



# **Goals of Sustainable Agriculture in Sierra Leone: Can they be achieved in the Absence of Climate Change Capacity Building of Small-holder Farmers?**

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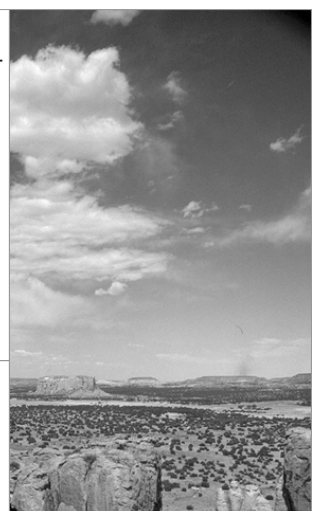
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## Summary

The present national goal for agriculture is food security and self-sufficiency through commercial agriculture (extensification), by providing machineries and agro-chemicals that would not be affordable, accessible and available to all farmers in Sierra Leone. It is therefore imperative to note that a potential of bypassing small-holder farmers does exist- which may be very detrimental to the achievement of feeding the entire nation through commercial agriculture alone. It should not be overemphasized that the average population of Sierra Leone will not attain food self-sufficiency status without sufficient locally produced food; and this will only be possible by improving on small-scale farming in tandem with commercial agriculture. The emergence of climate change impacts will exacerbate this problem. Small-holder farmers have been greatly affected and indigenous food production is gradually declining because small-holder farmers have often missed their start-of-farming dates; pest and disease proliferations are becoming high and the adaptive capacity to address these problems is low. Ignorance to address these problems would also pose negative impacts on sustainable food production in Sierra Leone. Science, technology and innovation therefore have major roles to play. These in combination with capacity building of small-holder farmers in the area of climate change adaptation in agriculture, can undoubtedly spur sustainable agricultural production and economic growth in country.

## Background

Reforms of agricultural policies in Sierra Leone often take GDP growth as the major target for agricultural development in the country. Commercial agriculture such as high concentration on cash crop production and mechanized large-scale agriculture have therefore often been the interest of the public sector. The fact that GDP is only a macro-economic indicator, and does not speak well for the poor, who form over 70% of the country's population, puts agriculture as one of the least of livelihoods options, if small-scale farmers are bye-passed in its development.



Increase in the impacts of climate change has been confirmed to have an inextricable link with food crops and livestock production. Thus climate change impacts could be especially deepening poverty in a fragile economy like Sierra Leone, which has little or no adaptive/financial capacity to respond to climate-related problems. Global estimates put temperature to be at a 1.50C rate of increase above pre-industrial temperature and suggest that any further 20C rise will lead to a decline of 5% in cereal production (Schar et al, 2006)- which will put 30-200 million people at risk of hunger – most of whom will come from African Countries. Other predictions even show that this rate of change will lead to 70% decrease in crop yields by the end of the century if no adaptation takes place. Climate change will also reduce the source of protein, and it is already responsible for the death of 150,000 people globally (Warren et al, 2006).

In Sierra Leone, the poor (about 75% of the country's population) greatly rely on agriculture as a major source of livelihoods. It is undoubted that agricultural production in the country is climate-sensitive. It is also noteworthy that each food crop has its own tolerance limit in terms of rainfall and temperature. In Sierra Leone, climate change is already on the verge of reaching and/ or exceeding the tolerance limit of the major food crops produced in the country. Already temperature is averaging around 280C and average rainfall is estimated to decrease by 3% below the 1990 estimate of 2746 mm. This is likely to affect major food crops such as rice (with tolerance limit of 250C), Cacao (180-210C) and Oil palm (250-280C). Hence, whilst mechanized farming is significant, conduct of scientific research and introduction of affordable, accessible and acceptable technology and innovation are equally important to solve this problem.

The total arable land resources of Sierra Leone for agricultural activities is 74.2% (5,362,000 ha). The lowland area alone, which is the most fertile, occupies 16.1% (1,165,000 ha)- 690,000 ha are inland valley swamps (IVS), 130,000 ha are the Bolis and the Mangrove swamps occupy 200,000 ha. It should be noted that these vast cultivable land areas are not only owned by the public sector- a large proportion is being owned by small-holder farmers. Most recent projections from the Ministry of Agriculture, Forestry and Food Security (MAFFS) indicate that tilling of 533,400 ha of land will achieve 80% of rice sufficiency level in Sierra Leone by 2010, but also 1,584 tractors and 2,438 power tillers would be needed. This is not enough- it can only increase wage employment of the labour force in handling machineries, though. Besides, it targets the production of only one of



the major food crops in Sierra Leone. Some essential questions that should first come in one's mind when undertaking such ventures include:

- 1) Can mechanized farming alone provide nation-wide year-round consumption of locally produced food crops in Sierra Leone?
- 2) Is rice the only cereal/food crop consumed in Sierra Leone?
- 3) Are small-holder farmers targeted in the extensification (commercialization) framework?
- 4) If so, are the machines/technology provided acceptable and accessible by all farmers?
- 5) If small-holder farmers are important, how can they cope with the changing climate in the absence of capacity building?

The public sector agricultural policy and other development programmes might be missing answers to these questions. Notably, even if 100% of small-holder farmers have access to tractors and power tillers, the directions in which seasonal changes are going, will put the use of these supplies to a state of 'helplessness', if capacity building in the area of climate change adaptation and agricultural innovations is not enforced.

## The ATPS-sponsored Research on Climate Change Adaptation

A research was conducted on behalf of the African Technology Policy Studies (ATPS) Network between December 2009 and October 2010 on climate change impacts on small-holder agriculture and the adaptive



capacity of Sierra Leonean farmers to respond to such impacts. It was in a bid to contribute to the development of robust adaptation policy that would be streamlined into national and local development programmes for enhanced agricultural productivity and socio-economic growth in Sierra Leone. The research targeted 500 small-holder farmers across the four agro-climatic regions in the whole of Sierra Leone. This was done using the multi-stage cluster sampling procedure and 10 Focus Group Discussions (FGDs). The findings

revealed quite interesting, but challenging issues that need public attention. Data structures transformed into a policy brief were developed from issues centering on: (a) effective indigenous and emerging technologies and innovations for climate change adaptation; (b) behavioural changes towards climate change adaptation measures at individual and institutional levels; (c) state of capacity building of the farming communities in Sierra Leone to adapt to climate change impacts; (d) state of climate change and climate variability across agro-climatic regions in Sierra Leone, (e) linkages between climate change and health, and the implications on food security and local economic growth, and (f) farmers' recommendations for building climate change resilience at the state and national levels in Sierra Leone.

## Emerging Issues from the Findings and implications for Agricultural Production

Small-holder farmers in Sierra Leone have been reportedly affected by slow and low returns from their farming activities because:

- > They have low adaptive capacity to respond to unstable climatic shocks during their farming seasons;
- > There is complete neglect of the adoption of science and technology because farmers cannot afford for utility, and
- > Indigenous innovations are under-utilised and highly devalued.



Small-scale farmers cannot attain year-round food sufficiency status under the present climate change circumstance in Sierra Leone without capacity building & other adaptation measures.

Climate Change impact, as revealed from the study, is no longer a story especially in terms of its linkage with health, agricultural development and socio-economic rejuvenation in Sierra Leone. Indigenous farmers, who have been considered as aliens to the emergence of climate change and its impacts, have acknowledged that the occurrence of climatic events such as rainfall, temperature and cold is no longer normal as before, and most of these events have been erratic over the past two to three years. This has caused abrupt and unstable shifts in start-of-farming dates in the local farming calendars- as agricultural activities in the country are injected by rainfall and mild temperatures. Small-holder farmers have therefore been reportedly affected by slow and low

returns from their farming activities especially as a result of: (i) low adaptive capacity to respond to unstable climatic shocks during their farming seasons, (ii) complete neglect of adopting science and technology in farm practices because farmers cannot afford for utility, and (3) under-utilisation and high devaluation of indigenous innovations. Small-holder farmers can therefore not produce more to raise their social and economic status amidst of pools of responsibilities such as caring for the sick, paying for learning materials and school charges, responding to external anomalies, etc- a reason why poverty is tangential among small-holder farmers. State actors, donors, NGOs/CSOs, the private sector, academia, science experts, etc, therefore need to take these issues very seriously. In particular, specific issues which came out strongly in the research and therefore need urgent attention were the gradual experience of climate extremes, some crops almost reaching their tolerant limits, food shortage and low animal productions, and limited capacity building, etc.

Phenomenal changes in climatic parameters such as temperature, rainfall and cold are already being felt by farmers in Sierra Leone. Both meteorological weather and perceived farmers' observations show that temperatures are already around the threshold of the tolerance limit of crops, animals and humans. Temperatures are already showing up around an average of 28°C. Meaning major food crops such as rice, palm oil and cacao will be in danger if no urgent adaptation and mitigation measures are taken. Already farmers in the savannah woodlands region are experiencing a mixture of temperature and cold in extreme conditions. Rainfall is reportedly no longer stable across all agro-climatic regions in the country and this has been experienced in the past two to three years. As a result, crop failures, pest and disease proliferations, frequent animal deaths, hunger and low economic returns are presently the order in the indigenous farming system in Sierra Leone. Small-scale farmers cannot attain year-round food sufficiency status under the present climate change circumstance in Sierra Leone without capacity building & other adaptation measures.

Capacity building to respond to agricultural failures due to uneven climatic events was also observed to be crucial for small-holder agriculture in Sierra Leone. The capacity of small-holder farmers to adapt to climate change impacts has been very low. Indigenous weather predictions were mapped out from the findings as the most widely used methods farmers have been adopting to meet their seasonal planting requirements. Meanwhile, most farmers confessed that these

are past events that no longer work in recent years under the present erratic/unstable nature of climatic events across their specific agro-climatic regions. Also, even though some farmers are already aware of climate-related information such as weather, tree planting and planting dates, the importance of such information are not adequately diffused across the agro-climatic zones and digested for local use. In fact they are regional-specific and mainly from a single source (the radio). Small-holder farmers were also observed to be constrained by low adaptation strategies/ assistances across the agro-climatic regions. For instance the supply of seed rice was identified as the highest form of assistance, but only 30% of farmers (24% of which are from the rain forest region) have been reached so far. Other assistances are of very low importance in terms of supply and impacts.

The change in climate patterns and low adaptive capacity of small-holder farmers have been coupled with climate-related disease burden resulting to less yields and low economic returns from small-scale agriculture in Sierra Leone. High episode of malaria, yellow fever, diarrhea and cholera have bordered farmers across the country. Pest infestations/infections on food crops and animals are on the other hand high. Mapping a linkage between climate change impacts on health, food self-sufficiency and local economic growth reveals that the burden of climate-related diseases on small-holder farmers will lead to a 30% decrease in economic returns from agriculture, compared to a situation of no expenditure on health. In addition, meeting nationwide food self-sufficiency under the present circumstance as revealed from the findings would be a herculean task if no adaptation to climate change impacts takes place. Only an average proportion of 1% of farmers agreed on year-round food self-sufficiency from reserves made from produce; and 45% (the highest proportion) reported on feeding on reserved food for only 3-5 months in the year.

Building on already established work in Sierra Leone can be the fastest way of addressing risks and uncertainties resulting from climate-related repercussions on agricultural development and economic growth. Desk reviews show that there is already an established policy on Science and technology. This policy makes agriculture, food security and allied industries as the top-most priorities; and recognizes that they have the potential to increase outputs on crops, livestock and marine resources if science and technology could be mainstreamed in their development. Areas such as environment, whose ignorance can militate against

efforts to reduce climate change impacts, are also emphasized in the S&T policy in Sierra Leone. Furthermore, frantic effort is seen in the S&T policy formulation, as it tends to capture indigenous technology by suggesting upgrading and modernizing such technology so that it can better serve the needs of the society. Meanwhile, in practice this policy was dormant as a result of lack of proper coordination between responsible sectors that would otherwise help reduce vulnerability in the area of climate change, climate variability and impacts on agricultural development and socio-economic growth in the country. Without proper coordination between sectors, the adoption of science and technology, acceptability and valuation of indigenous innovations, and capacity building in the area of climate change impacts, national efforts for food self-sufficiency and security will be far from meeting targets. Meanwhile, attempts to promote science-led technologies in agriculture, should not only look for outputs in terms of consumer wants and GDP growth, but rather fulfill the needs of indigenous people.

## The Way Forward

Farms should not be looked at as single entities that focus on consumer-driven increase in yields/outputs. Otherwise neglecting essential elements such as indigenous needs and capacity building may jeopardize efforts to reduce shocks, food insecurity and poverty.



The key question that needs answer here is, “how should we develop a robust policy on climate change adaptation and sustainable agriculture in Sierra Leone?” It was clearly noted from the findings that responding to climate change impacts on agriculture requires well articulated and coordinated actions. Neglecting essential elements such as responding to indigenous needs and capacity building (both in terms of knowledge/training on climate change and development of cost effective technology), may greatly militate against efforts to reduce shocks, food insecurity and poverty. The public sector and its partners should therefore avoid thinking of agricultural production only in effort to increase agricultural exports. Thus the need of adopting the “System Thinking” approach is essential. Individuals, firms, policy-makers, etc. should look at farms in terms of

“Systems”. They should focus on inter-relationships between elements on the farm and patterns of change rather than the elements alone.

There is need for collaborated efforts by the national science and technology council of Sierra Leone (NaSTEC), the Ministry of Agriculture, Forestry and Food Security (MAFFS), the meteorological department, poverty-/Science and technology- oriented institutions/NGOs, national and international agencies, etc to pool resources and promote research and development in the country. In particular, the adoption of agro-meteorological technology should be essential to test the climatic requirements of crops across the country to identify crop suitability in each of the agro-climatic regions.

A shift in the agro-climatic regions might have occurred. It is recommended that the meteorological department, statistics office, the agriculture ministry, World Food Programme (WFP) and FAO be engaged in bid to develop new agro-ecological zones based on observed climatic variability. The meteorological department is key, but has low technical and human capacities to carry out effective and efficient meteorological data collection; the institution's capacity therefore needs to be built in terms of training and provision of modern agro-meteorological equipments that would be relocated in each of the agro-climatic regions for weather observations.

There is need to develop a science and technology communications strategic framework in the country. In particular, expert institutions such as the National Council of Science and Technology, African Technology Policy Studies (ATPS) Network and the National Telecommunication Commission (NATCOM) should play a leading role in this process. Specifically, the framework must include the formation of an advocacy committee to promote the adoption of science and technology for full-scale mainstreaming in national and sectoral development with specific emphasis on spurring small-scale agricultural development. In addition the framework should include the formation and networking of early warning committees in each agro-climatic region that would be linked directly to small-holder farmers for improved viability of their agricultural produces. The committee must include the media, meteorologists, and farmers' representatives locally based in each region; and should be coordinated by the National Early Warning Committee.



Innovations/technologies for climate change resilience are very uncommon across the country. Meanwhile few indigenous and emerging technologies/innovations were identified in the coastal plains and rainforest. Improvement on such innovations should be made and diffused across the country. The agricultural sector (including research institutions), NaSTEC, etc should link with the National Farmers' Federation of Sierra Leone to further identify new and cost-effective innovations/technologies that farmers would be willing to adopt for food security/self-sufficiency and local economic growth. HYVs and other hybrids (which are drought and disease-resistant) should be introduced at a large and faster rate to small-holder farmers across the country.

Capacity building on climate change is very essential and should be done in a sustainable manner. Farmers should be trained on farm and other practices that would help mitigate greenhouse gas emissions (which will otherwise create cyclic but negative impacts on the farming systems). In addition, adaptation of the educational curriculum (especially in science courses) should be made by incorporating some form of education on causes of climate change and impacts.

Capacity building in terms of technical assistances such as supplies and introduction of post-harvest technologies are also very crucial in small-holder agricultural production and commercialization. Meanwhile an attitude-toward-behaviour model was adopted to gain farmers perception on possible and acceptable adaptation measures for climate change resilience in the country. The national priorities that were identified include: (a) introducing high yielding varieties (b) value addition/ access to market finance (c) provision of food storage facilities, and (d) constant monitoring of water qualities. Regional-specific priorities are available upon demand from the research team.

Massive campaigns on the climatic factors that encourage the prevalence of these diseases must be effected. In addition, public health policies should incorporate discount rates of treatment for highly agriculture-oriented small-holder farmers. They should be encouraged with subsidies to increase their earning powers to tackle such externalities.

Recommendations for further research have also been identified. In-country and international support for such research should be made to track progress in

effectiveness of climatic data collections, improvements in the low adaptive capacity of small-holder farmers to tackle climate-related impacts on their farming activities, as well as technology and innovation diffusions across the agro-climatic regions in the country, etc. The need for specific research on the burden of diseases on the farming population, by calculating and documenting the Disability Adjustment Life Year is also paramount.

Funds for the National Adaptation Programme of Action (NAPA) should not only be directed towards research on emissions of greenhouse gases. The implementation of NAPA should ensure that funds are allocated for research on climate change impact on small-holder farming, as well as mitigation benefits for small-holder agricultural commercialization. The effort to build the quadruple helix by ensuring that climate-sensed programmes build coherence between policy makers, science experts, the private sector actors and civil society actors for stronger and more sustainable adaptation programme of action must be made and achieved. .

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