Impacts of agriculture and forestry in the control of climate change: The role of extension services

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ABSTRACT

Climate change is recognized as an important issue at the center of world discussion. The importance of agriculture and forestry in the control or mitigation of climate is an important issue that has gained a lot of attention recently. Climate smart agricultural and forestry practices a situation where practices that will promote mitigation and reduce emission towards a better food security and environmental friendly weather are considered in this review paper. Also the role played by extension workers was also discussed. Climate smart agricultural and forestry practices such as planting of drought resistant crops, changes in cropping pattern, irrigation efficiency improvement, afforestation and agro-forestry were elucidated.

It was concluded that an extensive extension service that will adequately educate and reach out to stakeholders at all levels will improve capacity to control the impact of climate change.

Keywords: Adaptation strategies, Agriculture, Forestry, Climate change, Extension services.

1. INTRODUCTION

Climate change has emerged as a global issue affecting every aspects of human existence. Worldwide, Increase in greenhouse emissions is responsible for the climate change impacts experienced. Agricultural activities and deforestation have been shown to contribute greatly to climate change. Results have shown that emissions from agricultural sources are believed to account for some 15% of today's anthropogenic greenhouse gas emissions. Agricultural Land use changes accounts for about 8% of the total emission (Ozor and Nnaji, 2011).

Agriculture practices posses a great threat on the environment because it provides food to human. The success of agricultural practice is dependent on the climatic condition. Africa’s agriculture is negatively impacted by climate change (Pearce et.al, 1996; McCarthy et.al, 2001). Interest in this area has motivated a substantial body of research on climate change and agriculture over the past decades (Fischer et.al, 2002; Wolfe et.al, 2005; Lobell et.al, 2008). Agriculture provides employment for about 70 percent of the labor force in the country. It provides exports for earning foreign exchange for the country's import of industrial Equipment and other requirements. For example, in 1960, agricultural commodities accounted for close to 90 percent of export values.

The role played by forest cannot be over estimated. Forests play an important role in the water cycle, regulate rainfall, carbon sequestering, as a source of food, a genetic bank and protect soils from erosion (Agbogidi and Eshegbeyi, 2008).

Extension services, both (agriculture and forestry) is one of the areas that have been neglected by government's policies. The consequence of governments neglect of extension services includes been understaffed and the workers been under-paid, ill-equipped, under-trained and low work motivation.

Agriculture and forestry are two of the main types of land use in. These sectors produce food, fiber and fuel. Any factors that impact agriculture and forestry will therefore inevitably affect the wellbeing of human populations, now and in the future.

This review attempt to provide information on the contributions of agriculture and forestry extension in the control of climate change.
2. AGRICULTURAL ADAPTATION TO CLIMATE CHANGE

According to Farinde et al., 2005 climate change is one of the risk factors that inhibit the efficiency of agriculture. Climate change adaptation is doing the right things to prevent the negative effects of climate change. Adaptation is the adjustments that occur in response to changing climatic conditions (IPCC, 2007). Adaptation also refers to societal response to climate change in an event of rising GHG emissions. Mitigation is a way of reducing climate change by reducing the GHG emissions. Both adaptation and mitigation are ways of reducing the negative effects of climate change. In all of this, the role of an extension worker cannot be overemphasized. Basically, adaptation aimed at developing the capacity to cope with damages associated with climate change, reduce exposure risk and present new ideas and opportunities. Agriculture alone contributes approximately 12 per cent of global GHG emissions. Methane (CH4) and nitrous oxide (N2O) are the predominant GHGs produced by agricultural activities.

Agricultural activities usually respond to the climatic patterns of the area. In the south, due to frequent rainfall activities there is differential soil type that allows water to penetrate the soil; this climatic pattern has lead to variance in crops production hence, the ease of production of cereals crops, roots and tuber crops. In the north, the soil is so hard (red ferrallite) that rainfall hardly seep into the ground, instead it simply flows across the surface. Mechanize-irrigation system and the use of fertilizer to revamp the soil nutrient for agricultural purpose are employed to make up for the lost nutrients due to erosion.

Farmers usually used contour ridges as a strategy to minimize soil erosion to encourage better root penetration and enhance moisture conservation (Lema and Majule, 2009). There are four primary sources of GHG emissions from agriculture: enteric fermentation, livestock manures, fertilizers and paddy rice. Enteric fermentation – digestion of carbohydrates by ruminant livestock – is the largest contributor of CH4 from agricultural systems, contributing 40 per cent of agricultural GHG emissions. The second largest source of agricultural GHG emissions (16 per cent of agricultural GHG) is management and storage of livestock manure, which produces both CH4 and N2O. Synthetic nitrogen fertilizers are the third largest source (13 per cent of GHG emissions from agriculture) and the largest contributor of N2O, which is created when nitrogen not taken up by crops undergoes microbial processes in soils. Organic nitrogen-containing fertilizers such as manure and compost are also sources of N2O emissions. Flooded (paddy) rice cultivation produces CH4 through anaerobic decomposition of organic materials (such as crop residues) in the rice paddy, contributing around 10 per cent of total agricultural GHG emissions.

3. FOREST ADAPTATION TO CLIMATE CHANGE

Planting of trees (afforestation) and agroforestry are two practices used in forestry to mitigate the negative effects of climate change. Tree planting is the process of transplanting tree seedlings, usually for forestry, land reclamation, or landscaping purposes. Silvicultural activities such as reforestation, or afforestation, depend on whether the area being planted has been forested or not. It involves planting seedlings over an area of land where the forest has been harvested or damaged by fire or disease or insects. Planting of trees as been a way of adapting to the effect of climate change.

Agroforestry is a rational land-use planning system that involves planting of food crops and trees simultaneously on the same piece of land (Adesina et al., 1999). Trees naturally consume GHG such as (chlorofluorocarbon (CFC), methane, nitrous, toxin and Salina) thereby causing heat trapping and the aftermath effect of climate change.

Recent research has demonstrated that comparing carbon stocks from two sites or treatments on the basis of samples taken to equal depth, rather than equal mass of soil, can overestimate rates of SOC increase by 20-30 per cent due to differences in bulk density (Palm et al., 2013, Powlson et al., 2016). It is important to note that practices that increased organic matter inputs to soil (crop residue management, organic fertilizers and agroforestry) had the largest mitigation potential through increases in SOC stocks, regardless of soil type.

In addition to the fact that agroforestry techniques can be perfected to cope with the new conditions that are anticipated under a drier condition and a higher population density, they lead to an increase in the amount of organic matter in the soil thereby improving agricultural productivity and reducing the pressure exerted on forests. In the drier parts of the Sahel, baobab (Adansonia digitata) and
acacia (Acacia) trees are usually planted by local farmers in the Sahel because of their usefulness during the hot and dry seasons of the year (Nyong et al., 2007). In south-western Nigeria, teak is generally planted because it can adapt to all kinds of weather condition. Deforestation and illegal tree cutting without replanting as shown in fig 2 below increase the amount of GHG gases.

4. THE ROLE OF EXTENSION SERVICES IN AGRICULTURAL AND FORESTRY CLIMATE CHANGE MITIGATION

Extension service is the dissemination of relevant information and advice to farmers and a mechanism for delivering information and advice as an input in modern farming. Forestry extension programme involve training activities for communities through short–term courses, field visits and practical demonstration in specific areas and disciplines including tree tending techniques, maintenance of hand tools, sustainable harvesting practices, interrelationships of the forest components etc (Eke, 2001). Training is regarded as an extension tip, which could be used as a communication method where agricultural development project (ADP) collaborates with other institutes to organize training. The role of an extension agent is crucial to the farmers because they serve as link between research and farmers bringing information of new improved technologies from researchers and informing farmers on climate smart techniques to mitigate climate change impacts (Oladele, 1999). Forestry extension will enable the farmers and the rural populace to know that forests will be better enjoyed by sharing their benefits if sustainably managed (Ogunwale et al., 2006). Negative impacts of deforestation which is a promoter of climate change can be solved via aggressive extension activities (Agbogidi and Dolor, 2002).

Climatic changes are a result of environmental mismanagement by man (Onumadu et al., 2001). Environmental degradation can be avoided by effective extension education given to farmers and forestry practitioners (Adeodun et al., 2005)

5. CONCLUSION

The world is already under pressure from climate change. The adverse effects of climate change have a particularly devastating effect on agriculture and the environment. The negative effect of this is already obvious on food shortages and increasing poverty. Lately, the health implication of climate change is becoming alarming due to environmental degradation. Obviously, agriculture and forestry plays a critical role in all of this.
The major constraint to applying agricultural adaptation strategies in some countries has been a general lack of knowledge, expertise and data on climate change. Extension services need to be fortified to disseminate tested research information to farmers on agricultural and forestry smart methods to reduce the impacts of climate change.

6. RECOMMENDATIONS

There is the need for policy advocacy at all levels of government to empower Agricultural and Forestry Extension Professionals to sensitize both farmers and forestry practitioners with the aim of providing sufficient food and non degraded ecosystem in by 2040. It is recommended that the implementation of policies be developed by: Exploring strategies to improve the quality of extension service provision with special emphasis on farmer empowerment and tree planting encouragement.

There is need to strengthen forestry extension services to obtain maximum co-operation from rural communities towards sustainable forest management. These services should be aimed at helping rural communities to articulate their needs, environmental problems and their perceptions of possible solutions to identified problems. Also, it is recommended that climate smart forestry and agriculture techniques be made known and adequate information should be given to rural farmers via extension service workers.

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