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Review

Climate change and changing food security risk in Ghana

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Agriculture is the most climate-dependent area of human life. In Sub-Saharan Africa, susceptibility to food insecurity is shaped by multiple stresses climate change. This article reviews literature on impacts of climate change on food security in Ghana. The paper reveals how climate change impacts and can potentially impact on the different shades of food security. It observes that food insecurity risk is amplified by existing spatial inequalities. The paper finds that farmers' decisions to adapt by changing crops could compel cultures to abandon their traditional foods which were used for certain rites and feasts. Revealing such intricate interconnections provides a framework that can shape policy measures in effective adaptation and resilience. Proactive approaches will undoubtedly prepare communities more thoroughly for the changes to come. Any adaptation strategy should take into consideration the knowledge of local residents and farmers and elicit a grassroots approach instead of a top-down approach.

Keywords: Climate change, risk, food security, Ghana.

INTRODUCTION

Agriculture is the most climate-dependent area of human life. In Ghana and most of sub-Saharan Africa as well as many developing countries worldwide, agriculture continues to play very significant role in national economies. Climatic factors are rarely stable and characterized by high inter-seasonal to inter-annual variations everywhere in the world. For countries such as Ghana where lives and livelihoods revolve around agriculture, changes in climate must be issues of great concern. The government of Ghana has taken a number of policy decisions towards mitigation of, and adaptation to, climate change impacts. This article discusses issues of climate change from an impact point of view. It relates climate to agriculture and food security and attempts to explain the relationship within the overall sustainable development of Ghana.

Food Security Trends in Ghana

In the last two decades, poverty levels have reduced in Ghana with the number of food insecure people consequently falling from 60% to about 26% (Wolter, 2006). Ghana was amongst the first in the world to halve the number of people living in poverty consistently for over two decades. This growth is explained by three factors, specifically high prices for cocoa, gold, and an expanding services sector. The performance of the cocoa sector is reinforced by prioritized government investments and policy that encourages cash crop production and exports in line with structural adjustment policies.

Since Ghana subscribed to structural adjustment policies in the 1980s amid worsening economic fortunes, the economy was reoriented to concentrate on the export of raw materials and integration into the global economy. This has resulted in an almost institutionalized priority that incentivizes cash crop production such as cocoa, mango, and pineapple to the neglect of the food crop production. While cash crop farmers are given input incentives, assisted to adopt new technology, pesticides, and guaranteed prices especially for cocoa, food crops are not.

This has systematically made food crop farmers poor, hence an unattractive means of income. In fact, subsidies for food crops produced were withdrawn completely during the economic recovery programme. Food prices subsequently rose while production declined considerably compared to the cheap food policy of the 1970s that emphasized food sufficiency from local production.

By 1981, at least twenty-four countries were facing food crises due to drought. Ghana was considered to be "critically affected" by this drought (McCarthy 1986) and

Table 1. Comparison of FAO and household survey-derived estimates of the prevalence of food energy deficiency for 12 African countries (from Smith et al. 2006)

Country	FAOestimate	Household surveyestimate	FAOrank	Household surveyrank
Ethiopia	44	76	4	1
Burundi	66	75	1	2
Malawi	32	73	8	3
Zambia	45	71	3	4
Rwanda	41	65	7	5
Mozambique	63	60	2	6
Senegal	24	60	10	7
Ghana	**15**	**51**	**12**	**8**
Guinea	31	45	9	9
Kenya	43	44	5	10
Tanzania	43	44	6	11
Uganda	21	37	11	12
Mean	*39*	*59*		

(Lobell & Burke 2010).

needed food aid urgently. For the first time in recent history, widespread hunger and starvation were witnessed and Ghana was chronically food insecure in this period. Households were persistently unable to access food in adequate quantities that were sufficiently nutritious and safe (Quaye 2008).

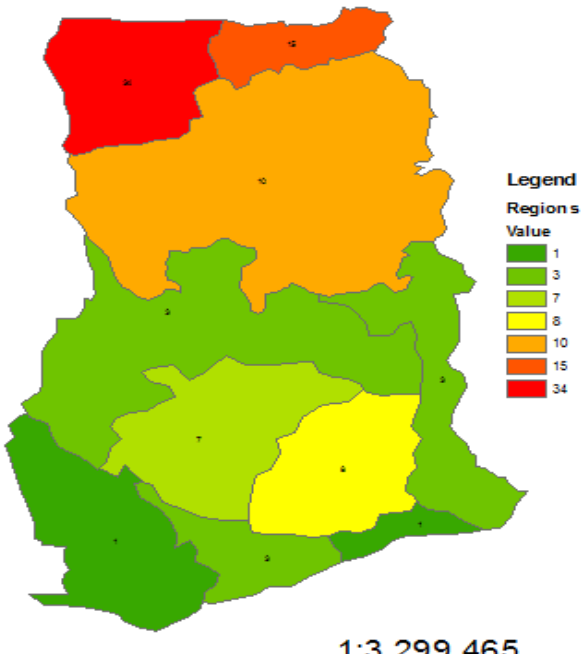
Even though food insecurity has decreased considerably in the last decade, malnourishment still persists especially in northern Ghana due to unstable production, low income and purchasing power, low yields as a result of degraded soils, and physical access due to poor road infrastructure (FAO 2009). The picture of the number of people who are food insecure in Ghana is controversial as different organizations and studies have produced different figures (see table 4). This could be explained by the multifaceted nature of food insecurity. For instance, the FAO, which relies on national data of food supplies, estimates the prevalence of food energy deficiency to be 15% (Lobell& Burke 2010). However, this measure could be misleading as it focuses on food availability. Food availability does not automatically translate to food accessibility and utilization as there are many barriers that mediate access and utilization of available food. It does not adequately analyze household food insecurity. Again, the geography of food insecurity is masked in national level figures distorting the reality. Thus, this presents little use to practical policy planning (Smith et al. 2006). One study used household survey data to measure food insecurity. It examined the amount each household produced or purchased and extrapolated the number of households below a given calorie and diet quality thresholds. It was found that 51% of households in Ghana were food insecure (Lobell & Burke 2010). Although it may be an overestimate, it gives detailed analysis and has significant practical policy planning use as it reveals the nature and geography of food insecurity in Ghana.

Despite the contributions of agriculture to the GDP and its huge potential, agriculture remains underdeveloped making Ghana not self-sufficient in food production. Agriculture is almost exclusively rain-fed with less than 5% of arable land under irrigation (Ghana Irrigation Development Authority 2010). With climate change intensifying weather extremes and shifting raining seasons, the impacts on agricultural output is projected to be severe. The ramifications on food security are manifold. 55% directly depend on agriculture for income and livelihood while 39% of the GDP is agriculture and 40% of export earnings are agro-based (Ghana Statistical Service 2012; MOFA 2013).

Climate Change and Food Security Vulnerability in Ghana

High population growth, low technology, inflation and degrading soils continue to be major hindrances to achieving food security in Ghana. However, the most important factor in the fight to feed Ghana is a seasonal variation of rainfall. The frequency and intensity of climatic extremes such as dry spells and droughts as well as floods cause substantial losses in yields (Barron et al. 2015; ISDR 2015; Mârza et. al 2015; Molle & Mollinga 2003) and consequently affect household income and overall national growth. Due to reliance on rain-fed agriculture, food production is vulnerable and very sensitive to climate change and variability. Several climate models have consistently projected not only higher temperatures in semi-arid regions but declining rain amounts and duration. El Niño, a South oscillation event, is also projected to intensify droughts and floods (IPCC 2013). Currently, the El Niño phenomenon is driving drought in southern Africa, Ethiopia, India, and Thailand. In a globalized world of interconnectedness and interdependence, this has significant ramifications on

Figure 1. A map showing the percentage of food insecure people by region in Ghana.



(Quaye, 2008)

Ghana which imports over 60% of its rice consumption (Nutrition and Consumer Protection Division Food and Agriculture Organization of the United Nations, FAO 2009). This causes a changing food taste and preference for imported rice from the United States and Southeast Asia. This dependence means that drought in South Asia has significant implications on prices of imported rice and consequently undermines both food availability and food access especially for the urban poor who do not produce alternate foods themselves. According to Smith et al. 2006, the majority of food insecure people in Ghana are urban-based.

Defined as having "secure access by households and individuals to nutritionally adequate food at all times and procured in conformity with human aspirations and dignity" (Yaro, 2004), food security is multidimensional. It implies food availability, stability, access and the ability to utilize available food. These dimensions are projected to be affected by climate change. An exploration of these effects is necessary for practical policy planning to build a resilient society in the face of climate change.

Climate Change and Food Availability in Ghana

The food availability dimension emphasizes how much food can be physically produced to feed people in a sustainable manner. Ghana currently produces below its true potential attributable to declining crop yields and soil fertility. Unlike the cash crop sector, especially cocoa where the provision of technology, improved access to credit, and relatively maintained rural infrastructure has spurred growth and has incentivized entry, the food crop sector has been declining. Yield gaps persist while the population continues to grow in excess of 3% (see table 5). In theory, providing appropriate technology under cheap and accessible conditions could eliminate this yield gap and raise productivity per capita on land. However, this is unlikely for practical reasons. Years of neglect of food crop production has resulted in the use of outmoded farming practices that exposes land and the environment to degradation. It has been established that food availability in Ghana is climate dependent. For instance, in 1990, following drought, food availability declined by about 40% inducing food price hikes. In times of droughts, crop farmer's livelihoods depend on the woods and forests which destroy the environment's capacity to deal with future changes in the hydrological cycle. Years of degradation makes the land more vulnerable to erosion. Climate change is expected to stress this already precarious situation. Various climate change models project severe weather conditions in West Africa including frequent flooding. Food crop farmers are amongst the poorest of poor in Ghana, and they are also least protected by the state. Climate change, therefore, will impact food production because of pre-existing entrenched vulnerability. It will affect food availability in two ways: as a shock and as a stressor. Droughts and floods wipe out harvests and yields and induce shortage in food availability in the short-term. Low incomes, limited livelihood alternatives, unemployment, and weak or non-

Table 2. Current and potential yields for food and export crops in Ghana.

Crop	a) Average Yield (tonnes per hectare)	b) Potential Yield (tonnes per hectare)	Yield Gap (b-a)	Yield Gap
I. Major Food Crops				
Cereals				
Maize	1.5	2.5	1	40%
Millet	0.8	1.5	0.7	47%
Rice – rainfed	2.1	3.5	1.4	40%
Rice – irrigated	2.8	5	2.2	44%
Starchy Staples				
Cassava	11.9	28	16.1	58%
Cocoyam	6.7	8	1.3	16%
Plantain	8.1	10	1.9	19%
Yam	12.4	20	7.6	38%
II. Major Export Commodities				
Cocoa	0.4	1	0.6	60%
Pineapple	60	100	40	40%

(Wolter 2006 based on Breisinger et. al 2008).

existent state support could transform these short-term shocks into long-term stresses when farmers are unable to cope with and recover from them.

Climate Change and Food Access in Ghana

Food availability does not automatically translate to food accessibility. The ability to acquire food either through production or purchase is a function of labor, land, and income. The security of access is hence assured when households are able to command sufficient amounts of these factors to either produce or purchase enough food (Lobell & Burke 2010). Access to food is therefore compromised when land loses fertility due to erosion induced by climate change-related flooding or when farm household income falls as a result of droughts and floods while food prices rise. The nature of agriculture makes it vulnerable and sensitive. The slightest changes in climate will have disproportionate impacts on households that depend on it. This is particularly true for poor households in rural areas whose lives and livelihoods are entirely dependent on rain-fed agriculture. But rural households are not producers of food, they also consume. If climate change induces higher prices, they benefit as producers. Conversely, they suffer most when they have to buy food due to poor yields. Low-income urban households are also likely to be affected. Rapid urbanization and changing preferences in Ghana has led to a taste for rice imports from the United States and Southeast Asia, in particular, Thailand and Vietnam. Recent El Niño induced droughts coupled with declining soil fertility has put pressure on production and prices. This has a significant impact on the prices of imported food and consequently the ability of poor urban households to afford food.

According to Cohen and Garrett (2009), less than 15% of households engage in agricultural production producing mainly fresh vegetables for wealthier households. Over 90% of household food needs in Accra are purchased. This could take up over 60% of household income for the poorest households. Weak formal safety nets for poor urban residents compel poor households to eat cheap foods which are often less safe and nutrient deficient. Vulnerability to food security in Ghana has both spatial characterization and an inter-household dynamic (see figure 1). For wealthy households, regardless of their location, changes in food prices will have a little net effect due to their inherent capacity to cope. For lower income households who barely make ends meet, a change in the price of food has significant implications on both quality and quantity of food consumed.

Climate Change and Food Stability in Ghana

A crucial dimension of food security is the stability of availability and access throughout the year. Poor yields and depleted stocks compromise household food security in Ghana until the next harvest (see table 6). In highly subsistence households, poor yields combined with poor storage facilities and limited diversified livelihoods translates into early depletion of stocks exposing them to months without adequate nutrition (FAO, 2008). Climate change-intensified disasters such as dry spells, droughts, and floods pose a significant threat when crops and livestock are lost during such events. The results could be a tragic loss of access to food in the lean season. This could dip poor households living on and below the poverty line into chronic or transitionary food insecurity.

Table 3. Months of Household Food Insecurity in Upper West, Upper East and Northern Regions of Ghana.

Crop	Upper West			Upper East			Northern		
	Months of Harvest	Months of Stock Depletion	Months of food insecurity	Months of Harvest	Months of Stock Depletion	Months of food insecurity	Months of Harvest	Months of Stock Depletion	Months of food insecurity
Sorghum	October	June	4	August	February	6	November	June	5
Maize	October	June	5	October	April	6	September	June	3
Millet	September	April	4	July/Nov	January	6	November	June	5
Rice	October	June	5	November	April	7	October	May	5
Yam	October	May	6	NA	NA	NA	September	June	4
Groundnut	-	-	4	October	April	6	September	April	5
Cowpea	October	June	5	October	March	7	October	May	5
Soybean	September	April	-	NA	NA	NA	November	April	7

Source: Quaye(2008).

Climate Change and Food Utilization in Ghana

Historical climatic data show that the average temperature has increased by 1^{o}C from 1961 to 2000 (Issahaku & Maharjan, 2014). Increasing temperatures could cause food quality to deteriorate and storage span to be compromised as households may not be able to afford cooling and refrigeration. Also related is water security. Higher temperatures induce intense evapotranspiration and consequently water availability for practicing good hygiene.

Climate change may exacerbate vector-borne diseases through flooding and compromise both the productivity of labor and capacity to utilize food resulting in malnutrition (Constantin de Magny et. al 2006). In a study of cholera bouts and climatic variability, it concluded that there is a strong link between times of outbreaks and global climate variability. They observed that the onset of cholera epidemics in Ghana during the 1990s was highly correlated with previous warm events.

The cultural interpretation and affiliation to certain food are vital in assessing the utility of food and how climate change may modify them. Food is not biophysically valued but it is socially determined. In Ghana, there are certain ethnic groups who prefer certain kinds of foods than others. Changing climate has been projected to adversely affect crops such as cassava, maize, and sorghum. Farmers' decisions to adapt by changing crops could compel cultures to abandon their traditional foods which were used for certain rites and feasts. For instance, yam yield is projected to decline by almost 11% by 2025, prompting farmers to allocate less and less land to yam production (Issahaku & Maharjan, 2014). Ethnic groups in northern and southern Ghana with yam festivals may be compelled to modify the nature and scope of their festivals.

Again, stable access to food could be jeopardized if there is volatility in global food prices due to climate-related changes. Both farming and non-farming households could spend more on food against a fixed income.

Conclusions, reflections, and recommendations

Climate change is predicted to have a detrimental effect for Ghana in the next few decades. Increased extreme weather events with more intensity, shorter growing seasons, water scarcity, and lower yields are just some of the tragic challenges that Ghana is projected to experience in future years. There are adaptation strategies that can help people acclimate to the new changes that climate change will bring. Some strategies are suggested below. However, it must be acknowledged that adaptation will not solve these issues alone. Mitigation of greenhouse gasses accumulating in the atmosphere due to human activity must be addressed, particularly by developed countries that are the highest contributors to this issue.

There are many general adaptation strategies that countries in the south can use to increase their resilience in the face of climate change. Proactive approaches will undoubtedly prepare communities more thoroughly for the changes to come than waiting until reactivity is the only available approach. Any adaptation method should take into consideration the knowledge of local residents and farmers and elicit a grassroots approach instead of a top-down approach from the government or other developed countries.

Agricultural research is a field that can be explored much more thoroughly in developing countries. Issues such as biotechnology, sustainable agricultural methods, and heat-resistant, drought-tolerant, and pest-resistant varieties of seed, post-harvest handling techniques, salinity, and pest control are all topics that warrant future research, especially pertaining to the climates of

countries in the south. However, biotechnological approaches must take into consideration the wider environmental effects, long-term human health impacts, and the corporate structures that currently have ownership over these methods. It will not help the planet in the long run if biotechnology has widespread detrimental effects on the environment despite producing more food in the short run. Likewise, although large-scale farms with genetically modified monocrops have been embraced in many developed countries, it should be critically examined whether that approach is appropriate for countries in the south where over 50% of the population subsists on agriculture. Regardless, agricultural methods must be adapted to produce the needed amount of food for people living in the global south.

Water management is critically important to the success of food production and will be even more vital in the future as the climate changes to weather patterns and water availability in some areas. One example of an adaptation strategy is to develop aquifer storage systems for use during times of floods to save that water for use during dry spells or droughts. Improved water storage is one of the most effective ways to ensure water availability after floodwater dissipates. Preventing forest degradation and soil erosion will also help during times of floods to absorb the water quicker. Ensuring thick forests are maintained will help them act as sponges during monsoons and flooding. Other integrated water management approaches include the proper lining of waterways, introducing sprinkler and drip processes, and construction of small to medium-size dams. These methods will help to deal with the lowering water levels where groundwater is pumped using tube wells.

Cash incentive programs are another adaptation strategy that can enable people to adapt on a household level. Cash for work programs that focus on the refurbishment of society/community assets (sustainable irrigation mechanisms for example) may be effective in addressing the food insecurity situation in vulnerable areas as they provide income generation opportunities to households at risk, thereby increasing their access to essential food items. Systems such as these will necessitate collaboration between governmental, non-governmental, and private entities. From a household perspective, diversifying income sources will make that household much more resilient when problems arise. Sole dependence on agriculture for households in the global south will likely cause a lack of income more and more often as climate change shortens growing seasons and causes other effects to agricultural land.

No matter what strategies are chosen to help communities adapt to climate change, the governments in these areas must be proactive as their citizens' lives and livelihoods depend on their policy approaches. Left alone, climate change will devastate communities and create more food insecurity in these vulnerable regions. Climate change and food security are two of the most pressing problems that our world faces, and the mitigation and adaptation strategies undertaken now will determine the state of our planet in the next 100 years.

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