Climate change and selected reemerging diseases in West Africa

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Abstract:

With the fast growth in population and industrialization, there is now buildup of gases such as carbon dioxide, ozone and methane in the atmosphere. These gases continually trap the sun's radiation or energy, releasing them back to the earth and resulting in the continual increase in the earth's surface temperature. The increase in temperature globally, has led to the reemergence of climate change sensitive diseases such as malaria, schistosomaiasis, African trypanosomiasis and cholera in West Africa. These diseases have been projected to increase in West Africa due to the changes in climate over the past decades in this region. This report therefore focuses on climate change and selected reemerging diseases in West Africa.

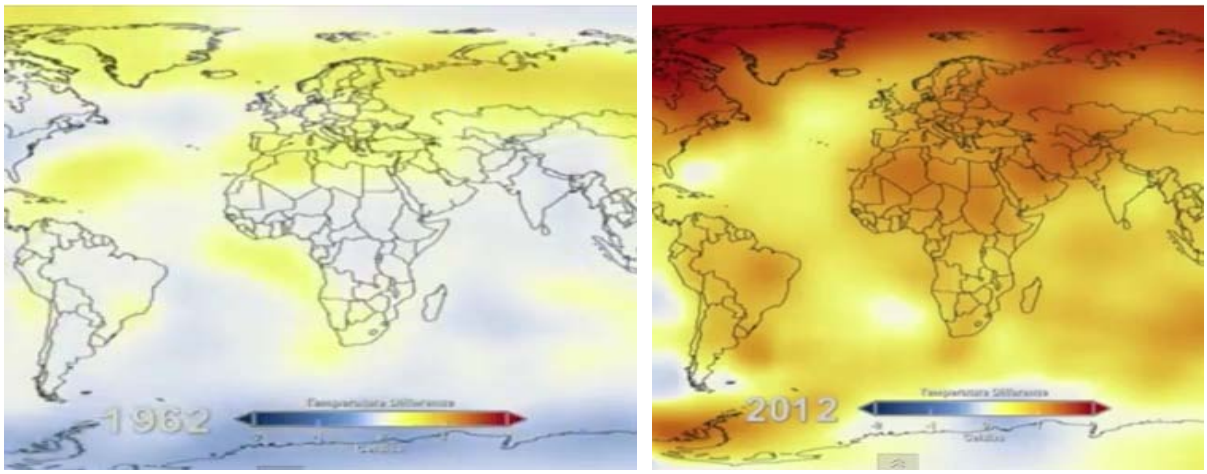
Introduction:

The earth's atmosphere and surfaces have continued to be warmed since industrialization and urbanization began, and the earth's warming trend have been attributed to anthropogenic climate change. Earth surface temperatures are expected to continue to increase and the global average temperature is projected to warm and reach values between 1.4 and 5.8 ^{0}C by the end of the current century, with land areas warming more than the oceans, while the high latitudes of the north and south are projected to warm more than the tropics (IPCC, 2002). In West Africa, there have been observed changes in the climatic conditions over the last few years. The observed climatic change is a shift of climatic zones southwards and this shift has now resulted in the spread of the Sahara desert downwards into the Sahel region (Wittig, 2007). As result of these climatic changes in West Africa over the last decades, the region may experience extreme hydrologic cycle such as flood and drought. Existing evidence from a study by Patz and co-workers indicates that the changes in climate system on a wider scale may have impact on both

humans (emergence of human diseases and mortality mainly due to heat waves and famine from crop failure) and the environment (wildfires and sea level rise) globally (Patz *et al*., 2005). Therefore, this report summarizes studies on climate impacts with focus on reemerging diseases in West Africa.

West Africa and Climate change

West Africa is the westernmost region of the continent Africa. West Africa lies within longitude 30^0 W to 20^0 E and latitude 0^0 (equator) to 30^0 N. This region of Africa is made up of fifteen (15) countries with population of over 250 million people and covers a land area in excess of five (5) million square kilometers (OHCHR, 2013). As the earth's surfaces continue to warm, climatic conditions over West Africa is expected to change dramatically. A look at the climate map of West Africa over this period (Figure 1) revealed that, the land surface temperature of this region have increase from what used to be low in 1962 to higher values in 2012. This observation is in line with the predicted land surface temperature increases as reported by the IPCC (2002).



a.1962 **b**.2012

Figure 1: Temperatures of West Africa in a. 1962 and b. 2012
Source: http://www.youtube.com/watch?v=5StFFQ236jE&NR=1&feature=endscreen

The Sahel region of West Africa is well noted for severe droughts and the notable ones were in the 70s and 80s (Nicholson, 2013). A recent review by Nicholson of studies on the rainfall pattern and its inter-annual variability in the Sahel region of West Africa found that, the magnitude of precipitation in the region have changed over the years. However, according to this report, rainfall in the Sahel region has shown some degree of recovery since the severe dry climate conditions in the 1970s and 1980s (Nicholson, 2013). Nicholson (2013) observed that, the pattern of the West Africa monsoon that links the whole of West Africa countries has been altered and for that matter throughout the region, precipitation has been generally limited to summer months (May – August), while the month of August experience the maximum amount of rainfall.

Vector-borne diseases

The dramatic changes in the pattern of temperature and precipitation of West Africa due to climate change are expected to have impact on the epidemiology of vector- and water-borne disease in this region. According to Patz and co-workers, major potential major vector- and water-borne diseases which are mostly influence by climate changes are malaria, lymphatic filariases, onchocerciasis, schistosomaiasis, African trypanosomiasis, dangue and yellow fever (Patz *et al*., 1996). With regards to current conditions in West Africa, vector-borne diseases that may be intensifying in the region are malaria, schistosomaiasis, and African trypanosomiasis.

Climate change and reemerging diseases

Reemerging diseases are diseases such as malaria, tuberculosis and cholera which were on the decline in the past but are now bound to increase in the near future due to return of favourable

conditions of which climate change cannot be left out. The direct effects of climate change on specific disease that are peculiar to West Africa are discussed below.

Malaria: Malaria is one of the most prevalent and important vector-borne disease in the World. It is cause by five *Plasmodium* parasite namely; *P. falciparum*, *P. vivax, P. ovale*, *P. malariae* and *P. knowlesi* (WHO, 2012a). According to the World Health Organization, in 2011 the global estimate of people at risk of malaria infection were 3.3 billion, and out of this figure, populations of sub-Saharan Africa countries were observed to have the highest risk of getting malaria (WHO, 2012a). Malaria transmission is mostly affected by factors such as temperature and rainfall. Higher temperatures have been found to reduce the sporogonic duration of malaria parasite and increase mosquito survival (Craig *et al.*, 1999). Craig and co-workers observed that at lower temperature values for instance 16 ^{0}C, the development of malaria parasite ceased, while at temperatures below 18 ^{0}C, transmission of malaria parasite by mosquitoes were found not to be possible because few adults' mosquitoes survived the 56 days requirement for sporogony. However, at 22 ^{0}C, parasite sporogony was likely to be completed in less than three weeks (Craig *et al.*, 1999). Also in this report, it was reported that mosquitoes breed well and mostly in turbid and stagnant water bodies formed after rainfall (Craig *et al.*, 1999). In another report by Coluzzi and co-workers, with respect to the main kinds of mosquitoes that transmit the malaria parasite to humans, it was observed that *Anopheles gambiae* mosquito preferred wet and humid regions or zones, while *Anopheles arabiensis* were seen to adapt much well in drier climate zones (Coluzzi *et al.*, 1979). In West Africa, due to the dramatic changes in the climate and the resulting increased in the average daily temperature and sporadic rainfall, favourable conditions for mosquitoes will prevail, promoting the reproduction and development of mosquitoes, hence malaria cases in this region is expected to rise. In a recent malaria report by the World Health

Organization in 2012, West Africa countries were seen dominating the list of countries with the highest number of malaria reported cases and deaths from malaria (Figure 2) reflecting the effect of climate change in this region. Predictions by Rogers and Randolph based on biological transmission models driven primarily by temperature; put West Africa among major regions of the world at greater risk of the spread of malaria caused by *P. falciparum* by the year 2050 if climatic conditions do not return to expected (Rogers and Randolph, 2000).

Schistosomiasis: Schistosomiasis is another vector-borne disease caused by flat worms of the genus *Schistosomia* namely *S. mansoni, S. haematobium and S. japanicum*. The prevalence of the disease has increased primarily in arid warm regions of the globe as result of the construction of dams across rivers or lakes for irrigation purposes due to the unpredicted pattern of rainfall from climate changes (Patz *et al*., 1996). Irrigation expansion systems serve as breeding place for water snails, the intermediate host for the parasite *Schistosomia*, that have been established to cause the disease schistosomiasis globally. Temperature and rainfall may play a role in the development and transmission of *Schistosomia* parasite. Warmer temperatures as a result of climate change have been found to influence the development of the *Schistosomia* parasite within the freshwater snail and the rate of cercarial infestation in human (Patz *et al*., 1996). West Africa is an arid warm region; hence the possibility of schistosomiasis spreading and becoming a problem for this region as temperature increases pretty much likely according to reports or evidence from literature. In Senegal along the Senegal River delta, it was observed by Ernould and Sellin that, *Biomphalaria pfeifferi* snails were responsible for transmitting *Schistosomia mansoni* parasite during the wet or rainy season, while in the dry season the freshwater snail *Bulimus globosus* was responsible for transmitting *Schistosomia haematobium* parasite (Ernould and Sellin, 1999). Not quit recently, parasitological surveys conducted by Clements and co-

workers in selected West Africa countries namely; Burkina Faso, Mali, and Niger over the period 2004 to 2006, found amazing clusters of schistosomiasis infestations at 418 surveyed locations in these countries (Clement *et al*., 2008). Also, reported work by Laden and co-workers recently, found an overwhelming prevalence of schistosomiasis in one of the 36 federal states of Nigeria. The study was on urinary schistosomiasis in five villages around the Gusau Dam in Zamfara state in Nigeria. They found 47% overall prevalence of urinary schistosomiasis with mean egg count for the study area to be 23.8 eggs ml^{-1} of urine (Ladan *et al*., 2013). With these astonishing observations reported so far, if temperatures continue to increase in the future, West Africa may have a major share of the predicted additional five million schistosomiasis cases attributed to climate change by the year 2050 as modeled by Martens (1995).

African trypanosomiasis: African trypanosomiasis also known as sleeping sickness is caused by protozoan species of the genus *Trypanosoma* and spread by tsetse flies. The *Trypanosoma brucei*, is the main parasite for African trypanosomiasis and consist of two commonly sub-species namely; *T. brucei gambiense* and *T. brucei rhodesiense*. Tsetse flies are much abundant in West Africa and their distribution in this region may depend mainly on the vegetation cover. According to the World Health Organization fact sheet N°259 which was made available online in October 2012, sleeping sickness was endemic in only 36 sub-Saharan Africa countries, and in this report, *T. brucei gambiense* was observed to be responsible for 95% of the reported cases of the disease in the sub-region (WHO, 2012b). Again, information from the recent report by the World Health Organization on the Human African Trypanosomiasis (HAT) control and surveillance programme organized between the years 2000 – 2009 indicate that, out of the 36 endemic countries, thirteen of those countries were from West Africa. These countries are Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Nigeria, Senegal,

Sierra Leone and Togo (Simarro *et al*., 2011). These endemic countries received WHO and NGOs assistance for HAT surveillance and establishment of control activities, while Gambia and Niger which are listed as endemic countries received no funding, because no cases were reported in the last 20 years in these countries (Simarro *et al*., 2011). This staggering piece of information by the WHO shows that with the exception of Mauritania, all countries of West Africa are considered as endemic when it comes to HAT disease. Researchers working on Africa trypanosomiasis in the sub-Saharan Africa have predicted that, there would be changes in the risk and the spread of the disease in the region. According to McDermott and co-workers, by the year 2050, semi-arid and sub-humid zones of West Africa will see a decline in the spread of Africa trypanosomiasis particularly due to drier climate conditions, while the disease situation in the humid region of western Africa will be less changed because tsetse fly is found mainly in hot and humid conditions (McDermott *et al.*, 2002).

Conclusion and remarks

So far, from evidence presented, it is obvious that changes in climatic conditions over West Africa may have astounding impact on the rate of spread and the human risk to reemerging diseases such as malaria, schistosomiasis and African trypanosomiasis in the region. To curb the nuisances of the reemerging diseases in West Africa, the current surveillance and preventive measures or strategies underway in this region through the help of the WHO and some NGOs should be intensified. Public awareness and education on eradicating the aforementioned diseases should be promoted. Also further studies on other adverse consequences of climate change such as impart on air quality, land ecosystems and agriculture, marine and freshwater ecosystems is important and therefore needed.

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Figure 2: Cumulative proportion of the global estimated cases and deaths accounted for by the countries with the highest number of a. cases and b. death. **Source:** WHO (2012a). World malaria report 2012. http://www.who.int/malaria/publications/world_malaria_report_2012/wmr2012_no_profiles .pdf