or more of a number of influences including habitat destruction by deforestation, flooding, pollution, competition, predation, parasitism, disease, introduction of species, direct hunting and over-harvesting by man. Others are poverty, oil spillage, bush burning, overgrazing, population pressure and predominant use of agro-chemicals. One pertinent finding of this study is the revelation that about 95 % of respondents associated agrobiodiversity degradation in the region to oil spillage. No doubt a Niger Delta geo-ecological zone is known as a region where petroleum is explored in commercial quantity in Nigeria. Oil spillage is one of the prominent widespread, intractable and disturbing environmental problems associated with petroleum exploration (NEST, 2001). Oil spillage has occurred with increasing tempo of petroleum production primarily in almost all oil producing states of Niger Delta. It is also the greatest single factor associated with the hemorrhage of agrobiodiversity in the region. The impact of oil spillage on agrobiodiversity has ranged from the barely tolerable to utterly disastrous levels.

The impacts are observed in loss of fishes, crustaceans, and other aquadiversity, emigration of wildlife, destruction of livestock and crops, devegetation of agroecosystem, damage to soil microflora and fauna by heat and deposition of primary and secondary contaminants. Besides, there are other numerous petroleum associated difficulties which impacts agrobiodiversity. For example, during exploration, the landscape is very considerably disturbed through path construction, trampling, and vehicular movement whether on cultivated or uncultivated land. The setting up of field camp, construction of helipads and erection of a drilling rig take up substantial amount of space often displacing all other land uses. In this process of permanent land conversion, agriculture and agricultural biodiversity is almost invariably the prime loser. This loss is from the point of view of both the immediate space converted and the agroecosystem severely polluted and destroyed when the oil which may be accompanied by gas begins to flow. Besides, the resultant spillages which usually cover extensive areas, destroys economic trees, farmlands and cause structural changes, a crust and a pan formation on the soil. A pan which often occurs after oil spillage on the soil is a hard concretionary layer formed at, or beneath, the soil surface. Pans can restrict roots, making crops or natural cover vulnerable to physiological drought, trees vulnerable to wind throw and subsequent death. The process of agrobiodiversity degradation may be difficult and very costly to heal or reverse once it gets underway. In some cases it may be virtually

impossible to reclaim or rehabilitate the agrobiodiversity in the area affected by oil spill. This is particularly the case if vital seeds, fungi and soil organisms are lost and with such loss there is also likely to be altered micro climate.

The result of the study also showed that respondents did not identify monoculture as a challenge associated with agrobiodiversity depletion in the region. The finding was expected and can easily be explained. Most rural farmers and even foresters have been lured into trading off their diversity rich and sustainable polycultural practices for the promised increase yields from commercial agriculture and continuous monocultural practice. A dominant theme of modern agricultural development has been reduction in diversity. This is seen in crop and livestock breeding in the region where the genetically narrow varieties and breeds that now dominate agriculture have replaced a multitude of locally adapted strain. Agrobiodiversity is threatened by the ongoing replacement of agroecosystems in the region with modern monoculture style agriculture. Also continuous monoculture and commercial agriculture are widely acclaimed diversity destructive agro-practice (McNeely *et al* 2000). It is the pertinent fact that many rural farmers and foresters in the region are ignorant about the adverse effects of the acclaimed justification of monocultural practice. Soule and Piper (2002) pointed out that so much is lost, and sadly, so little is gained by such drastic, large scale conversions as land cleared of forests will yield for as little as two to three years of intensive cropping. Besides, such practice engenders loss of diversity and this is a danger to agriculture itself. The primary source of variation required for crop improvements is locally adapted cultivars or closely related wild species, as farmers abandon the more diverse locally adapted varieties in favour of the highly selected, genetically narrow, high yielding new strains, the breeding base of agrobiodiversity is depleted.

On the findings that most respondents (> 50%) did not associate urbanization with agrobiodiversity degradation in the region, a ready explanation could be found in the fact that farmers and foresters like most sectors of human populace hold misconception about urbanization. To them urbanization is synonymous with social and economic development, improved standard of living and modernization. They are ignorant of the side effects of urbanization. They are not knowledgeable of the fact that urbanization trails unpleasant consequences which as outlined by NEST (2002) include: increase demand for utilization of diversity rich and fertile agricultural land, for non-agricultural use, farmland fragmentation, declining agricultural yield, shifts to alternate and less demanding crops, partial or total abandonment of agriculture in favour of alternative employment, deforestation, and migration of people from agrobased rural settlements to towns. BOSTID (2002) describing the effect of urbanization on agricultural biodiversity pointed out that urbanization has tended to promote exploitation of agrobiological resources and weaken the traditional systems employed in the management of such resources. As local communities are urbanized, agrobiodiversity which have proved able to survive and thrive in these environments are depleted. The findings of this study have far reaching socio-economic implications in areas such as food security and sustainability, poverty alleviation, and crude oil exploration. Agricultural biodiversity is the key to rural and

national prosperity. The nation's food security system can be built on ecological security (FAO, 2008). Ecological security implies the conservation and sustainable management of the basic life support systems of land/water, flora/fauna and the atmosphere. It involves concurrent and integrated attention to all the components of the biosphere including agrobiodiversity (McNeely, 2009). The security of agrobiodiversity in Niger Delta region is under challenge from human lifestyles and patterns of agricultural, industrial and economic development and urbanization. Population growth is exceeding the capacity of natural agroecosystem to support them on a sustainable basis. The ultimate implications are reduced food production, with consequent threat of food security. There is need to reverse this trend. WRM (2001) has in its report titled "Our Common Future" raised the need to accord the highest priority to making development ecological sustainable. While it is important to think about the future, what is even more important is to conserve a better common present, our agricultural biodiversity on which our food security depends.

The study reveals that poverty is one of the cardinal challenges to agrobiodiversity degradation in Niger Delta region of Nigeria. The finding has serious implications for the present poverty alleviation drive of the government of Nigeria. The geography of environmental development indicates that Niger Delta region and is richly endowed with abundant agricultural biodiversity. Currently, the agrobiodiversity is facing degree degradation across the length and breadth of the region. The natural support systems are adversely affected as key environmental indicators are increasingly stressed. The agrobiodiversity conservation culture is fading. All these problems have strong linkage with poverty. The change is to reduce poverty by accelerating equitable income group and promoting access to the necessary resources technologies and education. The present poverty alleviation programme of the government is a laudable effort in this direction. The scheme has many palliative programmes some of which include the provision of soft loans to would be grass roots based small scale investors, education and skill acquisition training programmes and many more. There is need for poverty alleviation programme to be focused on the poor rural farmers through credible grassroots based organizations. This is because rural farmers have made unalloyed contribution in protecting and developing agricultural resources - in particular a diversity of cultivated, semi-wild any wild plants used for food, fuel, and medicine. Their efforts in maintaining and developing food crops, medicinal plants and their wild and semi-wild relatives will make direct and vital contributions to practical conservation of the region's agricultural biodiversity.

Conclusion

Based on the findings of the study, it was concluded that throughout the Niger Delta region, the diversity of agrobiodiversity and agroecosystem is being eroded. Rural farmers and foresters are aware of the proximate and remote challenges of agrobiodiversity degradation in the region. While the proximate causes could be attributed to habitat destruction, indiscriminate use of agrochemicals, oil spillage and exotic species pollution, the underlying causes are rapid population growth, extreme and persistent poverty, and perverse economic incentives and policies.

Recommendations

On the basis of the findings of the study, the discussions and conclusion thereof, the following recommendations were made:

- I. The governments of Niger Delta states should develop innovative funding mechanisms to support agrobiodiversity conservation programmes in the region by:
 - (a) Collecting special taxes on agricultural resources such as timber extraction, wood trading, trade in crop and livestock products, and other activities connected with the sector.
 - (b) Building conditionality into concession agreement for instance, in an area that has such extensive--agroresources as timber/fisheries, concession could be sold to private investors.
 - (c) Seeking more collaborators from the private sectors including multinational oil companies, industries and voluntary organizations.
 - (d) Allocating a substantial percentage of Ecological Fund for agrobiodiversity conservation programmes/projects.
 - (e) Allocating an appreciable amount in the annual state budget for agrobiodiversity conservation programmes.

REFERENCES

- Barrow, C. J. 2002. *Land degradation: development and breakdown of terrestrial environment*. Cambridge: Cambridge University Press.
- Blaide, P. and Brookfield, H. 2007. *Land degradation and the society*. London: Methuen Publishers.
- BOSTID 2002. *Conserving biodiversity: a research agenda for development agencies*. Washington, D.C.: National Academy Press.
- Clark, W. C. and Munn, R. E. 2006. *Sustainable development of the biosphere*. Cambridge University Press
- Davis, A. G. 2007. *Plants in danger, what do we do?* Switzerland: IUCN.
- Devos, A. 2005. *Africa, the devastated continent: man's impact on the ecology of Africa*. The Hague: Jurk Publishers.
- Drake, J. A. 2009. *The Ecology of biological invasions*. Chichester: John Wiley and Sons
- Ehrenfeld, D. W. 2008. *Conserving Life on Earth*. New York Princeton University Press.
- F. A. O. 2008. *A forester guide for community involvement in upland conservation*. Rome: FAO.
- Gray, A. 2001. Impact of biodiversity conservation on indigenous peoples. In: W.R.M. (Ed.). *Biodiversity: social and economic perspectives*. London: Zed Books Ltd.'
- Griffins, I. L. and Binns, J. A. 2008. Hunger, help and hypocrisy: crises and response to crises in Africa. *Geography*, 73(1), 48-54.
- Haries, L. D. 2004. *The fragmented forest: island biogeography theory and the preservation of biotic diversity*. Chicago: University of Chicago Press
- Harison, P. 2007. *The Greening of Africa: Breaking through in the battle for land and food*. London: Paladin Grafton Books.
- Hawkes, J. G. 2008. *The Diversity of crop plants*. Cambridge: Harvard University Press.
- Igbozurike, U. M. 2007. *Agriculture at the cross-roads: A comment on agricultural ecology*. Ile Ife: University of Ife Press.

- James B. 2006. Stabilizing mine dumps with vegetation. *Endeavour*. 25(96).
- Kloppenbung, J. 2008. *First the Seed*. United Kingdom: Cambridge University Press.
- Mason, I. L. 2008. *The world dictionary of livestock breeds, types and varieties*. Willingford: CAB International
- McCormick, J. 2008. *Acid rain: The global threat of acid pollution*. London: Earthscan Publications.
- McNeely, J. A. 2008. *Economic and biological diversity: developing and using economic incentives to conserve biological resource*. Gland: IUCN
- Moore, N. W. 2003. The value of pesticides for conservation and ecology. In N. W. Moore and W. P. Evans (Eds.) *Some safety aspects of pesticides in the countryside*. London: Cambridge.
- Myers, N. 2009. *Deforestation rates in tropical forests and their climatic implications*. London: Friend of the Earth.
- Nigerian Conservation Foundation, 2009. Nigeria environment is ill. *Matters* 1(1) 4 - 6
- Nigerian Environmental Study/Action Team (NEST) 2001. *Nigeria's threatened environment*. Ibadan: Intee Printers Ltd.
- Norton, B. G. 2008. *The preservation of species: a value for biological diversity*. New Jersey: Princeton University Press.
- Olivier, L. 2001. The role of the national botanic conservancies and protected natural areas. *Environmental Encounters* (8) 142 – 147.
- Pain, S. 2008. No escape from global greenhouse. *New Scientists*, 120(1638), 38 – 43.
- Parsons, P. A. 2009. Conservation and global warming. In IUCN (Ed.) *Ecological guidelines for development in the humid tropics*. Morgesi: IUCN.
- Pimbert, M. 2009. *Sustaining the multiple functions of agricultural biodiversity*. London: International Institute for Environment and Development.
- Plucknett, D. L. 2006. Social perspectives of multiple cropping. In: C. A. Francis (Ed.) *Multiple cropping systems*. New York: Macmillan
- Saunders, D. A. 2001. Biological consequences of ecosystem fragmentation: a review. *Conservation Biology*, 5(1), 18 – 32
- Shepherd, G. 2002. *Managing Africa's tropical dry forests: a review of indigenous methods*. London: Oversea Development Institute (ODI).
- Shiva, V. 2001. Biodiversity, biotechnology and profiles. In: WRM (Ed.) *Biodiversity, social and ecological perspective*. London: Zed Books Ltd.
- Soule, J. D. and Piper, J. K. 2002. *Conservation of Agroecosystem: Its challenge*. Massachusetts: Sinauer Associates.
- Srivastava, J.; Smith, N. J. H. and Ferno, D. 2001. Biodiversity and agriculture: Implications for conservation and development. World Bank Technical Paper Number 8.
- Steinlin, H. J. 2002. *Monitoring the world's tropical forest*. Cambridge: Cambridge University Press.
- Wilkie, C. 2001. Threats to biodiversity. *Scientific Americana* 261 (1989), 108 – 116.
- Wilson, E. O. and Peter, C. 2008. The current state of biological diversity. In: E. O. Wilson (Ed.) *Biodiversity*. Washington: National Academy Press.
- World Conservation Monitoring Center (WCMC) 2002. *Global biodiversity: a status of the earth's living resources*. London: Chapman and Hall.
- World Rainforest Movement (WRM) 2001. *Global biodiversity: social and ecological perspective* London: Zed Books Ltd.
