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CLIMATE CHANGE AND INFECTIOUS DISEASE IN GHANA

Applications for Post-Conflict Recovering Liberia

By

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Executive Summary

In Sub-Saharan Africa, in addition to the lifetime risks of consuming unsafe water, living in inadequate sanitary conditions, and inhaling polluted air to which millions are exposed, emerges a silent health risk: a changing climate. While more developed countries are better able to adapt to the challenges ahead, climate experts predict devastating outcomes such as sea level rise, atmospheric alteration, changes in weather systems, shifts in rainfall patterns and seasonality as well as increasingly frequent and severe weather events, to which most low income countries may not have the financial, scientific or technologic expertise to adapt (WHO, 2012[1]).

On that note, what are the potential public health implications of climate change along the western coast of Africa? What are the implications of rising sea levels, increasing temperatures and heavier downpours on the proliferation of infectious disease in the sub-region? What would a changing climate mean in a post-conflict recovering nation like Liberia? Using the Ghanaian scenario as a case study, the objectives of this research paper are: 1) to assess the role of climate change in the spread of infectious disease in Ghana, 2) to identify adaptive measures taken or underway, and 3) to extract the lessons learnt and best practices which may be applicable within the complex confines of the Liberian context.

Having reviewed the scientific literature and the progress made towards climate change adaptation in both Ghana and Liberia, it is proposed that further dialogue be encouraged between the two nations to foster enhanced cross-fertilization and knowledge sharing. While the effects are already being felt, it is also recommended that, beyond the policy level, more efforts be made at the technical and project level to ensure more effective disaster risk preparedness and the sustainability of developmental initiatives in Liberia.

Introduction

For many decades, tackling infectious disease has been known to be a pervasive challenge in the developing world, largely contributing to disease burdens in most parts of Sub-Saharan Africa and Southeast Asia. According to the World Health Organization, every year, infectious diseases claim 3.5 million lives, mostly in children under 5 years (WHO, 2012[1]).

While the discovery of penicillin and immunization went a long way in assuring quantum leaps in public health care in the developed world, the developing world, sadly, lags behind. The lack of effective policies, regulations, human capacity, systems and structures, coupled with endemic poverty, collectively contribute to the extensive environmental health challenges observed in poorer regions of the world (WHO, 2012[1]).

In Sub-Saharan Africa, millions of people are exposed to lifetime risks of consuming unsafe water, living in inadequate sanitary conditions, and inhaling polluted air (Mabugonje, 1995[2]). In addition to these lifelong risks and in the shadows of the HIV/AIDS and malaria pandemics emerges a silent but pervasive public health risk: a changing climate.

As defined by the United States Environmental Protection Agency, climate change refers to any significant change in climate lasting for an extended period of time. This may occur in the form of changes in temperature, seasonality, precipitation or wind patterns, among other effects, which occur over decades or longer (US EPA, 2012[3]). A clear indication of a changing global climate is observed in the considerable warming of the earth's atmosphere; global temperatures have risen by 0.8^{o}C within the last century, largely due to anthropogenic factors such as increased greenhouse gas emissions dating as far back as the Industrial Revolution (WHO, 2012[1]).

Climatologists caution, however, that global warming and the implicit ecological implications in an ecosystem as intricately interdependent as the earth's biosphere are not the only adverse consequences of climate change. They predict other devastating outcomes such as sea level rise, atmospheric alteration, changes in weather systems, shifts in rainfall patterns and seasonality, as well as increasingly frequent and severe weather events (WHO, 2012[1]).

According to Costello, et al (2009[4]), while extreme weather events occurred at an average of two disasters per year just six years ago, the rate has risen to slightly more than six extreme events a year; with 70% occurring in the poorest regions of the globe in Asia, the Pacific, Africa and the Middle East. In 2010, overwhelming floods in Pakistan displaced 22 million people, and resulted in massive environmental health challenges (WHO, 2012[1]).

While richer countries possess the financial, scientific and technological comparative advantage and can more readily "adapt" to climate change, what does this mean for poorer countries (NAS, 2010[5])? What are the potential health implications of climate change along the western coast of Africa, for example? How would a low income recovering nation like Liberia adapt to rising sea levels, increasing temperatures and heavier downpours amidst the enormous existing socio-economic challenges of post-conflict reconstruction?

Taking the Ghanaian scenario as a case study, the objectives of this paper are:

1) to assess the role of climate change in the spread of infectious disease in Ghana,
2) to identify adaptive measures taken or underway, and
3) to extract the lessons learnt and best practices which may be applicable within the complex confines of a post-conflict recovering context.

The specific geographical location of interest in this study is the Ghanaian capital, Accra (Figure 1).

1. Ghana: An Overview

With a population of 24 million, Ghana is a dynamic nation along the western coast of Africa (Ghana Statistical Service, 2010[6]). It was the first African colony to gain independence in March 1956. Geographically, it is bounded by Burkina Faso, Cote D'Ivoire, Togo and the Altantic Ocean. With its discovery of oil in commercial quantities and its long history of rich minerals such as gold, diamond, manganese and bauxite, economically, Ghana is classified as a lower middle income country (World Bank, 2012[7]).

Figure 1: Map of Ghana indicating the Capital City Accra[8]

Lying along the coast, Accra[8], the capital and the largest city, is home to 2.2 million inhabitants (Figure 1). The city has rapidly modernized in the last decade, with recent growth and urbanization largely exceeding service capacity in the areas of electrical supply, sanitation coverage, waste collection, and potable water provision, presenting numerous implications for the spread of infectious disease across the country[7].

Using various climate change models to facilitate backward extrapolation into time, data from the World Bank Climate Change Knowledge Portal[9] indicates the following average monthly rainfall and temperature patterns for the city of Accra from 1960 to 2009. The heaviest rains are known to occur from March to June, followed by a milder rainy season from September to October (Figure 2).

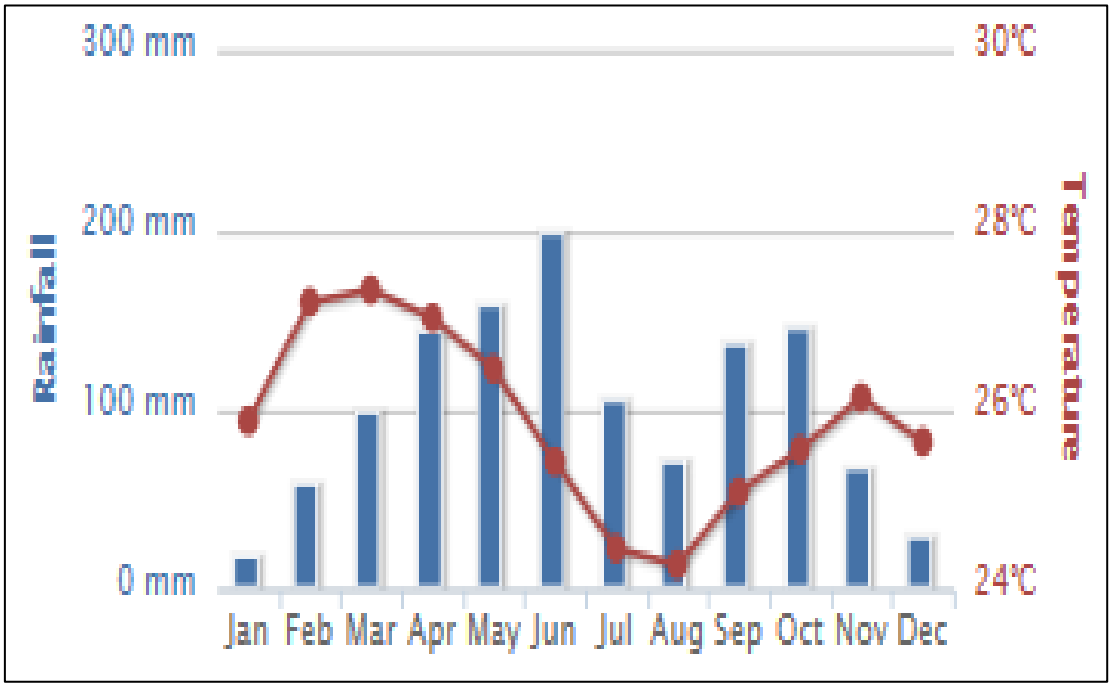

Figure 2: Average Annual Rainfall Patterns in Accra from the 1960 to 2009[9]

2. Climate and Infectious Disease Transmission

According to the Bulletin of the World Health Organization, (2000[10]), scientific evidence showed a direct influence of inter-annual and inter-decadal climate variability on the epidemiology of vector-borne diseases. A more recent article by Dr. Paul Epstein (2011[11]) highlighted the two key mechanisms by which climate change enhances the spread of infectious disease: 1) global warming expands the geographic conditions conducive to transmission of vector-borne diseases, and 2) extreme events result in the proliferation of mosquito, water and rodent-borne diseases. Epstein argued that a clear indication of the

climate-infectious disease relationship is the fact that mosquito-borne diseases are currently appearing at higher altitudes in the mountains of Africa, Asia, and Latin America. The Kenyan capital, Nairobi, which lies one mile above sea level, has, in recent times, recorded and unusually high incidence of malaria, a trend which did not occur decades ago[11]. McMicheal, et al, (2006[12]) summarizes the effects of climate change on public health as follows:

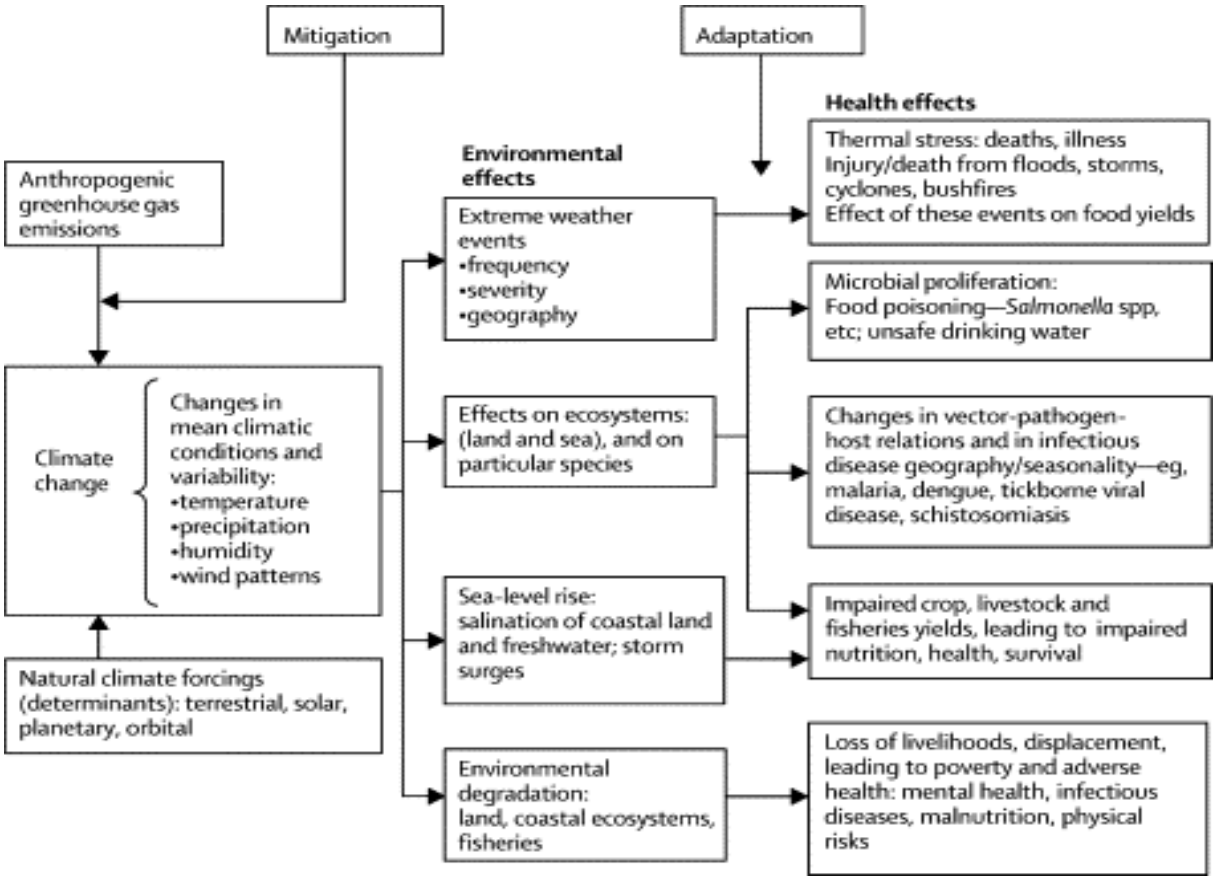

Figure 3: Pathways of Impact of Climate Change on Human Health[12]

Cholera, for example, was originally thought to be a disease purely associated with poor sanitation. While John Snow's 1854 discovery of the mode of transmission of the disease was a significant public health milestone (UCLA, 2012[13]), recent revolutionary understanding suggest that beyond poor sanitation, other factors such as the environment, hydrology, and weather patterns also come into play.

3. Climate, Floods and Disease in Ghana

To assess the relationship between climate and temporal patterns of cholera outbreak in Ghana, a 20 year time series analysis was conducted using the wavelet method across monthly cholera incidence in Ghana, proxy environmental variables, and climatic indices from 1975 to 1995. The findings highlighted the existence of an association between temporal patterns of cholera cases in Ghana at the end of the 1980s with both the global climatic index and two regional climatic parameters, namely: 1) land and sea surface temperature anomalies, and 2) rainfall (Magny, et al, 2006[14]). Current research shows that climate change plays a crucial role in the proliferation of cholera, with predictions suggesting that as temperatures continue to rise, outbreaks will become increasingly common; essentially because warmer temperatures favor microbial growth (Magny, et al, 2006).

Beyond global warming, changing rainfall patterns in the west-African sub-region also contribute to the proliferation of other infectious diseases such as malaria, diarrhea, and other potentially lethal conditions. According to Dr. Eric Laroche[15] of WHO's Health Action in Crisis Cluster: "*West Africa's annual floods bring with them not only the threat of vector-borne and communicable diseases, but it further endangers the lives of people already malnourished by the food price crisis*."

A 2006 Report[16] by Action Aid International identifies four possible types of floods likely to occur in African cities: 1) localized flooding, 2) small streams in urban areas, 3) major rivers overflow, and 4) wet season flooding. In the Ghanaian capital, Accra, due to changing precipitation patterns, ill-equipped drainage systems and increased impervious surfaces, disease-laced floods are becoming an annual occurrence. After a night of torrential rains in October 2011, the Odaw River overflowed its banks, bringing the commercial district to a

total standstill. Other significant flood events in the history of Accra were recorded in 1973, 1986, 1995, 1999, 2001, and 2002, respectively, all resulting in major property damage, and the spread of pathogens and pollution from solid waste, industrial waste, and sewage in poor slum communities (UN Habitat, 2011[17]).

While the floods are currently known to be of short duration, largely due wet season flooding and riverine overflow, with sea level rise, flooding is expected to become an even greater problem. Using satellite imagery and GIS, simple flood models have been developed to predict that possible impacts of climate change in Accra, specifically regarding damage of property and potential health effects following a 10-year 24-hour rainfall total (167.6 mm). Findings showed that those particularly vulnerable are the poorer slum residents living near the Odaw River (Figure 3).

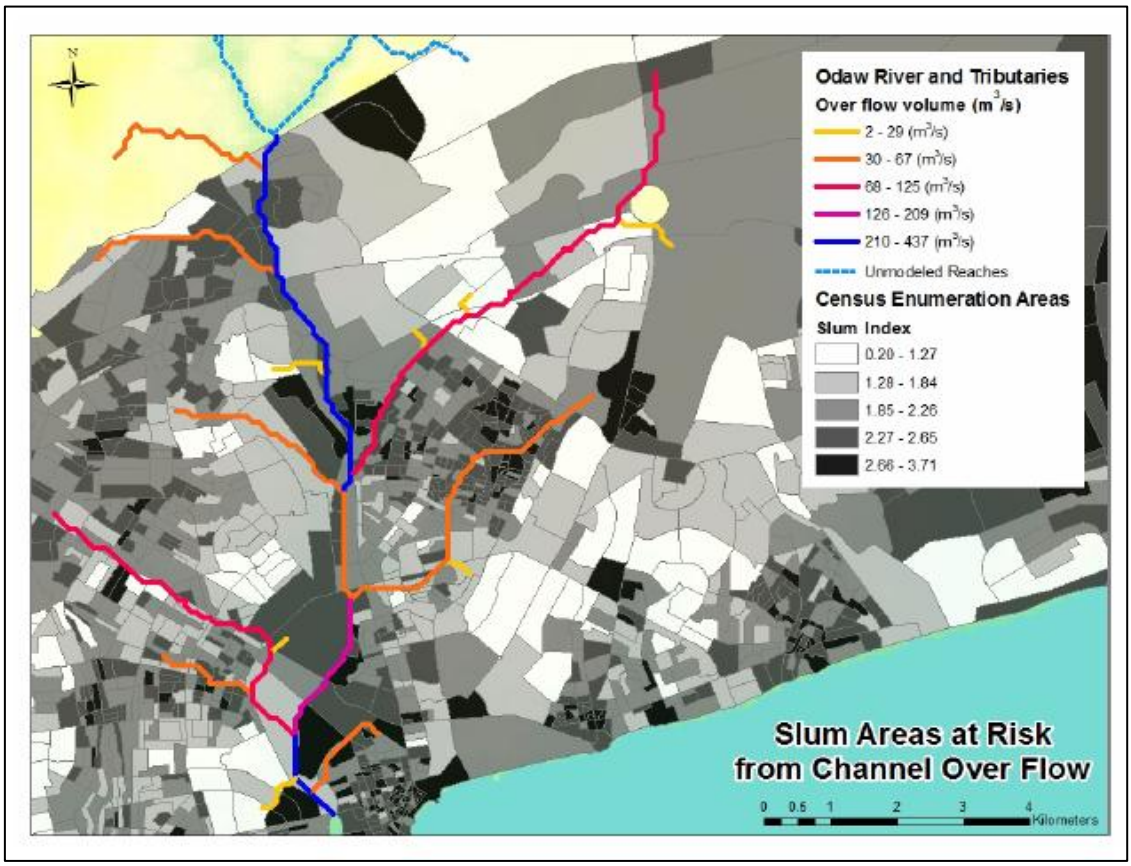

Figure 4: Slum Areas at Risk from Channel Overflow in Accra[17]

4. Tackling Climate Change in Ghana: Adaptation

Despite the many challenges, several measures have been taken towards climate change adaptation in Ghana. The formulation of a National Climate Change Adaptation Strategy (NCCAS[18]) is underway to help facilitate the reduction of climate change risks and impacts in national development planning efforts. Its strategic focus will be to enhance climate change mainstreaming into national development and create awareness on the need to build human, institutional, and financial capacity to cope with the challenges ahead. In 2011, the National Disaster Management Organization (NADMO[19]) designed a pilot project to spearhead climate change adaptation in five districts across the country. As a pre-emptive measure, vulnerable infrastructure, including houses, roads, markets, schools and hospitals located in disaster prone areas, will be relocated to safer locations to ensure effective disaster risk reduction.

Under the University of Ghana[20], research projects across thematic areas such as: agriculture and food security, water resources and management, biodiversity and ecosystems, public health, awareness and advocacy are also underway to: 1) train and develop human resources, 2) build national climate change adaptation research capacity, 3) influence policy through public awareness and targeted advocacy, and 4) disseminate knowledge and best practices in climate change adaptation. Led by the EPA of Ghana, a similar project Ghana: Capacity Development and Adaptation to Climate Change on Human Health Vulnerability[21] was conducted to develop locally appropriate adaptations to reduce projected climate change impacts, and help integrate climate change concerns into national and local health policies and measures. Over the past few years, numerous conferences and workshops have also been held across the country, bringing together local and international stakeholders, all in an effort to discuss and clearly chart the national plan of action.

5. The Liberian Scenario

As a small nation recovering from 14 years of civil conflict and now threatened by the devastating effects of a changing climate, Liberia has much to learn and borrow from Ghanaian context. However, unlike Ghana, which has attained middle income status and may be in a slightly better financial and scientific preparedness to tackle climate change, the United Nations Development Programme (UNDP[22]) cautions that Liberia's ability to adapt to climate change is limited by low economic and technical advancement. UNDP cites ill-adapted agricultural activities, unsustainable logging practices, unregulated coastal sand mining, over-dependence on biomass, inadequate infrastructure, low level of socio-economic development, low institutional capacity and inadequate meteorological and hydrological data and data gathering capability as contributing factors to climate change vulnerability within the country. Indications of climate change impacts are currently being observed in the form of reduced rainfall in some places as opposed to relative heavier rainfall along the coast, extreme coastal flooding events, soil erosion and sea level rise (Figure 5).

Figure 5: President Sirleaf Assessing Damage of Property in coastal Virginia[23]

With funding and technical support from the Global Environmental Facility and the United Nations Environment Program (UNEP), in 2008, Liberia completed its National Adaptation Programme of Action (NAPA[24]). In terms of highest priority, the NAPA proposed the following:

At the Policy Level	At the Project Level
a. Capacity building to integrate climate change in development planning, designing infrastructure, land and coastal zone management planning and institutions; b. Raising awareness by dissemination climate change and adaptation information, particularly to vulnerable communities such as farmers and costal settlements; c. Mainstreaming adaptation to climate change into policies through programs in agriculture, forestry, fisheries, energy, health, gender and meteorology/hydrology.	a. Integrated cropping/livestock farming with the objective of diversifying crop farming through the cultivation of soybeans, lowland rice and small ruminants rearing; b. Improved Monitoring of Climate Change with the objective of generating reliable hydro-meteorological data and improving the measurement of climatic parameters; c. Coastal defense systems for the cities of Buchanan and Monrovia with the objective of reducing the incidence of flood, erosion, and siltation in Monrovia and Buchanan.

Table 1: Key Recommendations of the National Adaptation Programme of Action[24]

Other crucial steps taken to date include: 1) the establishment of the National Climate Change Steering Committee with the mandate to develop a National Climate Change policy and establish a National Climate Change Secretariat; and 2) the formulation of the National Communication Strategy on inventory of Greenhouse gases. While numerous steps have been taken at the policy level, the extensive effects caused by coastal erosion in the capital, Monrovia, and other coastal cities such as Buchanan and Harper, suggest the need for further action at the project level (UNDP, 2011[22]). Borrowing from the five district pilot project designed by Ghana's National Disaster Management Organization (NADMO[19]) and contextualizing its implementation within the post-conflict setting, for example, may be one

option to help effectively ensure disaster risk reduction in the most vulnerable parts of the country.

On the way forward, National Focal Person on Climate Change in Liberia, Bejamin Karmorh recommends that: 1) climate change be mainstreamed in all national policies, programs, plans and activities, 2) institutions responsible for climate data collection and monitoring be rebuilt to create an enabling environment for climate change monitoring, 3) public awareness and sensitization sustained and 4) available human resource capacity built to enhance adaptation mitigation efforts across the country (FrontPageAfricaOnline, 2012[25]).

Conclusion

While climate change is not the only source of infectious disease proliferation along the western coast of Africa, with its implications for massive destruction of property and the creation of climate refugees, it does represent a significant threat to sub-regional development and stability. Building upon the lessons learnt from adaptive measures taken in the Ghanaian context, as well as the recommendations of the Liberia National Programme of Action, much more needs to be done at the project level to ensure disaster risk preparedness in a socio-economically and politically recovering nation like Liberia.

Moving forward, as Liberia seeks to attain middle income status by 2030, it is proposed that further dialogue be encouraged between the two nations to foster cross-fertilization and knowledge sharing. To protect future generations, more decisive action seems to be the only viable option. In the words of former UN Secretary-General and Nobel Laureat Kofi Annan, "*There is no trust more sacred than the one the world holds with children. There is no duty more important than ensuring that their rights are respected, that their welfare is protected, that their lives are free from fear and want and that they can grow up in peace.*"[26]

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