

CULPRITS, CLIMATE CHANGE AND COPING STRATEGIES IN AFRICA

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Abstract

In sub-Saharan Africa, populations are predominantly rural, dependent on rain-fed agriculture for subsistence and livelihoods. Poor families are ill-equipped to respond to changing patterns and the shorter growing season caused by warmer days and nights. Key climate change scenarios in the region are presented like shifting rainfall regimes, droughts, etc with the attendant impact on agricultural output. Coping strategies have been presented which can be replicated in other parts of the world with similar challenges

Keywords: *climate change, Nigeria, Africa, rainfall, coping strategies*

1. INTRODUCTION

In recent times, and in particular over the past three or four decades, the issue of global climate change due to the greenhouse effects, including global warming and sea level rise have been a topic of scientific discussions and public debate. Climate changes concern remains one of the major focuses of national and international modern-day research and the trend is bound to continue far into the future. This is a consequence of interrelationship between Man, Climate change and Environment as well as the connection between environment and conflict in developed and developing countries all over the world (Olufemi and Samson, 2012).

Climate change affects countries economies and food security through variety of channels. Rising temperatures and changes in rainfall patterns affect agricultural yields and both rain-fed and irrigated crops (Wiebelt et al, 2011). The Intergovernmental panel on climate change preaches that human activity, (primarily related to fossil fuel consumption) is mostly responsible. While climate change will affect everyone; it is expected to have uneven effect on those living in poverty in developing countries (Olufemi and Samson, 2012).

This issue of Climate change, brings with it changes in weather patterns that can have serious impact for human beings, upsetting seasonal cycles, harming ecosystems and water supply, affecting agriculture and food production, causing sea-levels to rise, to mention but a few. Climate change has been blamed on anthropogenic (human) activities which result in increased release of green house gases (GHG) and widespread deforestation both of which alter the balance of atmospheric gases in favours of the green house gases. These GHGs include carbon (IV) oxide (CO₂), methane (CH₄), and nitrous oxides (N₂O). Arrhens (2001) reported that many scientists believe that the main cause of global warming is the greenhouse gas, CO₂ whose concentration has been increasing primarily due to burning of fossil fuels and deforestation.

With reference to sub-Saharan Africa, there is growing interest on the likely impacts of climate change on agriculture, economic growth and sustainable development. Incidences of climate change include changes in soil moisture, soil quality, crop resilience, timing/length of growing seasons, yield of crops and animals, atmospheric temperatures, weed insurgence, flooding, unprecedented droughts, sea level rises and many more (Ogbo et al, 2013). Although the exact nature and extent of the impacts of climate change on temperature and rainfall distribution patterns remain uncertain, most key investors and stakeholders in agricultural development in the Third World have agreed that it is the poor and vulnerable who are the most susceptible to changes in climate as they occur. This is particularly true for those communities in sub-Saharan Africa who rely entirely on rain-fed agriculture for their livelihoods.

Such communities, already struggling to cope effectively with the impacts of current climatic variability, will face a daunting task in adapting to future climate change. While rural communities are the primary ‘investors’ and risk-takers in rain-fed production, there are also a wide range of associated support agents upon whose strategies, decisions and operations they often depend. Farmers and agricultural stakeholders will need to adapt their tactical and strategic planning to these evolving climate risks, but given the magnitude of the existing poverty, food security, environmental and health challenges that are faced in sub-Saharan Africa, adaptation to climate change should not and cannot be divorced from those current development priorities (Cooper, et al, 2008).

2. CLIMATE CHANGE SCENARIOS IN SUB-SAHARAN AFRICA

2.1. Shifting Rainfall regimes

The immediate post-colonial economies of most countries in sub-Sahara African were dominantly “planned” and many proposed activities depended on the continued presence of mean rainfall levels which occurred prior to independence (Owusu, et al, 2008). Gleick (1993) reported that rain-fed agriculture constitutes at least 97% of agriculture in all West African countries. Since the 1970s, West Africa has undergone a period of declining rainfall, punctuated by a series of severe droughts and marked by a shift in rainfall regime. Rainfall variability and the incidence of meteorological drought have been identified as the main causes of reduction in levels and their subsequent impact on power generation (Nicholson et al., 2000; Van Edig et al. 2001).

The rainfall data for 1983-2003 analyzed between the months of July - August for some sites in the Eastern humid zone of Southern Nigeria shows that the "August break" may indeed "be breaking". The tension affects the world's crude oil price! And the “August break” again is “breaking” to add to the problem of polluted farmlands! An interdisciplinary solution is needed to meet the challenges posed to agriculture by the rainfall anomalies (see Figures 1-5).

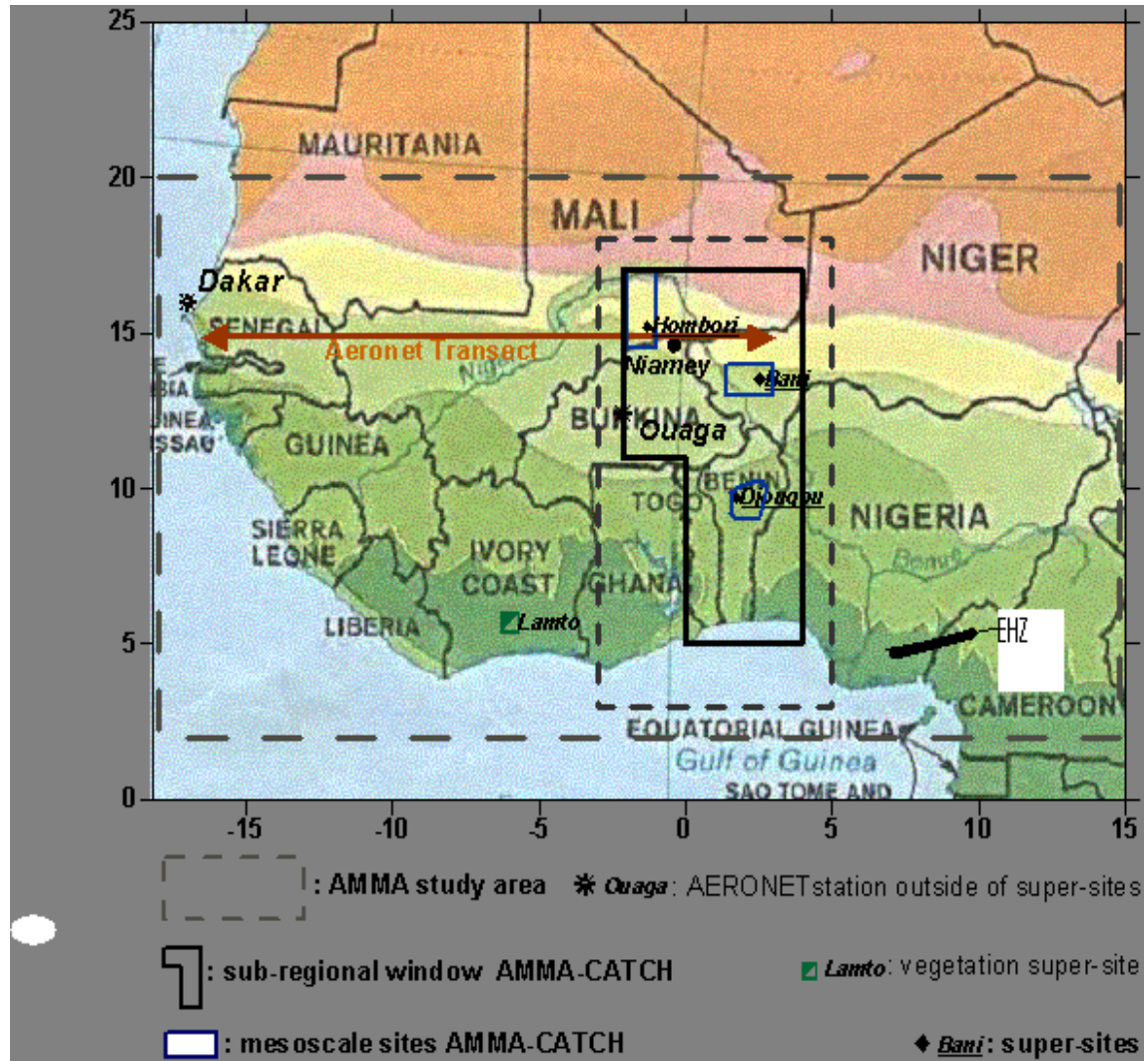


Fig. 1. The African Monsoon Multidisciplinary Analysis (AMMA) study area with the Eastern humid zone (EHZ) indicated.

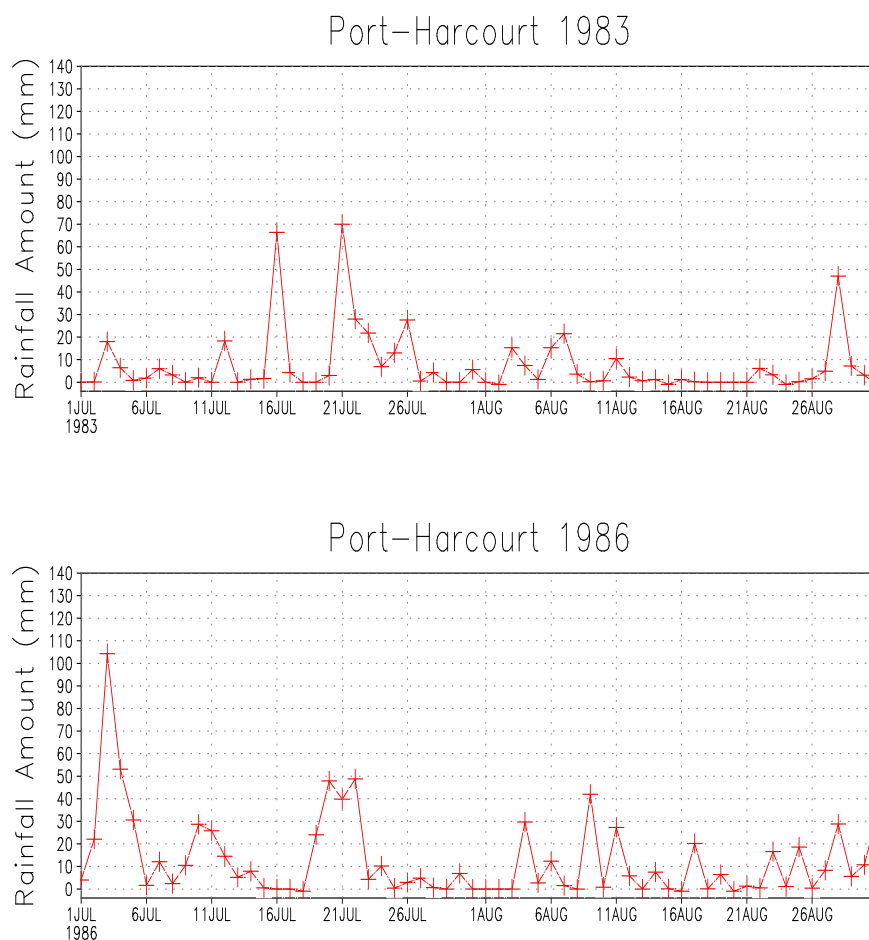


Fig. 2. Some years with signs of “August break” in the rainfall regime at Port-Harcourt

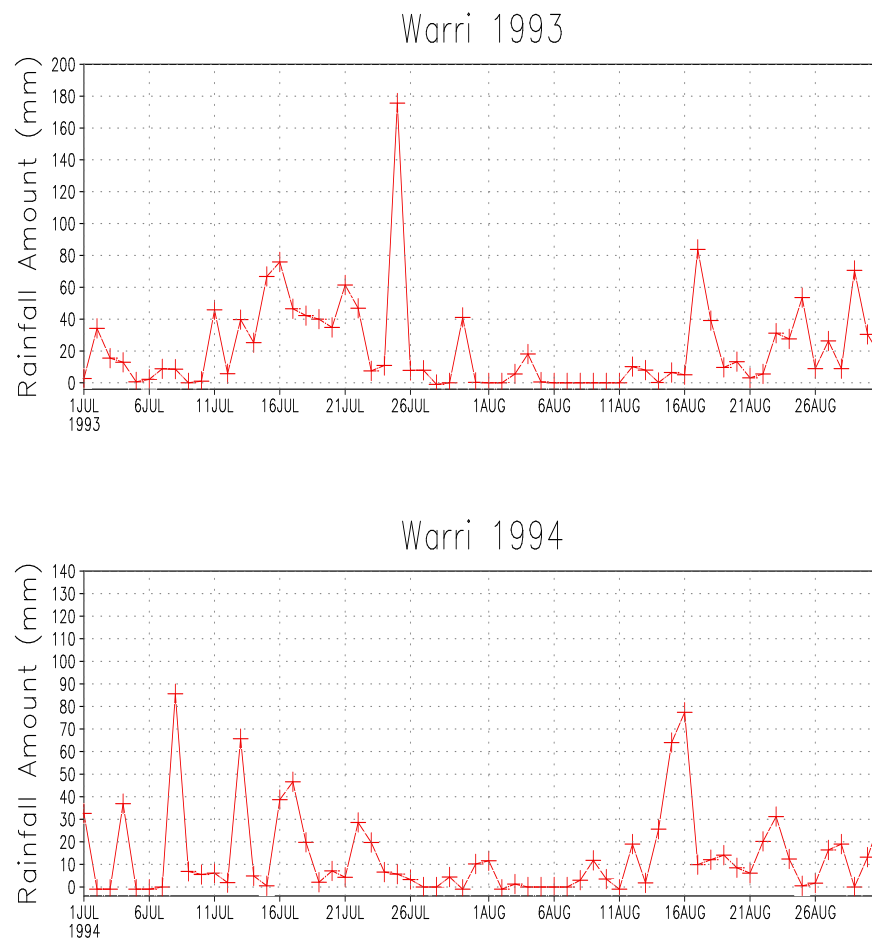


Fig. 3. Some years with signs of “August break” in the rainfall regime at Warri

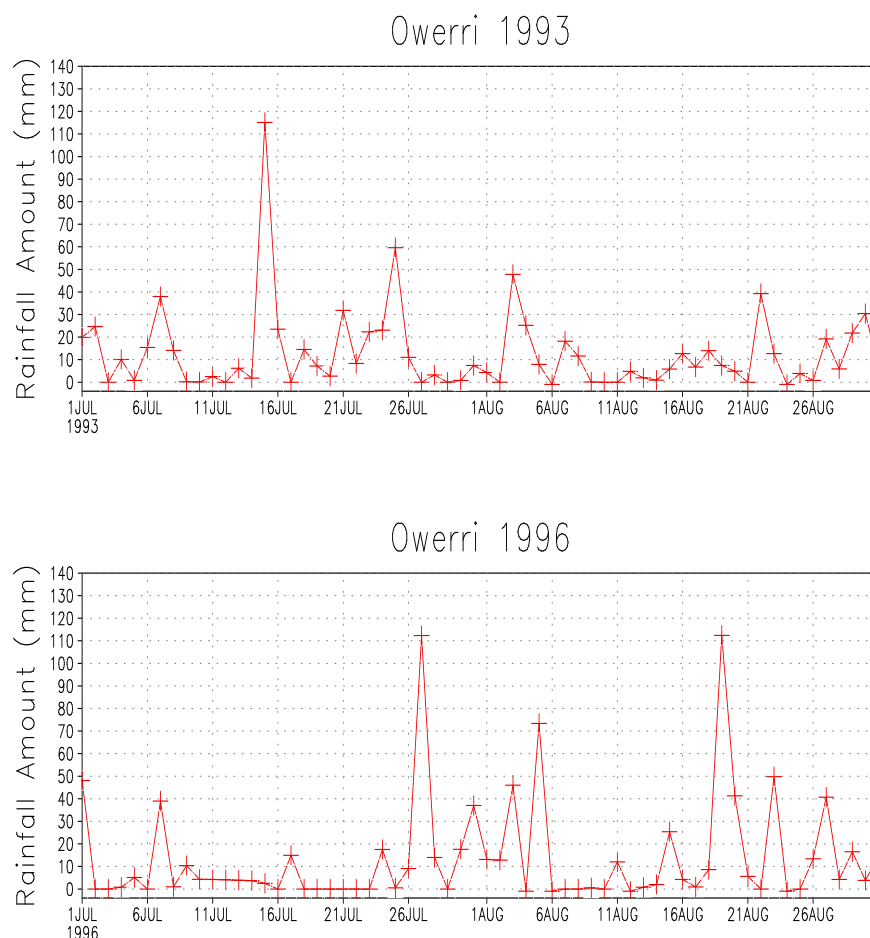


Fig. 4. Some years with signs of “August break” in the rainfall regime at Owerri

The oil-rich region of Nigeria where the Agricultural farmlands are polluted by the oil companies are in our study area! The tension-soaked part of Nigeria, the Niger-Delta region is part of the Eastern humid zone of Nigeria. In the study by Chineke et al. (2010), the July-August daily rainfall data was analyzed for twenty years in the oil-rich Niger Delta area of Nigeria where subsistence agriculture is the main source of livelihood for the inhabitants, more than 70 percent of whom reside in the rural areas that depend on rain-fed agriculture. We have noticed that the “August-break” may indeed be breaking. Marked variabilities have been reported in West African rainfall (Olaniran, 1991; Sivakumar, 1992; Asadu, 2002; Brooks, 2004; Brown and Crawford, 2008; Odekunle and Eludoyin, 2008; Salako, 2008) which has negative implications for agricultural activity in the study area since it may exacerbate the present poverty levels in a tension-soaked region.

2.2. Droughts

Drought is a recurrent climatic phenomenon across the world. It affects humanity in a number of ways such as causing loss of life, crop failures, food shortages which may lead to famine in many regions, malnutrition, health issues and mass migration (Masih, et al, 2014). Dealing with drought has long

been a key element of policy making in sub-Saharan Africa but the poor outcomes of drought experience in many situations mean that there is yet far to go in refining drought management to avoid the suffering from hunger and starvation (Gautam, 2006).

Anthropogenic climate change is expected to change the distribution, frequency and intensity of precipitation and result in increased intensity and frequency of droughts, with damaging effects on the environment and society. The impact of drought on a society depends not only on the severity and duration of the drought, but is also mediated by social factors which determine that society's vulnerability to, or ability to cope with, drought (Brooks, 2004). The available estimates on drought impacts suggest that, during the period 1900–2013, there were 642 drought events reported across the world resulting in a huge toll to humanity, killing about 12 million people and affecting over 2 billion (Masih et al, 2014).

2.3. Floods

Flooding is among the most devastating hazards in the world claiming more lives, causing damage to property and infrastructure than any other natural phenomenon (Chineke et al, 2010). Flood disasters in Nigeria had caused physical damage to structures, social dislocation, contamination of clean drinking water, spread of water borne diseases, shortage of crops and food supplies, death of non tolerant tree species, disruption in transportation system and serious economic loss. NEMA (2012) reported that a total of 95 LGAs were flooded in 14 states of Nigeria, which represented 12.3% of the 774 LGAs in Nigeria (Vanguard Newspapers, 2014).

In late 2006 and early 2007, floods of unprecedented spatial extent (and timing) occurred across Somalia, Ethiopia and other parts of East Africa which is broadly in line with projections in the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report for increases in autumn and winter rainfall (Christensen et al., 2007).

As a result of floods and attendant landslide, villagers in Sardauna Local council of Taraba State, Nigeria were rendered homeless, following a three-day downpour. This occurred on July 30 through August 2, 2012. Torrential rainfall on August 13, 2012 and the attendant flood led to the collapse of the Shendam bridge in Plateau State, Nigeria. The rain fell throughout the weekend of that week and Monday night swelling rivers and streams to overflow Shendam and Langtang North and South which were worst hit.

3. COPING STRATEGIES

Dike et al, (2010) revealed that renewable energy projects in many developing countries especially Africa have demonstrated that solar energy can directly contribute to poverty alleviation by providing the energy needed for creating businesses and employment. Solar energy technologies can also make indirect contributions to alleviating poverty by providing energy for cooking, space heating and lightning. They further suggested that accelerated development and deployment of new and advanced energy technologies, energy efficiency improvements and fossil fuel technologies that produce near-zero harmful emissions will address the countries climate change mitigation needs.

Cooper et al (2008) have highlighted 'diversification' and 'response' coping strategies that have evolved to deal with both expected rainfall uncertainty and evolving within season fluctuations in rainfall. They suggested the following adaptation to climate change:

- a) changes in crop management practices. eg. choice of fields, planting densities, crop varieties, etc
- b) land use and land management. Eg. fallowing, tree planting or protection, irrigation and water harvesting, soil and water conservation measures, etc

4. CONCLUSIONS

Efforts to reduce sub-Saharan Africa's exposure and sensitivity to climate variability have to begin with analysis of recent events to identify barriers to their effective management. Success in this endeavour will be closely related to scientific and social capacity to anticipate climatic hazards, deliver effective support when they occur, and learn from these experiences. Masih et al, (2014) suggested that there is an urgent and dire need to progress on various fronts of drought mitigation such as early warning and forecasting, building the resilience of the societies, short term relief efforts, long-term planning and capacity building. We strongly recommend dependence on renewable energy options for electricity generation, use of fuel efficient cooking stoves, deforestation (Chineke, 2011; Dike et al., 2010).

In today's climate of growing energy needs and increasing environmental concern, alternatives to the use of non-renewable and polluting fossil fuels have to be investigated. One of such alternative is solar energy. Solar energy is quite simply the energy produced directly by the sun and collected elsewhere, normally the Earth. One of the Nigeria's problems is providing electric power to small rural communities that cannot be reached by the national power grid especially if there is political will for electric power sector reform (Chineke and Ezike, 2010). The use of solar energy as an alternative source in rural and remote areas will aid the growth of cottage industries; it is an abundant and cheap source of energy (Chineke, 2011).

While the burning of fossil fuels introduces many harmful pollutants into the atmosphere and contributes to environmental problems like global warming and acid rain, solar energy is completely non-polluting. Monthly averages of daily global irradiation are usually used for the estimation of the PV electricity output (Chineke and Igwiro, 2008). For example, assuming a small 100 Wh stand-alone PV installation with a battery and battery charger, together with a performance ratio of 0.75, the power production ranges from about 300 to 600 Wh per day in most locations in Africa and South West Asia, except in winter seasons in the extreme North and South. This energy is sufficient to drive 3 energy-efficient lights for 6 hours per day, or 3 energy efficient lights for 4 hours plus a radio, or a pump to deliver 3000 liters of water from a depth of 20 meters. Note that this calculation does not take into account possible losses due to the saturation of the battery capacity.

Nigeria has solely depended on non-renewable sources for power generation for the electricity used in the country (Chineke and Igwiro, 2008; Dike et al, 2011). It is quite clear that there is need to enhance the energy sector with a reliable renewable source like the photovoltaic cell, which generates its electricity from the sun. To alleviate the growing need for power in rural households not connected to grid electricity in Nigeria assessed the domestic load demand of rural areas which will serve as input data in the design of photovoltaic-based rural home electrification systems, and also assist governments in their rural electrification planning framework. Their work showed that rural households in Nigeria will require 2.324 kWh/day in order to meet their basic power requirements for such loads as lighting and electronic appliances radios and televisions (Adeoti et al., 2001; Chineke et al., 2007; Chineke, 2008; Dike et al, 2010).

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