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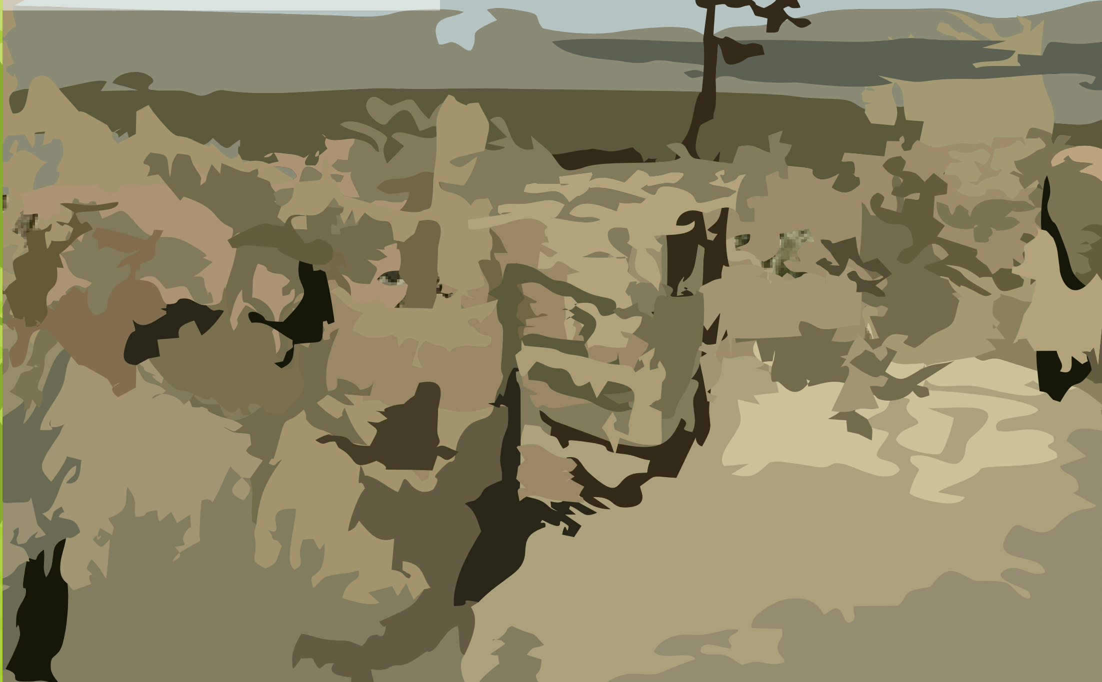

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1. Introduction

It is recognised that climate change will impact Africa negatively and therefore will have dire consequences for food security. However agricultural innovations can be used to forestall this or minimise the impacts. Innovation is an interactive process involving various critical actors working in a given socio-economic and cultural system to bring about improvements or advances in the production of goods and services. Agricultural innovations therefore are the interactive processes as well as the products and services that are produced by this process.

The Intergovernmental Panel on Climate Change (IPCC, 2007) defines climate change as “a change in the state of the climate that can be identified (for example, by using statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period, typically decades or longer”.

Analysis by Agyeman-Bonsu et. al (2008) showed that both maximum and minimum air temperatures increased by 2.5 and 2.2°C respectively between 1961 and 2001in Ghana. Furthermore, the future climate change scenarios generated indicates that both the maximum and minimum temperatures increased over years in all agroclimatic zones of Ghana. The projections indicate that the average maximum temperature of the Sudan Savanna Zone is expected to increase by 3°C by the year 2100 and 2.5°C in all other agroclimatic zones. The average minimum temperature is expected to increase by 2.5°C in the Sudan Savanna, Guinea Savanna and the Semi-Deciduous Rainforest Zones by the year 2100. For the Transition and the High Rainforest zones, the minimum temperature is projected to increase by 3°C and 2°C, respectively, by the year 2100

The Government of Gambia (2003) used forty years (1951-1990) of current climate data to develop the baseline climate scenarios for The Gambia. The analysis showed that in the 1951-1990 period, the behaviour of the climate of The Gambia shows almost equal distribution of wet/cool and dry/warm years. Thus, the 1951-1980 period was wetter and relatively warmer while the 1961-1990 period was drier and cooler. However, between the two periods, the rainfall for the months of July and September significantly decreased.

To develop the climate change scenario for The Gambia, the equilibrium General Circulation Model (GCM) outputs were used to create the climate change scenario (The Government of Gambia, 2003). Therefore, on the average, by 2075, mean temperature of The Gambia is projected to increase by 3°C to 4.5°C depending on the GCM used. By 2100, a decrease of 59% (HCGG), 17% (HCGS) and 15% (GFDL equilibrium model) is projected. On the other hand an increase of about 15% (GFDL01) and 29% (CCCM) about the 1951-1990 average rainfall amounts are projected in The Gambia (The Government of Gambia, 2003).

Climate change's impact on agriculture and human well-being will include the biological effects on crop yields, which would lead to impacts on outcomes including prices, production and consumption; impact on per capita calorie consumption and child malnutrition. The biophysical effects of climate change on agriculture induce changes in production and prices, which play out through the economic system as farmers and other market participants adjust autonomously, altering crop mix, input use, production, food demand, food consumption, and trade. Agricultural production in Ghana and the Gambia is predominantly rain-fed and any changes in rainfall pattern would have serious impact on productivity. Recent projections on climate indicate that rising temperatures and frequent droughts will increase the incidences of bushfires and environmental degradation. The changes in the climatic conditions in the past have deepened rural vulnerability to poverty and enhanced the process of land degradation and desertification. Investments in agriculture are becoming expensive, risky and less profitable.

The impact of climate change on cereal production in Ghana was assessed using the CERES model. CERES MAIZE and CERES MILLET models were used to generate growth and yield of maize and millet, respectively. The model output showed that there was a consistent decrease in the yield of maize in the Transition Zone due to an increase in temperature and solar radiation and a decrease in rainfall. However, the decreases in the projected yields were not significantly different from the baseline yields. The percentage decrease in the projected maize yield ranged from 0.5 percent in the year 2000 to 6.9 percent in the year 2020. With respect to millet, however, the changes in the climatic variables did not effect any change in the projected yield of millet. This could be ascribed to the drought tolerant nature of millet (Government of Ghana, 2003).

In the Gambia, the agriculture sector alone provides employment for about 75% of the labour-force, and an estimated two-thirds of total household income (The Government of Gambia, 2003). These attributes make the sector a prime area for investments, if the nation's socio-economic development policy objectives of poverty alleviation and household food security are to be realized. The sector is characterized by subsistence rain-fed, cash and food crops production and horticulture. Agro-industrial activity is mainly limited to groundnut milling, cereal processing, cotton ginning and sesame oil extraction.

The Government of Gambia (2003) predicts that all crop growth parameters (kg dm/ha) for the maize crop would undergo significant reductions under climate change. Furthermore, grain weight is estimated to be 28% (CCCM), 31% (HCGG), 33% (HCGS) and 40% (GFDL) lower than current climate values. Leaf and stem weights are also expected to be lower than current climate values by amounts ranging from 18 – 35% and 17 – 34%, respectively; and the nutritional value of the biomass products from maize will also be decreased due to decrease in nitrogen content, a situation that is similar for millet. However, simulation of the growth of groundnut suggests that groundnut production would be more favourable with climate change than under current climate scenarios. All growth parameters are estimated to be significantly higher under climate change scenarios, with grain weight estimated to increase by 9% to 25% above the current climate's production. Total dry matter production increases by 15 to 47% under climate change over current climate scenarios (The Government of Gambia, 2003).

2. Critique of Policy Options

Notwithstanding the foregoing, there have not been adequate policy-interventions to help farmers and vulnerable communities adapt to the impact of climate change and to improve food security in Ghana and the Gambia. Policies, plans and programmes in Ghana and The Gambia rarely recognize the adoption of local agricultural technologies and innovations for climate change adaptation although such technologies and innovations exist. Indeed a review of the draft adaptation strategy for Ghana and the National Action Plan for Adaption (NAPA) of the Gambia reveals that not much importance has been given to the need to harness agricultural innovations and technologies for adaptation to climate change and improving food security.

Although in Ghana and the Gambia, there are agricultural policies, the investments needed to implement these policies have been woefully inadequate.

In the Gambia for instance, annual investment levels in agricultural research and development for instance have fluctuated somewhat, largely due to yearly shifts in government and donor budgets (Stads and Manneh, 2010). However, in Ghana there has been an increase in agricultural research and development expenditures in recent times, which has been attributed to the presence of a policy environment in which the government of Ghana has recognized the importance of the agricultural sector (Flaherty, et al., 2010).

There is the problem of inadequate extension officers to spread the knowledge and help diffuse and transfer technologies and innovations. Even where there are agricultural extension officers, many of them have very limited knowledge of climate change adaptation. Furthermore, many farmers and vulnerable communities do not have access to weather forecasts as the most reliable means of obtaining weather forecasts is through the radio. Considering that coverage of electricity in many rural areas, where the farmers are, is limited and that many radio stations are located in urban areas, the spread of weather forecast through radio is limited.

Additionally, climate change adaptation and food security measures have the following shortfalls:

1. The use of tractors, irrigation systems and other means of mechanization are minimal.
2. The application of agro-chemicals including pesticides and herbicides on the farms is limited.
3. The adoption of improved seeds is very limited.
4. The processing of farm produce is very limited if non-existent in many farming communities.
5. Lack of coordination of efforts/initiatives for climate change impact adaptation and food security enhancement

3. Conclusion & Policy Options

From the foregoing, it is therefore imperative to pursue very important policy options to further promote the adoption of existing agricultural technologies for climate change adaptation and for improving food security in Ghana and the Gambia. The following have been proposed:

1. Review existing final and draft policies on climate change and agriculture to give prominence to the harnessing, adoption and transfer of agricultural technologies to farmers.
2. Provide the needed budgetary support to implement the policies and programmes developed.
3. Identify human and institutional capacity gaps for climate adaptation.
4. Improve public, especially rural farmers', access to information on climate change impacts and its adaptation measures.
6. Develop and implement education and training programmes for agricultural extension officers to better transfer knowledge and technologies to farmers.
7. Provide incentives for seed growers to produce seeds using technologies developed by national research institutes in Ghana and the Gambia.

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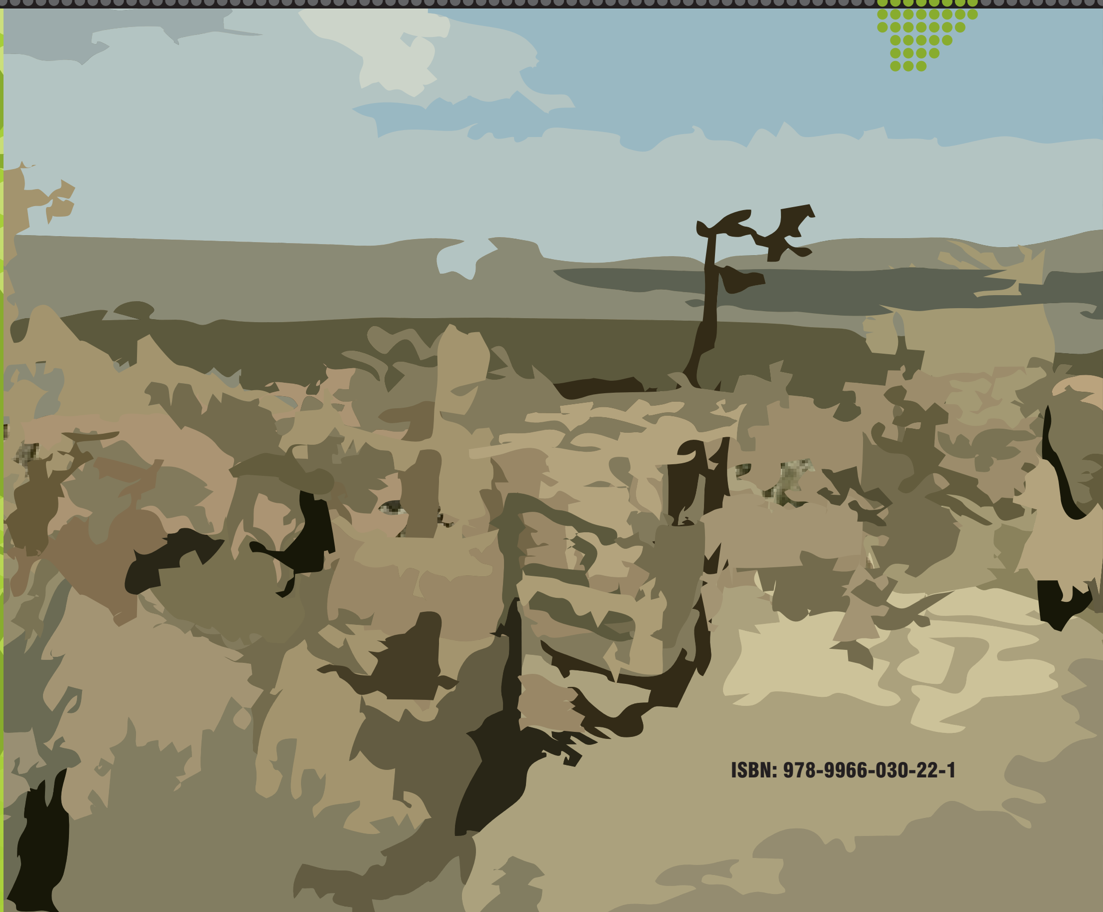

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