CRACKING THE CLIMATE CHANGE CODE: THE SUB-SAHARAN AFRICA REVOLUTION

Prof. Leonard K. Amekudzi
Thursday, August 3, 2023, KNUST

What is the Issue?

Climate change is a significant and urgent issue that people in sub-Saharan Africa should be concerned about for two main reasons. Firstly, climate change has far-reaching and detrimental impacts on the environment, food and water security, human health, economy, conflicts and migration in this sub-region. Secondly, the sub-region has limited mitigation and adaptive capacity due to limited technological capacity and resources.

However, Climate change is causing more frequent and severe natural disasters, disrupting the ecosystem and biodiversity. These changes negatively affect plants and animal species, threatening their survival and causing ecosystem imbalances. Climate change is disrupting agricultural systems due to lower crop yields, reduced food production, and food shortages in certain regions, affecting food security. Rainfall patterns are becoming erratic, affecting water availability and accessibility for domestic and industrial use and agriculture. Climate change is causing a rise in heat waves, air pollution, and the spread of vector-borne diseases, causing significant human health risks.
Vulnerable populations, such as older people, children, and those in low-income communities, are particularly at risk.

Climate-induced migration intensifies as climate change intensifies, as people are forced to leave their homes due to environmental challenges such as sea-level rise or drought.This displacement is causing tensions, conflicts, and an increased burden on infrastructure and resources in host regions. Extreme weather events and natural disasters are causing significant financial losses, infrastructure damage, and emergency response and recovery costs, straining national and global economies. Addressing these issues requires concerted efforts from individuals, governments, businesses, and international organisations

What did we do?

Given sub-Saharan Africa's vulnerability to climate change, we aim to crack the code. That is - understanding the intricate interplay between the climate system and our world's natural, social and cultural, especially in sub-Saharan Africa. We focused on four broad areas, namely 1) the impact of climate change on vector-borne diseases transmission, especially malaria, 2) the impact of anthropogenic activities on our landscapes and microclimate, 3) the Provision of climate service information and 4) building human capacity to combat climate change. Ultimately to inform policy action towards building resilience through appropriate adaptation and mitigation strategies to safeguard livelihoods and promote sustainable development in the face of climate change challenges.

Key Messages

1. **Malaria is weather- and climate-driven. Weather and climate information should be operationally included in malaria surveillnce as in the case of VECTRI model.**
2. **Human activities in SSA, for example, Ghana, have altered the climate system. Urgent policy action needed through climate science research**
3. **Providing climate information is crucial for outdoor activities in the face of climate change and climate variability.**
4. **Investing in capacity building in Climate Science will build a critical mass for tackling climate change challenges.**

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WHAT DID WE LEARN?

MALARIA IS WEATHER- AND CLIMATE-DRIVEN.

Malaria transmission and prevalence are significantly influenced by weather and climate conditions such as temperature, rainfall, humidity, wind, altitude, floods, droughts, and seasonal changes. These weather elements play a crucial role in the life cycle of both the mosquito and the malaria parasite, affecting their abundance and activity. Depending on the conditions of these factors in a particular geographical location, malaria transmission could be high or low. As climate changes, the geographical distribution of malaria also changes, either by expanding malaria transmission range to new areas or changing the intensity and timing of transmission.

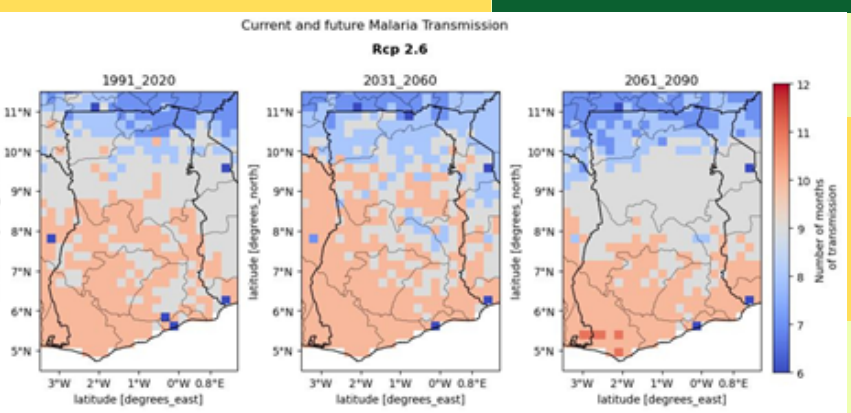

Fig. 1. Number of months of malaria transmission across Ghana at different climate periods

Human activities in Ghana, such as deforestation, uncontrolled urbanisation, unsustainable agriculture, mining and bush burning, have altered Ghana's climate. These activities are reducing the earth's capacity to act as a carbon sink and causing rising temperatures, frequent and intense extreme weather events, air and water pollution, shifts in rainfall patterns, and loss of biodiversity in the country. For instance, the Owabi watershed is distressed, and its potential to provide accessible and quality water is seriously threatened and unsustainable.

HUMAN-INDUCED CLIMATE CHANGE:

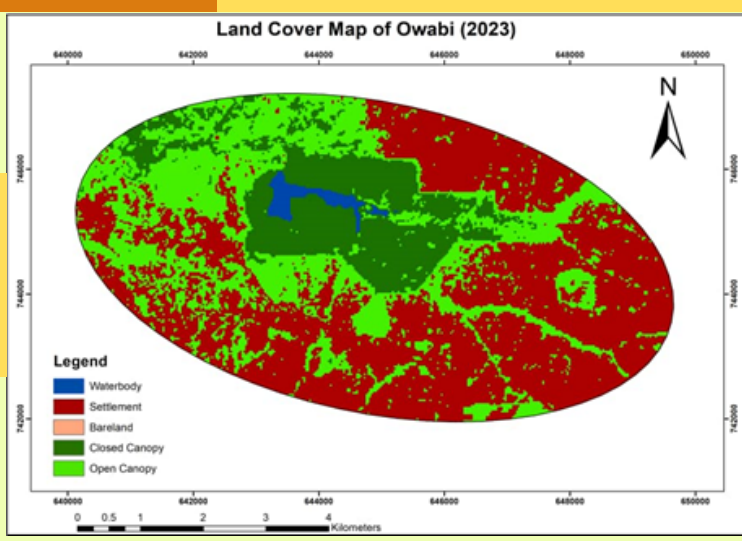

Fig. 2. Land cover changes map of Owabi

WHAT DID WE LEARN?

PROVISION OF CLIMATE SERVICE INFORMATION

Climate service information involves collecting, analysing, interpreting, and disseminating climate-related data and knowledge to support decision-making, planning, and adaptation to climate variability and change. With weather prediction technologies and early warnings, we could be aware of the undesired impact of weather and climate. We developed technologies and early warning services that provide essential climate information for climate risk management, disaster preparedness and response, policy formulations and research and innovations. For instance, the table below shows rainfall season onset and cessation dates in some selected areas across Ghana. This information is crucial for farmers, insurance companies, and other stakeholders to enhance their ability to tackle the challenges of a changing climate and work towards a more sustainable future.

Location	Onset date	Cessation date
Wa	> 20th April	< 2nd October
Navrongo	> 5th May	< 22nd September
Yendi	> 20th April	< 2nd October
Tamale	> 20th April	< 2nd October
Sunyani	> 16th March	< 22nd October
Kumasi	> 11th March	< 27 October
Ho	> 11th March	< 27 October
Accra	> 21st March	< 27 October
Takoradi	> 21st March	< 6th November
Axim	> 21st March	< 16th November

Table 1 : Rainfall onset and cessation dates from selected synoptic stations

The human resource with the expertise to provide critical insights into the causes and consequences of climate change are limited in sub-Saharan Africa. For this reason, in collaboration with the Ghana Meteorological Agency, KNUST started the Meteorology and Climate Science Programme, formerly run along the physics programme at KNUST and now a department, to build capacity in this field. The two institutions have collaborated with international bodies to run summer schools and training workshops to grow change agents with expertise and knowledge in meteorology and climate science. These experts are crucial for accurately predicting weather patterns, extreme events, and long-term climate trends, which helps make informed decisions and prepare for potential climate impacts.

CAPACITY BUILDING

Fig.3. Building the capacity of the next generation in meteorology and climate science.

STORIES OF CHANGE

Combating Malaria in Sub-Saharan Africa.

We contributed to developing a weather-driven dynamical malaria model called VECTRI for early detection and response. Our early warning tool provides seasonal malaria cases forecast. The VECTRI model has been used in some SSA and other countries for malaria case intervention and control. The model has helped identify critical areas where test kits and mosquito nets are needed.

Impact-based weather information:

KNUST and Ghana Meteorological Agency collaboration has yielded impact-based weather forecasts for farmers and fishermen. The users have testified that the forecast information is good and beneficial for their daily activities.

Capacity building:

The Department of Meteorology and Climate Science, in collaboration with the Ghana Meteorological Agency, has trained a critical mass of the next generation of experts in this field to help mitigate climate change in the sub-region.

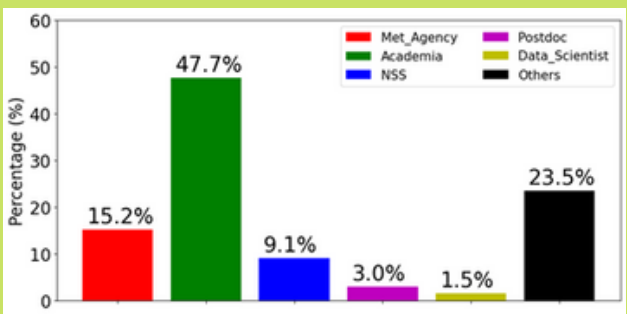

Fig. 4: Employment Portfolios of Prof. Amekudzi's Mentee Network

POLICY IMPLICATIONS

The following are some key policy areas and implications:

Malaria control: The VECTRI malaria model should be adapted to the National Control Programme for malaria surveillance and control.

Reforestation and Conservation: Policies promoting reforestation and forest conservation can help sequester atmospheric carbon dioxide. Governments can implement incentives for afforestation, support sustainable forestry practices, and protect existing forests to enhance carbon sinks.

Sustainable Agriculture: Policies on agricultural activities that have detrimental effects on the soil, water, biodiversity, and overall ecosystem health are critical.

Public Awareness and Education: Policies promoting public awareness and education on climate change will foster a better understanding of the issue and encourage individual actions to reduce emissions and support climate-friendly initiatives.

Ghana Meteorological Agency, over the years, has provided observational weather stations across the country. However, the density of the network of these stations has to be improved. Therefore, the Government should adequately resource and empower GMet to expand their observational network to continue collecting, interpreting and archiving reliable climate data for climate impact studies and early warning operations.

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WHAT'S NEXT?

CONCERT Project:

The primary objective of CONCERT is to provide an emission inventory of greenhouse gases such as carbon dioxide, methane and nitrous oxide while providing information on soil moisture and nutrients and soil carbon under responsible land management practises towards improving food security.

The FURIFLOOD project:

The FURIFLOOD project, on the other hand, is a project on the current and future quantification of extreme rainfall and Flood risk in West Africa. It focuses on rural and urban flooding to underpin science-based decision-making.

The malaria modelling team in the Department of Meteorology and Climate Science, in collaboration with the Vector-borne Disease Research Group in the Department of Theoretical and Applied Biology, to provide seasonal and sub-seasonal climate-based malaria forecasts for current and future climate scenarios.

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NEED MORE INFORATION?

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