



Assessment of Adaptation Strategies for Deforestation and Climate Change: Implication for Agricultural Extension System In Nigeria

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ABSTRACT

Addressing environmental crisis is one of the major challenges the present-day faces. The entire world, Nigeria all-encompassing are vulnerable to effects of deforestation because of their over-dependence on forest product as major source of energy (fuel wood extraction), farming activities, bush burning, poverty and overgrazing. However, deforestation has been affecting agricultural business with the most upsetting properties in Nigeria as: loss of plant biodiversity, increase soil and water erosion, massive carbon dioxide (CO₂) emission and increases the rate at which infectious diseases are conveyed. These ailments, arising from deforestation are capable of affecting agricultural production and productivity which in turn affects the living condition of a particular region affected by deforestation. Therefore, various adaptations to deforestation strategies become very essential if agricultural production in the country is to become significant in addressing present economic challenges. This research find out that agricultural extension structures in the country need to be restored by effectively re-defining the roles of the extension agents. This is essential since environmental crisis if not properly addressed, will affect future agricultural productivity of the country.

Keywords: Adaptation Strategies, Assessment, Agricultural Extension, Climate Change, Deforestation

INTRODUCTION

Deforestation is defined as clearing of any area of its natural vegetation cover, which normally leads to decrease in plants population resulting in loss of plant biodiversity (Aliyu *et al.*, 2014). Deforestation is also known as forest decline, forest fragmentation and degradation, loss of forest cover and land-use conservation is also defined as the indiscriminate felling of trees without their replacement (Mustapha *et al.*, 2012).

According to Becek and Odihi (2008), human activities are globally recognized as the principal cause of deforestation. Energy shortages are the greatest challenge, particularly, in rural areas of Nigeria. For instance, grid electricity and other conventional sources of energy are not reliable or in short supply. Nigeria has a population of over 170 million people with an average population growth rate of 2.8% (Food and Agriculture Organization, 2009). Fifty two percent (52%) of the population live in the rural areas with 70.8% in absolute poverty and living on less than US \$1.25 per day and do not have enough to pay for fuel (World Bank, 2006). With this population growth and without concomitance of economic

growth or technological advancement the high rate of deforestation is unavoidable. According to the United Nation's Framework Convention on Climate Change (UNFCCC, 2010), the overwhelming direct cause of deforestation is agriculture; with subsistence farming responsible for 32 percent, logging 14% and fire wood removal make up 5% (Mustapha *et al.*, 2012). Nigeria has the worst deforestation rate in the world, which can be attributed to increase in population with high poverty level bulk of the population depend on forests for their energy needs (International Institute of Tropical Agriculture, 2011).

Report from a study conducted between 2010 and 2014 in Benue State, Nigeria shows that Nigeria lost an average of 409,700 hectares of forest every year, equal to an average annual deforestation rate of 2.38% (Ekhuemelo, and Akeh, 2015). Saliu, and Alao (2010) observed that extensive deforestation has reduced 65 million hectares of intact forest cover of 1897 in Nigeria to the present 4 million hectares in 2010. The consequences of this according to the report are unhealthy development resulting to environmental degradation and accelerated wind and water erosion of the fertile land, which have left Nigerian soil too poor for sustainable agricultural production.

WHAT IS DEFORESTATION?

Deforestation is one of today's pressing worldwide problems relating to human survival, welfare and development. Deforestation as defined by United Nation's Framework Convention on Climate Change (UNFCCC) as the direct human-induced transformation of forestland to non-forest uses. Nigeria has the world's highest annual deforestation rate of primary forest at 55.7%. The country is one of the two largest losers of annual natural forests in Africa. At 11.1%, Nigeria's annual deforestation rate of natural forest is the highest in the world and puts it on the pace to lose virtually all its primary forest within few years. It is a major problem occurring in many parts of the country and the most adversely affected region is the less endowed Northern part of the country (Mohammed, 2014).

CAUSES OF DEFORESTATION IN NIGERIA

There are three major causes of deforestation namely: agricultural activities, fuel wood extraction and bush burning which are all outcome of human activities. Human activities are globally recognized as the principal cause of deforestation. Energy shortages are the greatest challenge, particularly, in rural areas of Nigeria. For instance, grid electricity and other conventional sources of energy are not reliable or in short supply. Nigeria has a population of over 170 million people with an average population growth rate of 2.5% (Food and Agriculture Organization, 2009). Fifty two percent (52%) of the population live in the rural areas with 70.8% in absolute poverty and living on less than US \$1.25 per day and do not have enough to pay for fuel (World Bank, 2006). With this population growth and without concomitance of economic growth or technological advancement the high rate of deforestation is unavoidable. Human activities that commonly cause deforestation occur in three different ways namely;

1. Agricultural activities

Large scale agriculture which requires a large land capital has also consumed a large portion of forested areas in Nigeria. Mechanized farming in the middle belt was practiced by indigenous farmers, but the system of shifting cultivation is still employed to improve crop yield. This required shifting of the farm sites to virgin and uncultivated lands thereby clearing existing natural forests Abere, (2010).

i.) Fuel wood extraction

There are many alternative domestic fuels such as Kerosene, domestic gas, wind energy, solar energy, electricity and fuel wood among others. Among all, fuel wood remains the commonest in Nigeria partly due to its ease of access, affordability, suitability, convention and vegetation scattering as other sources are either scarce, modern, costly, required high levels of education and technology to exploit, refine, distribute, store, utilized and maintained. Akut, (2008) revealed that in Jimeta, Yola, Nigeria; the use of fuel wood constitutes the major energy for cooking and room lighting and mostly used by the low income earners. Those who engage in this business a time employ the services of men to cut down trees and allow them to dry before they are sold. This has been contributing to deforestation in Nigeria. According to Okoye and Ezeonyejiaku (2010) the demand for fuel wood has been on steady increase by the increasing

population and urbanization despite the existing felling of trees decree in the states of the Sudano – Sahelian zone of Nigeria. The search for fire wood is said to be one of the primary causes for deforestation in developing countries. However, deforestation as one of the anthropogenic activities is contributing to erosion, flooding, loss of soil nutrients, poor agricultural produce, global warming, climate variability, climate change and desertification.

ii.) Bush burning

Bush burning is a major tool used in clearing the forest for shifting and permanent agriculture and for developing pastures. Fire used responsibly can be a valuable tool in agricultural and forest management but if abused it can be a significant cause of deforestation (Rowe *et al.*, 1992). Based on data available from 118 countries representing 65 per cent of the global forest area, an average of 19.8 million hectares or one per cent of all forests were reported to be significantly affected each year by forest fires (Eleri, 2012).

EFFECTS OF DEFORESTATION

Every year, about 13 million hectares of forest are converted to other land uses (FAO, 2010), leading to biodiversity losses, soil erosion, and massive carbon dioxide (CO₂) emissions. At the same time, demand for timber products is rapidly increasing, especially in the developing world. With this population growth and without concomitance of economic growth or technological advancement the high rate of deforestation is unavoidable.

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Biodiversity loses

Many trees, shrubs, herbs and assorted animals have been depleted while some are endangered. For instance, several plant species have been over exploited especially those with edible seeds, nuts and kernels are now endangered. Most primates such as guenons, mangabeys, drills, chimpanzees and gorillas are now endangered (Akachuku, 2007). In fact, the lowland gorilla which is endemic to the Cross River National Park at Mbe Mountain is seriously endangered through hunting and habitat destruction. Numerous elephants that were found in our ecosystems have disappeared while the number of other mammals such as hippopotamus, manatees and leopards has decreased tremendously. Reptiles such as crocodiles, monitor lizards, alligators, royal python and boar constrictor are very few. Also, several species of amphibians, fruit bats, fishes, snails, and bird's e.t.c are threatened, endangered or extinct. Several crops have been "lost" as the younger generations of Nigerians may not know them. These "lost" plants are of serious economic importance (food, medicine, etc). They include algae, mushrooms, roots, vegetables, tubers, fruit trees, culinary plants, medicinal plants etc. Akintoye *et al* (2013) in studies carried out in Cross River state have confirmed that losses of biodiversity, from logging and unsustainable NTFPs collection are serious threats to forests conservation in Nigeria.

Increases soil erosion

Deforestation also disrupts water cycle (Burmamu *et al*, 2013). The long term effect of deforestation on the soil resources can be severe as clearing the vegetative cover of the earth's surface results to soil erosion. According to Burmamu *et al* (2013) a study of soil erosion due to deforestation in Biu local government area of Borno State, Nigeria showed that more than 1000 tons of soil has been lost to gully erosion. Soil loss caused by erosion in Sade town of Bauchi State, Nigeria was estimated at 31,000 tonnes (Rattenbury, *et al.*, 1988). This erosion led to a wide scale loss of crops, livestock and the collapse of some buildings.

Carbon dioxide emission (CO₂)

It has been noted that deforestation cases are widespread in the context of increasing commercial pressures on land and deepening of forest depleting which is worsening global warming Achike, *et al* (2014). According to Onoja (2008) report indicated that deforestation in Nigeria is a major area of environmental concerns and indeed one of the most important issues of the last ten decades. The relationship between deforestation and Green House Gas emissions was explained by Botkit and Keller (1997) who noted that when forests are cleared and trees are burnt or rot, carbon is released as carbon dioxide which then goes to increase the volume of greenhouse gas in the atmosphere that can combine with ozone in the ozone layer to deplete the protective layer of the atmosphere thus stepping up global warming.

ADAPTATION STRATEGIES

Adaptation is learning to cope with the impacts of climate change (deforestation) as reported by Gwary, (2010). Adaptation in this regard, is the evolutionary process whereby population becomes better suited to its habitats. Deforestation is a threat to environmental sustainability. In an attempt to address the effects of deforestation farmers are compelled to employ the following deforestation adaptation strategies which include; conservation agriculture, use of fuel efficient wood stove, use of alternative energy.

Conservation agriculture

As stated by Dumanski *et al.* (2006) Conservation Agriculture is an application of new agricultural technologies to expand production while concurrently protecting and enhancing the land resources on which production depends. Application of Conservation Agriculture promotes the concept of optimizing yields and profits while ensuring provision of local and global environmental benefits and services. Zero tillage, along with other soil conservation practices, is the cornerstone of Conservation Agriculture. In Mafeteng District, NGOs together with the Ministry of Agriculture and Food Security are promoting conservation agriculture for the purposes of minimizing soil erosion, deforestation and increasing crop yields (International Federation of Red Cross and Red Crescent Society, 2006).

Use of fuel-efficient wood stove

In a study conducted by Amogne, (2014) on The Role of fuel Efficiency Stoves in Achieving Millennium Development Goals: Case of Ethiopia revealed that Worldwide, 3 billion people are dependent on burning biomass fuels for cooking (World Vision, 2011; Anhalt and Holanda, 2009; Sepp and Mann, 2009). In Sub-Saharan Africa (SSA), wood-based biomass is the dominant source of energy where about 81% of rural households and 60% of urban dwellers depend on it for cooking-far more than in any other region in the world (Modi *et al.*, 2006; World Vision, 2011 and Ekouevi and Tuntivate, 2012). According to Economic and Social Commission for Asia and the Pacific (ESCAP), wood fuel, agricultural residues and animal waste account for 65 to 70% of the energy used in rural areas of Asia and more than 25% in urban areas.

Report from a study on the Role of Fuel Efficient Stove in Achieving the Millennium Development Goals; Case of Ethiopia by Amogne, (2014) showed that the dissemination of efficient stoves in the households can be a step taken toward minimizing indoor air pollution, decreasing time and money spent on fuel wood, and can prevent the rate of deforestation substantially (Anhalt and Holanda, 2009). They further added that, the goal of any improved cook stove program is to develop more efficient, energy saving, and affordable biomass cook stoves that can help overcome local pressure on wood resources, cut down the walking time required to collect the fuel, reduce cash outlays necessary for purchasing fuel wood or charcoal, and reduce the indoor-air pollution.

Use of alternative energy

In a studies conducted by Mustapha *et al.* (2012) on Determinants of Adaptation to Deforestation among Farmers in Madagali Local Government Area of Adamawa State, Nigeria revealed that energy shortage is the greatest challenge, particularly in rural areas of Nigeria. For instance, grid electricity and other conventional sources of energy are not reliable or in short supply.

In addition, a large amount of renewable energy resources including hydroelectricity, kerosene, solar radiation, wind and biomass are present. Hydro resources are estimated at 14,750 Megawatts, solar radiation is estimated at 3.7 -7.0 kilowatt-hour/m³ per day, wind energy 150000 Terra Joule per year and biomass at 144 million tons per year (Baofu, 2013). However, lack of exploitation of these resources has caused an invariable over-dependence on only the biomass of forest resources; which is threatened by total devastation.

IMPLICATION FOR AGRICULTURAL EXTENSION PRACTICE IN NIGERIA

Despite Nigeria's rich agricultural resources endowment, however, the agricultural sector has been growing at a very low rate. Less than 50% of the country's cultivable agricultural land is under cultivation. Even then, smallholder and traditional farmers who use rudimentary production techniques, with resultant low yield, cultivate most of this land. The smallholder farmers are constrained by many problems including those of poor access to market, land and environmental degradation and inadequate research and extension services (International Institute for Tropical Agriculture, 2011). With the emergence of deforestation thread on both human and animal survival agricultural extension system in the country will need to address the following in order to overcome the militating effects of deforestation;

Firstly, extension agents can play a vital role in assisting farmers in implementing policies and programs that deal with deforestation mitigation. For instance, regarding credits and other inputs extension agents could be employed to educate farmers in their area of interest; assist in forming community groups; link farmers to governmental, nongovernmental and private organizations at the national and international levels; and perhaps assist with proposal preparation or negotiations with other players.

Secondly, the curriculum of agricultural students in tertiary institutions needs to be re-examined and expanded to accommodate issues of deforestation. Also research processes and agenda should be influenced to address deforestation adaptation and mitigation. The thread posed by deforestation if ignored will no doubt render the goal of achieving food safety in the country unreachable.

Thirdly, it is great importance to improve the capacity of individual extension agent, groups, organizations and communities to ensure necessary rural development, poverty alleviation and environmental protection Dagnbol-Martinussen (2002). Investment alone cannot lead to desired level of development." Therefore, building the capacity of people, groups and organization is vital because they must have the ability and responsibility to resolve their problems and develop their communities and environment.

Finally, designing an effective communication cycle for multidisciplinary teams to develop and retain new repertoires for managing complexity. Karbasioun (2007) found that information sources such as governmental extension agents and farmers own experience are the most important information for farmers that allows effective information cycle between extension agent and other fields of study.

CONCLUSION AND RECOMMENDATIONS

Nigeria lost an average of 409,700 hectares of forest every year, equal to an average annual deforestation rate of 2.38%. The consequences of this according to the studies are unhealthy development resulting to environmental degradation and accelerated wind and water erosion of the fertile land, which have left Nigerian soil too poor and porous for sustainable agricultural production. Agricultural extension in her bid to improve food production, friendly environment and overall standard of living in the rural areas of the country has faced a number of challenges which deforestation is very outstanding. For agricultural extension to address these problems there is a need for the extension agents to rise up to these encounters. Extension agents need to be adequately equipped with knowledge regarding new and advanced deforestation adaptation strategies. Farmers need to take active parts in issues related to environmental crisis and the government need to come up with favourable policies to address environmental crisis.

All these midst other issues if ignored will surely mark the effort of agricultural extension practice to bring about food safety an illusion, as the thread and risk posed by deforestation will in no doubt affect the yield and overall production and productivity of the farmers.

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