



**unitar**

United Nations Institute for Training and Research

**ACCCA**

Advancing Capacity to Support Climate Change Adaptation



## **FINAL REPORT FOR THE ACCCA PILOT ACTION**

***"Capacity Development and Adaptation to Climate Change on Human Health***

***Vulnerability in Ghana***

**Geographic focus of the project:** Ghana, Ashanti and Northern Regions

**Targeted sector or system of the project:** Vulnerable groups in Urban, Peri-urban and Rural poor communities

**Targeted decision makers/actors:** The following stakeholders and beneficiaries have been identified:

- Ministry of Health(MOH)
- Ghana Health Service(GHS)
- District Health Officers
- Traditional and Community Leaders
- District Chief Executives(DCE's)
- Ministry of Environment and Science (MES),
- Environmental Protection Agency (EPA),
- Ministry of Food and Agriculture (MOFA),
- Ministry of Fisheries (MF),
- National Disaster Management Organization(NADMO)
- Environmental Application and Technology Centre (ENAPT Centre)
- Carter Centre for the Control of Guinea Worm Infestation in Ghana
- Universities and Research Institutions
- Traditional Rulers
- Community and Opinion Leaders
- Rural Folks

## I. Purpose of Project

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The purpose of the project was to develop locally-appropriate and time-sustainable capacity as necessary to undertake pre-disaster socioeconomic, technical prevention and adaptation options available to reduce the potential adverse impacts of climate change on human health vulnerability in Ghana. The intersection of present vulnerability and the prospect of climate change and its impact on human health in Ghana warranted a proactive action to reduce the risk of large-scale, adverse effects. The project among other things sought to create a platform for social and collective learning process between communities, researchers, medical practitioners and policymakers to better understand the linkages between climate variability and/or change on one hand and human health on the other. Using human health as the main focus, the project identified the synergistic linkages between climate change and development priorities to ensure mainstreaming of climate change adaptation into district and national health policies, plans and programmes.

## II. Methods

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Risk communication was effected through community-based **participatory approach** by the bottom-up approaches between actor/sector involvements

Other tools that were be employed during the project implementation included:

**(a) Mapping Disease in time and space and Scenario analysis:**

Observed time series data of monthly disease outpatient morbidity data was obtained from Regional Health Directorates. Using, Climate variables (mean air temperature, rainfall) data we estimated the proportion of Guinea-worm and Malaria incidence attributable to climate change in selected endemic area in Ghana. Spatial analyst was used to assess hotspots of guinea worm infestation in the study area. The assessment was based on the number of guinea worm infestation recorded in each district in 2007. Each district was assigned a risk factor based on the number of guinea worm infestation. The district was reclassified into composite maps for high, medium and low risk of guinea worm infestation based on their spatial distribution. Incidence of malaria and guinea worm infestation were studied through historical data using regression and comparative analyses. Changes in rainfall and temperature patterns were compared with malaria and guinea worm. Scenarios of malaria incidence and guinea worm infestation were also generated under “business as usual” and policy intervention for 2050. Group participatory and community-based interactive workshops were organized to build relevant capacity to mitigate the impact of climate change

**(b) Epidemiology survey** was carried out using the Seasonal Pattern Assessment Questionnaire. Baseline data records on disease incidence at different seasonal periods at various health centers as well as retrospective analysis of total hospital cases (Admissions, Mortality and OPD) over different time periods was carried out. This relationship was applied using risk assessment method to estimate the population at risk (Bruzzi et al., 1985).

### III. Activities

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The process of planning adaptive strategies helped to identify a systematic evaluation of priorities and constraints, and the involvement of stakeholders at the community level to link local actions to global concerns. The project also helped to identify current and future climate change experiences of human health and response mechanisms in the target areas studied and this helped to prioritize options for adaptations to guinea-worm and malaria control. The project identified good practices at the local and community levels in relation to climate change health impacts for dissemination. It also considered policy options for adaptations by stakeholders. The various methods employed enabled the project to engage relevant stakeholders to buy-in for effective future implementation. Some of the activities employed included the following;

1. Building institutional and systemic capacities, for planning, prevention and control, preparedness and management of disease epidemics relating to climate change, including contingency planning, especially for droughts (heat stresses) and floods in areas prone to extreme weather events.
2. Investigation of vector-disease monitoring and surveillance in relationship to early-warning systems for effective disease control and prevention at studied localities.
3. Adoption of innovative local coping resilient adaptations to mitigate disease burden associated with climate change and variability in studied areas
4. Multi-stakeholder participatory forum and workshops to elaborate on the impacts of climate change on national health systems. Systematic evaluation of priorities and constraints at local and community levels to promote and link local actions to global concerns.
5. Building of local capacity through training-of trainers' workshops for the implementation of the concept of strategy switching and sustainable livelihood as a means of promoting increased resilience of local communities to climate change through training and social learning to encourage their participation in development of policies for socio-economic and environmental progress.
6. Leading various community and local actions to mainstream climate change adaptation and coping strategies into district and national policy-making process for health delivery systems in Ghana.

**To ensure effective implementation of the above listed activities a number of strategies were adopted.** These included;

- Implementation of pilot activities in the two districts Tamale and Mampong in, Northern and Ashanti regions respectively to facilitate the implementation, dissemination and use of the outcomes of the project with the view of mainstreaming of human health adaptation strategies at the district level.
- Community participation and stakeholder engagement
- Identification, through investigations of the bio-physical and socio-cultural-economic environment, a range of methods by which Ghana may improve its

capacity to respond effectively, efficiently and sustainably to future climate change impacts on human health.

- Providing an in-depth study, assessment and analysis, including cost estimates of in-action and ancillary benefits) (adaptation cost curves) and sensitivity analysis of technical and policy options for the consequences of climate change on human health.
- Developing a prioritized adaptation options.
- Incorporating experience gained from the critical examination of present climate-related problems in the design of appropriate responses to anticipated but as yet unquantifiable, future climate change by formulating appropriate human health related climate change adaptation policies.
- Incorporating transferable models of good practice in response to present climate change related human health risks and hazards.
- Involving a wide range of stakeholders from governmental institutions and civil society in these investigations to ensure that appropriate responses involved the whole of society.
- Raising of awareness of the threat of climate change to human health among policy-makers, the private sector and civil society, and including the cost of adaptation
- Disseminating findings at the national forum (using TV TM radio stations for the adoption of the Integrated National Climate Change Adaptation Policy Framework.

## **A. Project Briefing**

Guinea worm disease in the country was on the verge of being eradicated but a sudden upsurge in 2006 has left the Government of Ghana, Ghanaians, donor community and other stakeholders at loss as to how this could happen. The Northern Region is the hardest hit as far as Guinea worm cases are concerned and frantic efforts are being made to eradicate the disease which is afflicting the people. In January, 2007, the number of cases in the Region increased from January 2003 figure of 723 to 962 cases. Even though, by December 2007, the number of cases dropped to 68 the sudden upsurge of the disease that made Ghana second to Sudan in the number of cases the world over, can be attributed to interplay of so many factors. Inadequate supply of wholesome water, drying up of boreholes during the dry Season, climatic change, conflict among the people, inaccurate data on cases among other factors.

It is in the light of this that Dr Francis Agyemang-Yeboah, Head of the Molecular Medicine Department, School of Medical Science, Kwame Nkrumah University of Science and Technology and the Principal investigator to a UNITAR/ACCCA Pilot project "*Capacity Development and Adaptation to Climate Change on Human Health Vulnerability in Ghana*" led a team of researchers to the Northern Region to find out the extent to which climatic change in that part of the country has brought about the increased cases of the disease and to find ways and means of building capacity through community based integrated approach.

The **specific objectives** of the project include among others;

- a) Investigation of the impacts of climate variability and change on human health vulnerability in malaria and Guinea worm infestation among vulnerable groups in urban, peri-urban and rural poor communities in the Ashanti and Northern regions of Ghana.
- b) Identification and description of human health adaptation strategies and policies to reduce climate-sensitive disease burden (Malaria and Guinea worm infection) in Ghana
- c) To promote pre-disaster planning as a basic component of adaptation needed to help cope with and respond to climate change and variability in relationship to human health
- d) Development of communication of best practices in climate change and human health-related risk responses at the community and national levels.
- e) Development and adoption of educational and social marketing strategies to ensure that population at risk to climate change health-related diseases have the

To achieve these, about 200 hundred households with a mean count of 20 people were interviewed in a cross-sectional survey in 3 endemic areas in Northern Ghana.

## **B. Background**

The Northern Region is predominantly agrarian and the fact that their agriculture was rain-fed prompted the construction of dams. The dams which were primarily supposed to help farmers cultivate crops all year round, and become the main source of water for domestic purposes during the dry season. This is because the boreholes which provide safe water for drinking and other domestic purposes often dry up during the dry season. As a result, people will have to walk long distances to look for water and in some instances compete with livestock which also need water for survival. Since the animals have no troughs to drink from, they drink from the dams and other water bodies while people also fetch it for their domestic use.

Some people migrate from their places of sojourning to settle at where there is water. With the pressure on the few available water sources during the dry season, people infected with Guinea worm contaminate the dams and dug out water holes causing the infection rate to increase. So in a nutshell, once a water source is created, it invites people from other places to move in and they move in with Guinea worm with the peak season of the disease being the Dry Season. An exceptional case is however found with Libga Village in the Savelugu–Nanton District where boreholes never dry and has never recorded a single guinea worm case. The village has a big dam which never dries but its residents do not drink from the dam. Surrounding villages which have their dams and boreholes dried up use trucks and tractors to fetch water from the Libga Dam.

Conflicts in the Northern Region have also contributed to the upsurge of the disease and specific mention can be made of Dagbon crisis and the Konkomba-Nanumba conflict. Conflicts bring about dispersal of people and make supervision by guinea worm officials and volunteers very difficult thereby culminating in under-reporting of cases for subsequent action to be taken.

### **C. Climate change and guinea-worm infection**

The issue of guinea-worm cannot be ruled out since the disease is water-borne. The longer dry season being experienced in the northern part of the country of late implies scarcity of water for most part of the year. The scarcity of water calls for convergence of people to share water and also share water-borne diseases like Guinea worm. This is in the face of rainwater harvest not practiced in the area and the dams, dug out wells and boreholes continue to be the main source of water supply. This is because Water supply to Tamale and surrounding communities is about fifty percent (50%) of the water needs of the residents with potable water not exceeding forty percent (40%).

In order to solve the Guinea worm problem, the Regional Administration is implementing the policy of separating urban water supply from rural water supply. The former is being handled by Ghana Water Company Limited which provides the urban areas with pipe-borne water while the latter is handled by Community Water and Sanitation Agency that drill mechanized boreholes. Guided by the principle of “Eliminate diseases and there will be economic boom”, a number of stakeholders, viz; Ghana Health Service, Carter Centre,

WHO, UNICEF, JICA, and Red Cross Society have also joined hands in a collaborative effort to eradicate guinea worm in the next ten years.

Water Inventory System, a system that ensures that, not only boreholes are provided but to find out what is the best system has been adopted. This emanates from the fact that, some local people think boreholes do not give tasty water and as such prefer to drink water from the dams which may be contaminated by guinea worm-causing organisms.

Abating of dam water which involves using chemicals to make dam water wholesome for drinking has been another way to fight the disease. To be able to abate a water body the conditions required are that, it should be measurable by volume using depth markers which conforms to international standards and the water should be stagnant. In this case, the dams should be consistently abated every twenty-eight (28) days. Volunteers drawn from the communities play a role in the abating because it ensures community ownership while the district guinea worm eradication team offers technical support. *Typhae spp*, water lily and other water plants normally cover the water, making the abating difficult but slow down the drying of the dams. A problem however, exists with the Libga Dam which is too big to be abated. Floating Filters have been recommended for such big dams.

**Soka Pumps** fitted with filters have been put in the various dams to prevent the people from walking in the water in order not to contaminate it. Reverse Osmosis Machine in recent floods was brought by the Ghana Armed Forces to help pump water to where needed but was sent back since the Assembly could not afford the cost of its installation.

**Video shows and musical concerts** have also been adopted in the campaign against the spread of the disease. Artistes normally used in the campaign include Sheriffa Gunu, Sheriff Galey and Lord Wompeney, all local musicians.

**Rain water harvest** has been recommended and architects are supposed to be tasked to make the basement every house to be served with a water tank.

At the Savelugu Case Containment Centre, which houses those infected with guinea worm for treatment, adults do not normally stay but go back to their farms. **Rumor Registers** is a method used to identify and report cases to the health personnel. And with this, any school child who identifies a case and reports to his or her teacher is given a school bag.

### **Data analysis and results**

Knowledge scores (percent correct of the knowledge outcome) for both Climate Change and Guinea worm were constructed. The knowledge score for Climate Change composed of three question items namely: *Knowledge about Climate Change; basic definition of Climate Change; and how the effects of Climate Change can be minimized.* Questions relating to of Guinea Worm Infection and Climate Change were: *Knowledge about Guinea Worm Infection; causes of Guinea worm Infection; and prevention of guinea worm Infection.* To assess the distribution of scores among subgroup, the mean scores were computed for each category of key demographic characteristics of the participants in the community. Data was analyzed using Stata 10 for Windows (College Station, Texas).

**Table 1: Demographic Characteristics of participants in the community**

<b>Characteristics</b>	<b>Frequency (%) or mean (sd)</b>
<i>Age (Years)</i>	45 (15)
<i>Sex</i>	<i>n<sup>a</sup>=197</i>
Male	145 (73.6)
Female	52 (26.4)
<i>Ethnicity</i>	<i>n<sup>a</sup>=198</i>
Akan	1 (0.5)
Dagomba	197 (99.5)
<i>Religion</i>	<i>n<sup>a</sup>=201</i>
Christian	5 (2.5)
Moslem	182 (90.5)
Traditionalist	14 (7.0)
<i>Marital Status</i>	<i>n=202</i>
Single	7 (3.5)
Married	184 (91.0)
Divorced/Separated	3 (1.5)
Widowed	8 (4.0)
Co-habiting/Consensual union	0 (0.0)
<i>Educational Level</i>	<i>n<sup>a</sup>=199</i>
Never been to school	165 (83.0)
Primary	11 (5.5)
Secondary/Vocational	18 (9.0)
Tertiary	5 (2.5)
<i>Have a Vocation?</i>	<i>n<sup>a</sup>=191</i>
Yes	162 (84.8)
No	29 (15.2)
<i>Occupation</i>	<i>n<sup>a</sup>=149</i>
Farmers	18 (12.1)
Civil Servants	16 (10.7)
Others	115 (77.2)

<sup>a</sup> *Denomenators less than 202 means those observations were missing*



**Table 2: Knowledge about climate change**

Attributes	Frequency (%) <sup>b</sup>
<b>Heard about climate change?</b>	
<i>n</i> =202	
Yes	170 (84.2)
No	32 (15.8)
<b>Source of Knowledge</b>	
<i>n</i> <sup>a</sup> =170	
Television	15 (8.8)
Radio	132 (77.7)
Friends/Relatives	37 (21.8)
School	9 (5.3)
<b>Definition of climate change</b>	
<i>n</i> =202	
The difficult economic situation imposed by politicians	7 (3.5)
Changes in weather in Ghana	127 (62.9)
Less money in our pocket	43 (21.3)
Increases in the average global temperature due to man's activities	43 (21.3)

<sup>a</sup> Denominators less than 202 means those observations were missing

<sup>b</sup>Percent totally exceed 100% because of multiple responses

**Table 4 Knowledge about diseases likely to be affected by climate change (n=202)**

Diseases	Frequency (%) <sup>b</sup>
Malaria	110 (54.5)
Guinea worm	133 (65.8)
Epilepsy	15 (7.4)
Diarrhoeal diseases	36 (17.8)
Tuberculosis	12 (5.9)
CSM	29 (14.4)

<sup>b</sup>Percent totally exceed 100% because of multiple responses

**Table 5: Knowledge about mitigation/adaptation of climate change**

<b>Mitigation/Adaptation</b>	<b>Frequency (%)<sup>b</sup></b>
<i>Can effects of climate change be minimised?</i>	<i>n<sup>a</sup>=187</i>
Yes	152 (81.3)
No	35 (18.7)
<i>Some Mitigation/Adaptation heard about</i>	<i>n<sup>a</sup>=152</i>
Minimising green gas emissions of countries	62 (40.8)
Sequestration/mopping up of green gas	77 (50.7)
Having a disaster preparedness plan	10 (6.6)
Irrigation	12 (7.9)
Strengthening disease control and surveillance of implicated diseases	26 (17.1)
Improving food storage facilities	3 (2.0)
Improved health care	24 (15.8)
Planning to divert into different areas of agriculture	13 (8.6)
<i>Community action for mitigating climate change</i>	<i>n=202</i>
Reforestation immediately after harvesting	68 (33.7)
Productive forest cover	24 (11.9)
Adding chemical amendments to boost fertility	26 (12.9)
Reducing shifting cultivation	19 (9.4)
Reforestation marginal agriculture lands	30 (14.9)
Retaining debris/litter after logging operations	6 (3.0)
Shifting species	4 (2.0)
Replacing drought sensitive species	4 (2.0)
Substituting wood fuels for fossil fuels	5 (2.5)
Increasing protection measures against insects/pest invasion	4 (2.0)
increasing fire protection measures	116 (57.4)

<sup>a</sup> *Denominators less than 202 means those observations were missing*

<sup>b</sup> *Percent totally exceed 100% because of multiple responses*

Table 7: Knowledge about prevention of and action taken on Guinea worm

Attitudes/Practices	Frequency (%) <sup>b</sup>
<i>Individual Preventive measures</i>	<i>n</i> =202
Boil drinking water	49 (24.3)
Filter drinking water	182 (90.1)
Add a few herbs to your drinking water	0 (0.0)
Pray over water	2 (1.0)
<i>Community preventive measures</i>	<i>n</i> <sup>a</sup> =144
Communal labour to build bore-holes	25 (17.4)
Communal labour to clear bushes/vegetation	8 (5.6)
Educate children and other community members on Guinea worm prevention	111 (77.0)
<i>Action taken on Guinea worm infection</i>	<i>n</i> <sup>a</sup> =129
Take the person to the hospital	127 (98.5)
Take to the traditionalist/herbalist	1 (0.8)
Take to the mosque to be prayed for	1 (0.8)
Take to the church to be prayed for	0 (0.0)
Take the person to the chemist/pharmacist	0 (0.0)

<sup>a</sup> Denominators less than 202 means those observations were missing

<sup>b</sup>Percent totally exceed 100% because of multiple responses

Table 8: Agriculture /Food security

Attributes	Frequency (%)
<i>Change in agricultural production?</i>	<i>n</i> <sup>a</sup> =176
Yes	151 (85.8)
No	25 (14.2)
<i>Do farmers use fertilizers?</i>	<i>n</i> <sup>a</sup> =192
Yes	144 (75.0)
No	48 (25.0)
<i>Engaged in mechanised farming?</i>	<i>n</i> <sup>a</sup> =197
Yes	133 (67.5)
No	64 (32.5)

<sup>a</sup> Denominators less than 202 means those observations were missing

Table 9: Assistance received from Government and other groups	
Attributes	Frequency (%)
<i>Kind of support</i>	<i>n<sup>a</sup>=107</i>
Financial	15 (14.0)
Education on improving farming techniques	84 (78.5)
Input (fertilizers, feeds)	8 (7.5)
<i>Source of support</i>	<i>n<sup>a</sup>=91</i>
Government at the community level	10 (11.0)
Government at the district level	34 (37.4)
Government at the regional level	0 (0.0)
NGOs	47 (51.7)
<i><sup>a</sup> Denominators less than 202 means those observations were missing</i>	

## **Findings of the study**

### **Knowledge about climate change**

#### **(i) Knowledge about Climate Change;**

From the data it could be observed that, out of the sample of 202 respondents, 84.2% have ever heard of climate change with 15.2% who had never heard about it.

This implies that, there are still members of the populace who are ignorant about climate change.

Their sources of knowledge about climate change vary as follows; those who got to know it through Radio constitute 77.7%, Friends/Relatives 21.8%, television 8.8%, while those who knew about it at School made up 5.3% of the respondents. This implies that radio is very popular among the people and as such the best way to disseminate information.

#### **(ii) Basic definition of Climate Change;**

With the definition of climate change, the responses were quite interesting 62.9% defined it as the changes in weather in Ghana, 21.3% defined it as less money in their pockets and increase in the average global temperature due to man's activities while 3.5% think it is the difficult economic situation imposed by the politicians.

This indicates that even though majority of the people have a fair idea of climatic change, the concept is not well defined and a better understanding required.

About the diseases likely to be influenced by climate change, 65.8% mentioned guinea worm, 54.5% malaria, 17.8% diarrhoeal diseases, 14.4% CSM, 7.4% epilepsy and 5.9% tuberculosis.

#### **(iii) How the effects of Climate Change can be minimized.**

According to the respondents, a whopping 81.3% think climatic change can be minimized while 18.7% think otherwise. Some mitigation and adaptation methods they had heard about and percentage respondents are; Sequestration/mopping up of green gas 50.7%, Minimizing green gas emissions of countries 40.8%, Strengthening disease control and surveillance of implicated diseases 17.1%, Improved health care 15.8%, Planning to divert into different areas of agriculture 8.6%, Irrigation 7.9%, Having a disaster preparedness plan 6.6%, Improving food storage facilities 2.0%.

This implies that those who are of the view that climate change cannot be minimized need orientation to change their stand.

Some community actions for mitigation of climate change as indicated by the percentage of respondents include, increasing fire protection 57.4%, measures in reforestation immediately after harvesting 33.7%, reforestation marginal agricultural lands 14.9%, adding chemical amendments to boost fertility 12.9%, productive forest cover 11.9%, reducing shifting cultivation 9.4%, retaining debris/litter after logging operations 3.0%, substituting wood fuels for fossil fuels 2.5%, shifting species 2.0%, replacing drought sensitive species 2.0% while another 2.0% mentioned increasing protection measures against insects/pest invasion. With these community actions for mitigation of climate change, members of the community are yet to explore to the full what they can do to arrest the adverse effects of changes in climate and to forestall further changes.

## **Knowledge about guinea worm infection and climate change**

### **(i) Knowledge about Guinea Worm Infection;**

a) Preventive measures adopted to fight against guinea worm as put forward by individuals are as follows; 90.1% said by filtering drinking water, 24.3% said by boiling drinking water and 1% think by praying over water the disease could be prevented while none thinks adding a few herbs to your drinking water it could be prevented out of the 202 respondents. This implies that even though, the chunk of the respondents thinks by filtering and also by boiling the drinking water, which are no doubt some of the preventive measures, there are still people who think by praying over the water the disease could be prevented. This is rather unfortunate and something should be done about it.

b) With community preventive measures, Out of a sample of 144 respondents, 77.0% of them think by educating children and other community members on guinea worm prevention, 17.4% think by doing communal labor to build bore-holes while 5.6% think by doing communal labor to clear bushes/vegetation 5.6% the disease could be prevented. By clearing the bushes and vegetation could ensure environmental cleanliness and cannot prevent guinea worm infection. So, those who think that way should be educated to discard that idea.

c) On action taken on guinea worm infection, out of 129 respondents, 98.5% said take the person to the hospital, while 15% said they take the infected person to either the traditionalist/herbalist or the mosque to be prayed for. This means that there is still work to be done here fore the 15% to change their orientation.

### **(ii) Agriculture /Food security.**

Of the 179, 85.8% said there has been a change in agricultural production while 14.2% think nothing has changed. On the use of fertilizers, 75.0% out of 192 respondents replied in the affirmative with 25.0% replying in the negative. Also with a sample of 197 people, 67.5% are engaged in mechanized farming while 32.5% are not.

### **(iii) Assistance received from Government and other groups.**

Assistance received and the percentage of respondents who mentioned them are as follows; education on improving farming techniques 78.5%, Financial 14.0%, Input (fertilizers, feeds) 7.5% of the 107 people and the source of support according to 91 respondents by percentage, indicates that, 51.7% thought of support from NGOs, 37.4% from Government at the district level and 11.0% from the Government at the community level with none from the regional level.

Taking cognizance of the precarious nature of food security in the study area, more needs to be done to make agricultural activities viable enough to help feed the people. This is in the face of the chunk of the people engaging in farming activities for a living.

**CLIMATE RISK MANAGEMENT AND CAPACITY-BUILDING  
TAMALE (APRIL 21 – 24, 2008)**

**MODULE I**

**The Concept of Weather, Climate Variability and Climate Change  
Facilitator – Dr. FAYeboah(PI)**

Weather – reflects variability in atmospheric conditions on a daily or weekly basis. For example there may be sunshine and soon clouds develop.

Exercise I. Describe how the weather conditions change.

Climate Variability – refers to variation or changes in the land over months, years and decades.

Exercise II. What have seen changed in the land in your area since you were young?

Exercise III. GROUP WORK: Participants in groups share their in the changes that occur to the land over the years.

Climatic Change – generally refer to longer term trends in average temperature or rainfall often resulting wholly or in part from human activities.

Exercise IV. Discuss the various activities in your area and show how in your opinion they have affected the climate.

- (i) charcoal burning
- (ii) bushfires
- (iii) overgrazing
- (iv) tree cutting
- (v) farming practices

## MODULE II

### Strengthening Local Capacities in Managing Climate-Related Risks Facilitator – Mr. Thomas Quarcoo

INTRODUCTION: A drama to depict risky practices such as

- (i) charcoal burning
- (ii) bush fires
- (iii) overgrazing
- (iv) tree cutting

Exercise V:

1. How can the community prevent the climate-related risks as mentioned above?
  - a) Ask 5 people from all age ranges to give suggestions
  - b) Document suggestions

2. How can this be achieved?

- a) give suggestions and record how to mobilize local capacity

Example- vigilante groups to control those activities

- contact NADMO on disaster
- encourage tree planting
- control of grazing
- Other sources such as NGOs and other organizations for help

(seedlings, manure etc

## MODULE III

### Medium and Long Term Adaptation to Climate-Related Risks Facilitators – Dr. FAYeboah(PI), Mr. Derry, Mr. Quarcoo

Experts to talk about the following relating them to health (emphasis on guinea worm), livelihood and poverty:

- |       |                          |                      |
|-------|--------------------------|----------------------|
| (i)   | Agricultural Practices   | – Mr. Thomas Quarcoo |
| (ii)  | Water Management         | – Mr. Gilbert Derry  |
| (iii) | Environmental Protection | – Mr. Gilbert Derry  |
| (iv)  | Sanitation               | – Dr. FAY            |

Exercise VI:

Open Forum on the discussed topics



## MODULE IV

### Communicating Climate Risk Management (CRM)

Facilitator - Dr. FAYeboah(PI)

Presentation in pictures on how climate can affect individuals, community and the nation:

- (i) Agriculture and food security
- (ii) Water Resources
- (iii) Guinea worm
- (iv) Poverty
- (v) Malnutrition

#### Exercise VII

Suggest other ways and of communicating climate in pictures organizations that can do that.

- Agric Extension Officers
- Radio and Television
- Community (e.g. beating gong gong)
- NADMO
- Weather Forecasting
- Flood Warning
- Food Security
- Water Safety and Management

## DRAMA

### TOPIC: MANAGING CLIMATE-RELATED RISK THE LOCAL WAY

Characters: **Shaibu a farmer, Thomas a charcoal burner, Gilbert a hunter.**

The three are friends who normally in the evenings under a baobab tree after the hard day's work.

While there, they discuss issues covering various topics, including the day's work and how it fared, politics, football, the latest gossip in town, religion and the like. Occasionally, people who are from outside join in the discussion.

#### Act 1 Scene 1: Under the Baobab Tree

Enter Shaibu and Thomas

**Thomas:** Good evening (antere) my brother.

**Shaibu:** Good evening (naa). How are you?

**Thomas:** Quite well

**Shaibu:** Your wife, your children and all your relatives?

**Thomas:** They are all doing fine except my wife's sister who is suffering from malaria. How about your family?

**Shaibu:** They are all in good health.

They sit down on a piece of log polished and shiny for constant use as a seat.

#### Act 1 Scene 2: In the bush

Enter Gilbert (as he goes hunting)

**Gilbert:** (Talks to himself) Hunting nowadays is not lucrative at all.

I've combed the length and breadth of this bush but there is no game.

I've burnt almost all the thicket here but no game came out, only lizards.

What I'm I going to give my family for supper.

Gone are the days when I used to go on hunting expeditions with my late father.

Some thirty years ago, the haul for one hunting expedition was more than we can carry and we at times employ people we pay to help us.

#### Act 1 Scene 3: Under the Baobab

Enter Gilbert and Shaibu

**Shaibu:** How was hunting today. My millet is drying up because the rains are not forthcoming.

I've had enough of poor harvests for the past five years and I want to give up farming. Some twenty years ago I used to have bumper harvest every year as the rains never failed in its season. These days some rainy seasons aren't rainy and this makes farmers poorer and poorer. Aside the poor harvest, livestock have less to feed on.

**Gilbert:** Hmm! Brother, the world is becoming more and more difficult to sojourn. My case isn't that different. I'd no game for today.

Act 2 Scene 1: In the street "When the last tree dies the last man dies" campaign by EPA

Enter the friends

**Thomas:** Gilbert, have you heard the campaigns by 'government people' that because we burn the bush and the trees die we are also going to die.

They also say because some of us cut the trees for firewood and charcoal burning, we're all going to die.

**Shaibu:** These people are not serious. How can I grow my crops without clearing the land and burning the dried weeds? The trees around too will die for wife to use for firewood. How can I survive without that, even in the face of having poor harvest of late?

**Gilbert:** Whaaat! So they want me to stop hunting using fire.

They must be joking. A profession I inherited from my father who also inherited it from his father and has become ancestral legacy.

**Thomas:** If I stop cutting down trees, I can't burn charcoal to earn a living. So their campaign will make no impact. We'll surely sabotage it.

Enter an octogenarian

**Octogenarian:** My sons, why are you so furious? Is there anything wrong?

**Thomas:** The government people say we should stop cutting and burning trees for we will die if we do so.

**Gilbert:** But my used fire in hunting but died at a ripe age of 90 years. What do they want to tell us?

**Shaibu:** It is the 'slash and burn' method members of this village have been using in clearing the land for farming since time immemorial.

**Octogenarian:** My sons, this warning came up when I was young but dismissed it as a big joke.

But today, here we're with the consequences.

**Shaibu:** What are they? Old age makes you go back to childhood and you're behaving as such.

What consequences. Do you expect us to leave our work? No, a big no.

**Gilbert:** Shaibu, let him die before you bury him, allow him to finish explaining to us before we attack him.

**Thomas:** I don't think he has any better explanation. It will be better for him to stop than to make us angrier.

**Gilbert:** Just let him finish.

**Octogenarian:** Listen, now we are experiencing poor harvest of for and cash crops, wildlife is dwindling to extinction because we are destroying their habitat by felling down trees indiscriminately, poaching them haphazardly and bush burning which have gone for a long time.

**Thomas:** You're lying. Why do you lie so blatantly?

**Octogenarian:** Just listen and you'll understand what I'm saying. We ignored the warning in our days and today we are poorer and if you don't refine your methods of farming, overgrazing, and also 'killing' trees, this whole area will soon turn into desert. We're going to die if this happens because there will be no arable land to farm on. You could notice that the climate has changed drastically as compared to those days when you were young.

**Gilbert:** We don't have regular rainfall because we've offended the gods and we need to pacify them. So instead of helping us to perform the necessary rituals in order to get favorable climate, is that what you're telling us?

**Octogenarian:** The trees also excess absorb carbon dioxide from the.....

**Thomas:** I can't wait any longer.

They all leave the old man.

**Act 2 Scene 2: The three discuss the campaign, argument ensues an octogenarian appears,**

**Gilbert:** (Talks to himself) In fact, there may be wisdom in what the old man told us. We should have listened more. We're told not to kill animals at certain times of the year because the animals may be in their gestation. We've failed to observe this that is why we are finishing the animals up. I'll seek more from him; he has a lot to give to us before he leaves us for eternity.

Gilbert visits the Octogenarian at his house

**Gilbert:** Good morning sir.

**Octogenarian:** Good morning my son. Couldn't you go to work today?

**Gilbert:** No. I'm taking a rest. I'm here to listen to more of what you were telling us yesterday.

**Octogenarian:** Oh! That's great. It's always good to seek knowledge. Now sit down

Act 2 Scene 3: Thomas down with guinea worm, Shaibu down with malaria, already income levels have declined, diseases have compounded the situation

Act 3 Scene 1: The early rains bring floods and everything in disarray

Act 3 Scene 2: The three attend workshop organized by Dr. FAY and Associates

Act 3 Scene 3: THE three take the message home and to other members of the community

Bring down curtain

#### **D. Recommendations**

1. There is the need to educate the populace well enough for them to grasp the concepts of weather, climate, climate variability and climate change.
2. There is the need to build local capacity to manage climate-related risks, that is, how the community can prevent and handle risks associated with climate change.
3. There is the need to build local capacity for the adaptation of medium and long-term adaptation to climate-related risks.
4. The guinea worm disease still poses a threat to the community members and the water situation should be improved.
5. Food security is still precarious, in spite of efforts by the Government, NGOs and other development agencies.

NB. The next phase of the project in Northern Ghana was mainly centered on Climate Risk Management and capacity building to address issues that came out of the field survey.

E. Climate change photographs from northern Ghana



1. A Family/Househol Head



2. A open Climate Change community survey on Gunea-worm



3. Consent of survey by a village participant



4. A woman infected with Guinea-worm with her children



5. Washing hand after attending to patients



6. A Household Head interacting with the Principal Investigator



7. A lad infected with Guinea worm



8. A painful experience in dislodging a Guinea worm from a Child



9. A very dried village due to Climate Change Impact





10. Vegetative cover destroyed by bush fire during extreme dry season



11. Francis coming to terms with Climate change impact on water resource depletion



12. Severe Climate conditions dries up a village's water source



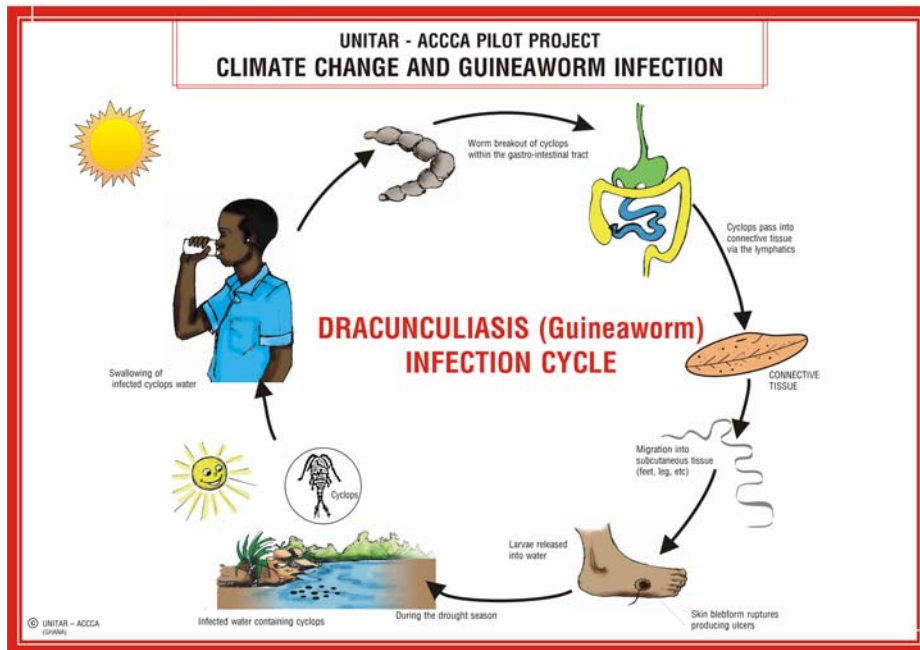
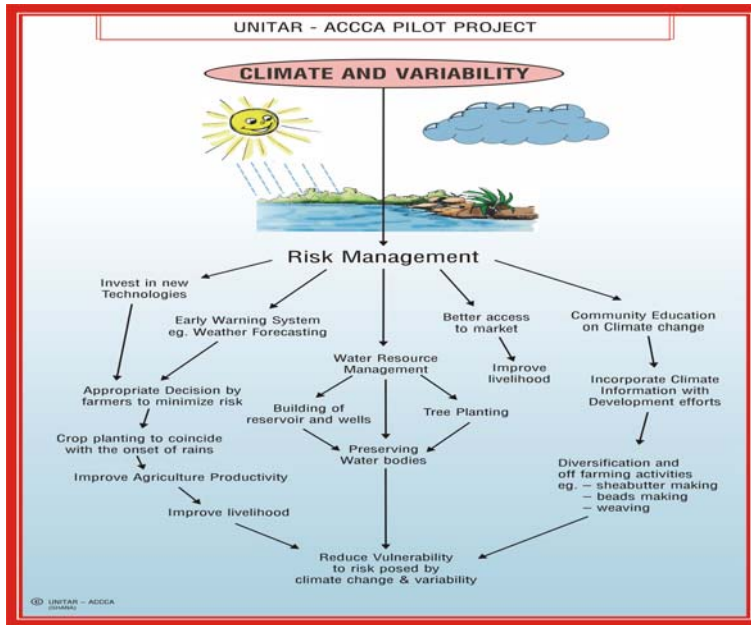
13. A natural dried-up well during extreme drought conditions



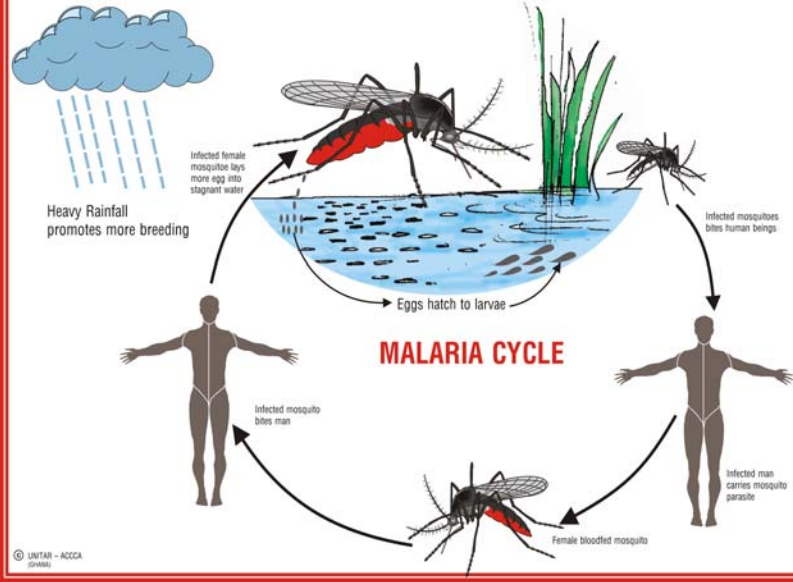
14. A village folk pointing to a dried dam which is their main source of water supply



15. Key Investigator's turn to interview a village elder on Climate Change



UNITAR - ACCCA PILOT PROJECT  
CLIMATE CHANGE AND MALARIA INFECTION



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## TREND OF GUINEAWORM CASES 2001-2007

DISTRICTS	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
EAST GONJA	2001	99	79	40	39	18	10	1	12	1	8	77	88	472
	2002	152	51	29	45	54	28	7	59	62	99	159	153	898
	2003	135	260	221	180	106	45	21	10	48	44	108	103	1281
	2004	43	86	66	62	50	22	13	3	4	90	29	56	524
	2005	85	49	38	36	47	23	13	2	1	10	26	44	374
	2006	34	36	26	58	21	12	10	4	0	37	114	30	382
	2007	39	9	1	11	13	9	9	2	2	3	10		108
GUSHEGU/ KARAGA	2001	4	35	15	20	21	14	9	0	0	1	5	0	124
	2002	3	11	6	5	11	47	12	3	2	31	61	17	209
	2003	34	51	37	107	69	31	40	14	3	22	33	58	499
	2004	41	54	47	48	92	47	41	16	4	13	24	16	443
	2005	19	25	21	23	47	63	24	7	1	3	7	7	247
	2006	18	15	22	14	13	9	4	5	1	3	7	8	119
	2007	9	6	10	3	23	11	4	0	0	0			66
NANUMBA NORTH	2001	236	207	61	35	30	23	11	11	3	11	35	67	730
	2002	188	105	92	30	83	7	23	4	10	46	153	168	909
	2003	247	207	79	87	54	33	31	13	7	38	144	97	1037
	2004	90	42	29	38	38	58	42	6	4	5	59	46	457
	2005	22	19	5	2	4	9	2	0	9	13	20	38	143
	2006	18	18	9	6	2	4	2	0	5	14	45	58	181
	2007	38	10	3	2	2	3	0	2	0	1	1		62
SAVELUGU /NANTON	2001	18	18	25	19	8	23	10	3	1	0	1	3	129
	2002	11	14	4	16	11	8	11	4	0	0	0	0	79
	2003	9	5	4	52	66	92	93	36	3	4	14	33	411
	2004	80	86	166	81	86	71	30	15	5	3	3	12	638
	2005	31	44	29	20	85	99	28	7	5	7	25	47	427
	2006	99	156	111	116	124	126	52	18	10	24	91	256	1183
	2007	666	513	341	168	126	126	48	13	8	4	16		2029
TOLON/ KUMBUNGU	2001	0	12	1	11	9	6	1	1	0	0	1	0	42
	2002	0	1	6	3	6	26	14	3	0	0	3	1	63
	2003	21	15	5	9	17	26	24	38	8	9	19	55	246
	2004	125	141	186	253	208	67	27	8	3	25	104	113	1260
	2005	143	134	127	115	102	70	39	9	5	31	56	74	905
	2006	144	158	94	83	62	59	37	11	7	27	66	79	827
	2007	96	78	51	57	41	35	16	7	7	3	15		406

WEST/CENTRAL GONJA	2001	44	161	97	75	75	18	10	4	2	31	51	43	611
	2002	63	43	45	46	61	62	24	12	15	17	34	45	467
	2003	45	68	87	92	56	26	44	8	11	13	37	37	524
	2004	36	40	48	27	31	17	12	5	4	10	11	23	264
	2005	26	11	20	7	3	8	2	7	0	9	14	36	143
	2006	25	18	8	5	6	3	2	1	1	3	7	7	86
	2007	8	5	5	2	16	17	3	3	0	0	1		60
YENDI	2001	27	18	28	28	35	16	0	0	0	2	3	10	167
	2002	11	7	8	13	40	14	33	14	5	28	19	27	219
	2003	52	64	60	102	162	96	35	7	1	11	16	36	642
	2004	41	34	44	119	208	84	29	11	1	1	8	11	591
	2005	27	25	22	42	36	20	9	5	0	6	16	39	247
	2006	50	42	35	49	41	44	31	11	1	6	13	12	335
	2007	19	21	16	17	10	9	11	2	0	0	1		106
ZABZUGU/ TATALE	2001	44	26	23	52	29	14	10	4	2	16	53	36	309
	2002	71	155	83	67	118	103	70	28	12	86	66	23	882
	2003	61	72	99	97	47	28	24	10	1	6	7	9	461
	2004	43	83	53	28	16	45	22	9	1	4	14	11	329
	2005	24	21	32	18	14	6	4	3	0	3	3	4	132
	2006	11	2	1	8	3	1	2	0	1	2	1	2	34
	2007	34	51	37	107	69	31	40	2	1	0	1		373
Totals		37599	3717	2858	2855	2825	2004	1166	492	288	883	1907	2138	24892

## KNOWLEDGE, ATTITUDES AND PRACTICES OF THE PEOPLE WITH RESPECT TO MALARIA AND CLIMATE CHANGE IN THE KWABRE DISTRICT

July-August, 2008

Following a successful field-survey and the subsequent training workshop on the concept of Climate Change and its effects on the Guinea-worm incidence in endemic areas in the Northern region of Ghana, attention was turned to the Ashanti region of Ghana and particularly the Kwabre district. The Kwabre District of the Ashanti Region of Ghana has an area of approximately 187 square kilometers with a population of about 210, 000 people who are mostly peasant farmers of petty traders. The whole district contains 88 communities with only one health District Hospital serving the entire population. The incidence of reported malaria cases is about 40% (indicating that 4 out of every 10 people will have the malaria parasite). The situation often gets worse with the onset of the rainy seasons. It was in this district that the survey and training workshop on Climate Change and malaria incidence was carried out.

### Data collection

The UNITAR/ACCCA Plot team collaborated with the Kwabre District Directorate of Health Services, headed by Dr. Awudzi Yeboah in recruiting personnel for the field survey. In all ten (10) were engaged to assist in the survey in all the 88 communities. Prior to the field survey a one-day intensive orientation session was organized for the data collectors who were taken through the concept of climate change and the malaria link. They were also taken through the questionnaires and how to administer them. The data covered all the sub-districts; viz, *Afrancho, Krobo, Old Asonomaso, Adanwomase, Kenyasi, Adwumam, Kodie, Buoho, Asenua, Ankaase, Atimatim, Maase, Aboaso and Mampong* (the district capital).

### Training workshop

The workshop was organized for the training of *opinion leaders, traditional rulers and duty bearers* from the various communities in the Kwabre district. In all a hundred (100) people were trained with Nana Oduro Agyemang, Nkosuohene of Kenyasi Traditional Area (*Developmental Chief of the area*) chairing the function. Other dignitaries who graced the function and also participated in the training workshop were; Professor Peter Donkor, Provost of College of Health Sciences, Kwame Nkrumah University of Science and Technology (KNUST) Mr. Boakye Ansah, Presiding Member, Kwabre District Assembly, Mr. Yaw Fobih, Expanded Programme on Immunization Officer of the Ashanti Regional Directorate of Health Services and Madam Agatha Ahia, Deputy Director of the Ashanti Regional Coordinating Council. The main facilitators were Dr. Francis Agyemang Yeboah, Principal Investigator of the UNITAR/ACCCA Project and Head of the Department of Molecular Medicine of KNUST, Dr. Awudzi Yeboah, Kwabre District Director of Health Services AND Miss Sharon Quarshie, Executive Operations Director, Zoomlion Group

Limited (environmental beatification and waste management firm). The press/Media personnel were duly represented.

The main objectives of the workshop among other things as outlined by Dr. Francis Agyemang Yeboah were;

- *To sensitize the participants on the impact of climate change on malaria incidence*
- *To promote pre-disaster planning at the community level to prevent or reduce malaria incidence*
- *To encourage group participatory action at the communal level to create Climate Change awareness*
- *To assist communities to adopt best customary practices as an adaptive strategy to mitigate the adverse impacts of climate change on malaria incidence*
- *To build resilient and sustainable local capacity to cope with climate change impacts*
- *To encourage participants to disseminate the message to their communities to help incidence to the barest minimum*

Some of the dignitaries took turns to advise participants on how to conduct themselves in order to avert the risk that malaria poses in the district.

Nana Oduro Agyemang, a prominent community chief, was full of praise for the organizers of the workshop and the funding agencies and also called for more of workshops of this nature. He advised participants to treasure health and to do all they could to eradicate malaria which is the number one killer disease in the district. Mr. Boakye Ansah (**the Presiding Member, Kwabre District Assembly**), emphasized that, the timing of the workshop was excellent as it coincided with the rainy season when malaria cases are normally on the ascendancy. He further reiterated that when one is down with malaria, all one's activities such as schooling, farming funerals etc. are invariably affected in addition to the unpleasant condition one goes through. Mr. Yaw Fobih (**Expanded Programme on Immunisation Officer of the Ashanti Regional Directorate of Health Services**) urged the participants to make sure they destroy the thriving places of the mosquitoes by draining all stagnant waters and cleaning our surroundings, saying , mosquito is an enemy that should be destroyed. Madam Agatha Ashia(**Deputy Director of the Ashanti Regional Coordinating Council**) on her part outlined measures the government has put in place to arrest the malaria menace to include; the implementation of the National Health Insurance Scheme, free-ante natal care and poverty reduction strategies. She further disclosed that, the government has by the close of June, 2008, spent two hundred and fifty million dollars on poverty reduction alone.

The Principal Investigator (PI), Dr. F A Yeboah took participants through the concepts of weather, climate, climate variability and the link with malaria. He took his time to explain to participants of the workshop the seasonal nature of malaria incidence. He noted that, malaria incidence is always on the ascendancy during the rainy (wet) season as mosquitoes



breed best under humid and warm conditions that promote precipitation in form of rainfall. Stagnant waters are also commonplace during that season. He told them to be conscious of ensuring environmental cleanliness, by draining stagnant waters, clearing weeds in the surroundings etc. Also they were advised to stop indiscriminate felling of trees and desist from the slash and burn method of farming as some of the climate variability and their attendant repercussions are self-inflicted.

Facilitating at the workshop, Dr. Awudzi Yeboah linked the malaria menace to the Millennium Development Goals (MDGs), that is, eight goals to be achieved by 2015 that respond to the world's main development challenges. The MDGs are drawn from the actions and targets contained in the **Millennium Declaration** that was adopted by 189 nations and signed by 147 heads of state and governments during the **UN Millennium Summit** in September 2000. They are:

- Goal 1: Eradicate extreme poverty and hunger
- Goal 2: Achieve universal primary education
- Goal 3: Promote gender equality and empower women
- Goal 4: Reduce child mortality
- Goal 5: Improve maternal health
- Goal 6: Combat HIV/AIDS, malaria and other diseases
- Goal 7: Ensure environmental sustainability
- Goal 8: Develop a Global Partnership for Development

Dr. Awudzi emphasized that, the MDGs recognize explicitly the interdependence between diseases, growth, poverty reduction and sustainable development; saying, malaria could be a hindrance to achieving four (4) of the MDGs if the disease is not prevented from overwhelming the developing countries. Goals 1, 4, 5 and 6 could never be realized if the issue of malaria is not tackled adequately. He acknowledged that development rests to some extent on the foundations of the health of the populace and it is based on time-bound and measurable targets accompanied by indicators for monitoring progress. He therefore urged the participants to involve themselves in outlining potential strategies for action designed to eradicate malaria in order to meet the goals and commitments of the Millennium Declaration.

Miss Sharon Quarshie, took the participants through the linkage of malaria and other diseases to poor sanitation and the absence of environmental cleanliness. As the Executive Operations Director of a waste management company, she advised them not to litter their surroundings and to ensure proper disposal of garbage. She emphasized that mosquitoes breed well at filthy places.

There was a drama by participants depicting two families, one conscious of their environmental cleanliness and hygiene and the other living in untidy environment full of refuse, empty tins and stagnant waters with personal hygiene thrown to the dogs. Members

of the former slept in insecticide treated nets while the latter did not. Members of the latter family even assaulted a sanitary inspector for telling them to weed their surroundings. It so happened that the family that had clean surroundings and observed personal hygiene had its members very healthy and sound, devoid of malaria, cholera, diarrhea and other forms of diseases. The other family had its members contracting all forms of diseases including malaria.

The drama carried home the information about seasonal weather changes, the incidence of malaria and other diseases and how the diseases could be prevented. It cannot be disputed that, the rainy season and its attendant humid conditions is inherent with growth of weeds, presence of stagnant waters and stinking decomposing garbage if not properly disposed or managed. It therefore behooves residents of a particular area to clear weedy areas, drain stagnant waters and observe personal hygiene in order to be free from being afflicted by diseases not excluding malaria.

At the end of the workshop, group and opinion leaders from the various communities were distributed with Climate Change-Malaria link posters by the Principal Investigator to be used at the community level to create awareness among the people.

**PS: All data collected from both survey are currently being analyzed.**

## SURVEY ON CLIMATE CHANGE AND MALARIA - ANALYSIS

### BASIC STATISTICS

#### **ETHNICITY**

1. Akan	87.5 %
2. Ga/ Ga Adangbe	1.3 %
3. Ewe	2.9 %
4. Northern	8.1 %
5. Other	0.1 %

#### **RELIGION**

• Christian	88.6 %
• Moslem	8.9 %
• Traditionalist	1.3 %
• Other specify	1.2 %
•	

#### **MARITAL STATUS**

• Single	26.8 %
• Married	62.0 %
• Divorced / separated	7.5 %
• Widowed	3.3 %
• Co- habiting	0.4 %

#### **ARE YOU EMPLOYED?**

1. Yes	64.3%
2. No	36.7 %

#### **WHAT IS YOUR OCCUPATION?**

1. Professional	8.6 %
2. Skilled	23.3 %
3. Unskilled	68.1 %

#### **EDUCATIONAL STATUS OF RESPONDENTS**

• Never been to school	14.9%
• Primary	45.4%
• Secondary	29.0%
• Tertiary	7.5%
• Vocational	3.1%

➤ Total respondents with primary only or no education 60.3%

## SEX OF RESPONDENTS

MALES 64.3% FEMALES 35.7%

## HEARD OF CLIMATE CHANGE?

- No 5.4%
- Yes 94.6%

## HOW DID YOU HEAR OF CLIMATE CHANGE?

- Radio 45.5%
- Friends 20.2%
- TV 13.3%
- School 7.7%
- Others 13.3%

## WHAT IS CLIMATE CHANGE/ GLOBAL WARMING?

- The difficult economic situation imposed on us by politicians. 1.7%
- Changes in weather in Ghana 75.7%
- Less money in our pockets 4.3%
- Increases in the average global temperatures over the years as a result of man's activities. 18.8%

## WHAT ARE SOME OF THE EFFECTS OF CLIMATE CHANGE?

1. More than expected rainfall in some areas 20.9 %
2. Less than expected rainfall in some areas 14.9 %
3. Floods 19.5 %
4. Poor crop yields 24.3 %
5. Drying up of rivers 12.9 %
6. Possible famine in some areas 5.4 %
7. Colder weather in some regions 35.1 %
8. Warmer weather in some regions 38.9 %
9. Increase disease burden of some diseases 48.5 %
10. Other 1.7%

## DO YOU KNOW OF ANY DISEASES IN YOUR AREA WHICH ARE LIKELY TO BE AFFECTED?

1. Malaria 85.0 %
2. Guinea worm 0.8 %
3. Epilepsy 0.3 %

4. Diarrheal diseases	7.7 %
5. Tuberculosis	1.1 %
6. CSM	1.1 %
7. Other specify.....	4.0 %

**CAN EFFECT OF CLIMATE CHANGE BE MINIMISED?**

- Yes 66.7%
- No 33.3%

**IF YES, WHAT ARE SOME OF THE MITIGATION / ADAPTATIONS YOU MAY HAVE HEARD ABOUT?**

1. Minimizing green gas emissions of countries	13.7 %
2. Sequestration / mopping up of green gas	2.4 %
3. Having a disaster preparedness plan (in case of flooding etc)	18.6 %
4. Irrigation	3.2 %
5. Strengthening disease control and surveillance of implicated diseases	8.0 %
6. Improving food storage facilities	3.2 %
7. Improved health care	36.1 %
8. Planning to divert into different areas of agriculture to suit the climate or alternate means of livelihood	8.0 %

**ATTITUDE & PRACTICES WITH RESPECT TO CLIMATE CHANGE**

**HAVE YOU HEARD ABOUT MALARIA?**

- Yes 99.9 %
- No 0.1 %

**WHAT CAUSES MALARIA?**

- Drinking infected water 5.8 %
- Eating infected food 10.8 %
- Insect (mosquito) bite 78.4 %
- Witchcraft / curse 0.1 %
- Other specify..... 4.8 %

**HOW DO YOU KNOW SOMEONE HAS MALARIA?**

- ❖ Fever 23.3%
- ❖ Fever, Chills & Headache 42.6%
- ❖ Headache 8.9%

- ❖ Vomiting 19.3%
- ❖ Other symptoms 6.0%

➤ 94% of respondent knew one or more symptoms of malaria.

#### DO YOU KNOW OF (FEBRILE) CONVULSION?

- No 1%
- Yes 99%

#### WHAT DO YOU THINK IS THE CAUSE OF CONVULSION?

1. Witchcraft/Demonic attack 6.0 %
2. Improper dieting 10.4 %
3. Mucous in the belly 26.8 %
4. Fever (Malaria) 37.3 %
5. Others... 19.5 %

#### WHAT DO YOU DO WITH A CHILD WITH CONVULSION?

1. Give Enema? 3.8%
2. Inhalation of herbal preparation 16.9%
3. Pouring water on child 22.0%
4. Send to hospital 48.9%
5. Other 8.4%

➤ More than 50% of respondents do not send their children with febrile convulsion to hospital but resort to various unhealthy activities.

#### WHAT GROUP OF PEOPLE SUFFERS MOST FROM MALARIA?

- Children only 32.1%
- Everybody 56.8%
- Women & Children 8.1%
- Women only 1.1%
- Others 1.9%

#### EFFECTS OF MALARIA ON CHILDREN

1. Anemia 27.1%
2. Failure to urine 33.1%

3. Inability to learn	2.4%
4. Poor development	27.2%
5. Others	10.3%

#### **EFFECT ON PREGNANT WOMEN**

1. Anemia in baby	5.1%
2. Anemia in mothers	36.3%
3. Low birth development	5.7%
4. Premature Delivery	13.3%
5. Spontaneous abortion	16.9%
6. Still birth	10.6%
Others	12.2%

#### **HOW CAN MALARIA BE PREVENTED IN YOUR COMMUNITY?**

1. Clear weedy environment	71.3%
2. Mass spraying of stagnant H <sub>2</sub> O	17.3%
3. Others	3.6%
4. Residual spraying	1.5%
5. Insecticide treated nets	6.6%

#### **WHAT IS THE FIRST THING YOU DO WHEN YOU GET MALARIA?**

1. Buy drugs from local drug store	40.1%
2. Go to hospital	50.0%
3. Pray for healing	0.9%
4. Use herbal preparation	6.7%
5. Other	2.2%

#### **HOW OFTEN DO YOU GET MALARIA?**

❖ Never (Rarely)	9.2%
❖ Once/Month	18.3%
❖ Once/Every 2weeks	2.7%
❖ Once/Quarter	17.6%
❖ Twice a year	52.2%

- 21% of respondents get malaria at least once a month
- 90.8% get malaria either once a year or more often.

**WHAT TIME OF THE YEAR DO YOU OFTEN GET MALARIA**

❖ All year round	12.3%
❖ Dry season	10.9%
❖ Other	0.6%
❖ Rainy season	75.2%
❖ Summer times	1.0%

**EFFECT OF MALARIA ON FAMILY BUDGET**

❖ Devastating effect	42.1%
❖ Moderate effect	34.1%
❖ No effect	5.6%
❖ Very little effect	18.1%

**HOW CAN THE COMMUNITY MEMBERS HELP TO PREVENT MALARIA IN YOUR COMMUNITY?**

1. Mass spraying of bushes and stagnant waters. 17 %
1. Communal labor to build boreholes
2. Communal labor to clear bushes and stagnant water
3. Educate children and other community members on how to prevent disease.
4. Other specify.....

**DIFFICULTY OF MALARIA PATIENT TO DO NORMAL ACTIVITY**

❖ A little	32.7%
❖ Not at all	1.4%
❖ Very much	65.9%

**DIFFICULTY FOR CHILDREN WITH MALARIA TO PLAY**

❖ A little	20.8%
❖ Not at all	2.5%
❖ Very much	76.7%



## DIFFICULTY IN DOING HOUSEHOLD CHORES

- ❖ A little 33.0%
- ❖ Not at all 7.8%
- ❖ Very much 59.2%

Now please think about the difficulties someone with Malaria has. Please, respond "not at all", "a little", or "very much".				
		NOT AT ALL	A LITTLE	VERY MUCH
5.8	Doing his/her normal activity	1.4 %	32.7 %	65.9 %
5.9	How difficult is it for children to play?	2.5 %	20.8 %	76.7 %
6.0	How difficult is it to do their household chores?	33.0 %	7.8 %	59.2 %
6.1	How difficult is it for them to earn enough for the family?	23.2 %	8.9 %	67.9 %

- 98.6% think there is some difficulty for malaria patient to normal activity
- 97.5% believe children with malaria have difficulty in playing.
- 92.2% say there is difficulty in doing household chores when one has malaria.
- 76.2% say malaria has either moderate or devastating effect on family budget.

## WHAT KIND OF HELP WOULD YOU NEED EXTERNALLY TO COMBAT THE DISEASE?

- Financial- To help pay hospital bills/subsidize 34.2 %
- Technical support to help clear refuse and etc 20.8 %
- Technical support to help manage cases in the community 4.4 %
- Technical support to educate people on prevention of Malaria 30.7 %
- Others specify..... 9.9 %

**IN YOUR COMMUNITY, WHAT PRACTICES EXIST FOR MITIGATING CLIMATE CHANGE?**

1. Reforesting immediately after harvesting?	30.6 %
2. Restoring to arrest erosion	9.1 %
3. Adding chemical amendments to boost fertility	5.3 %
4. Reducing shifting cultivation	7.4 %
5. Reforesting marginal agricultural lands	7.9 %
6. Retaining debris / litter after logging operations	9.3 %
7. Shifting species	0.1 %
8. Replacing drought sensitive species	0.7 %
9. Substituting wood fuels for fossil fuel	0.1 %
10. Increasing protection measures against insects/ pest invasion	2.3 %
11. Increasing fire protection measures	6.3 %
12. Others	2.7 %
Planting trees	0.7 %
Nothing	19.9 %

## Agriculture /Food Security

### IN YOUR VIEW, IS THERE SURPLUS OF AGRICULTURE PRODUCTS PRODUCED BY EACH FAMILY?

- Yes 41.2 %
- No 58.8 %

### DO YOU FARMERS USE FERTILIZERS?

- Yes 34.2 %
- No 65.8 %

### ARE YOU ENGAGED IN MECHANIZED FARMING

- No 90.7%
- Yes 9.3%

### WHAT KIND OF SUPPORT DO FARMERS IN YOUR COMMUNITY RECEIVE?

- Financial (such as cash for buying more equipment, feeds, fertilizer, irrigation etc) 52.3 %
- Education on how to improve farming techniques 25.4%
- Materials in the form of fertilizers and feeds 22.3 %

### WHO PROVIDES THE SUPPORT OR ASSISTANCE?

- Government at the community level 17.3 %
- Government at the district level 25.4 %
- Government at the regional level 3.2 %
- NGOs 23.2 %
- Others (Specify) 30.8 %

PHOTO EXCERPTS FROM SURVEY AND WORKSHOP FROM KWABRE DISTRICT



A typical community environment in the district



Rain-washed debris and stagnant water, a perfect breeding grounds for mosquitoes



A field worker interviewing one of the community women during the field survey.



A typical household in the community



The Principal Investigator interviewing a household head on Climate Change



A rubbish dumping area in one of the communities- the bushes and poor sanitation encourage mosquitoes breeding in the rainy season.



Gullies of this nature harbor mosquitoes in the rainy seasons.



Still-flowing streams are favorable grounds for mosquitoes-breeding.



Such jelly-cans/containers are used by households to collect after-bath water which can breed mosquitoes



One of our subjects showing some local herbs use for treating malaria



The health team at the district which took part in the field survey



The P.I. with the field team



The P.I. assisted by a traditional chief presenting a poster to one of the participants at the workshop



The community chief congratulating the P.I. for a good work done!





The banner used for the workshop



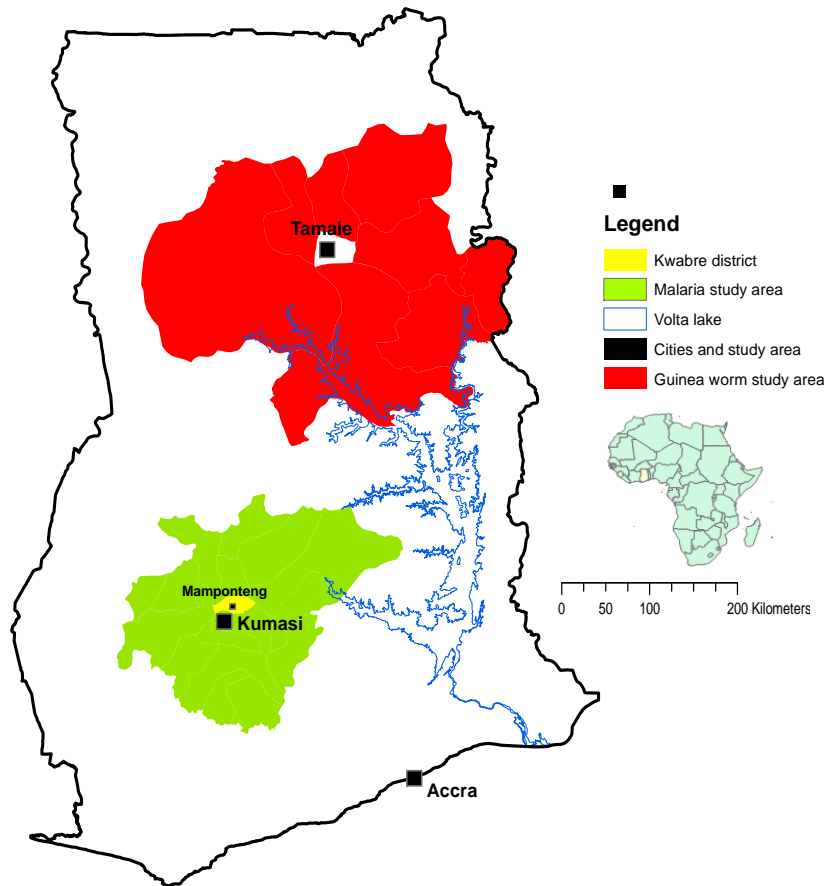
The P.I. in pose with a traditional chief and a district assembly executive after the workshop



Dr. Awudzi Yeboah the community Health Director of the district presenting his seminar at the workshop.

## Study area

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**Figure 1: Map of Ghana showing location of study areas**

### **Methodology - hotspots analysis**

Geographic Information System (GIS) spatial analyst was used to assess hotspots of guinea worm (GW) infestation and malaria incidence in the study areas. The assessment was based on the number of infestation and/or incidence recorded in the studied districts in 2007. Each district within the study area was assigned a risk factor based on the number of GW infestation and malaria incidence respectively. The study areas were then reclassified into a composite map for high, medium and low risk of GW infestation or malaria incidence based on their spatial distribution.

From the historical data, GW infestation has been declining in the study area since 2003. Data and information on GW in 2007 was therefore used to represent the current state of affairs in the spatial analysis (figure 3). On the other hand, malaria incidence in increasing

in the study area from 2001, and available information in 2007 was used to represent the state of malaria incidence in the spatial hot analysis (figure 4).

**(1) Hotspots of guinea worm infestation in Northern Ghana**

Risks indicators were set for the study area according to baseline information from 2001 to 2007 as below.

- >20% infestation - high
- 10-20% - medium
- <10% - low

From Figure 1, Savelugu/Nanton recorded more than 20% GW infestation and considered as highly endemic to guinea worm infestation. Again, Talon/ Kumbungu and Zabzugui Tatali districts recorded between 10 and 20% and coded medium risks, while other district such as Nanumba North, Yendi, West and Central Gonja recoded less than 10% infestation of guinea worm in 2007, and therefore considered as less risk to guinea worm infestation. The colour codes between pink and red in figure 1 below, therefore describe the range of guinea worm infestation in the study area. The risk factors and percentage of infestation has also been presented in Appendix 1.

**(2) Hotspots of malaria incidence in Ashanti Region**

From figure 2, Bekwai, Nkwawie, Kuntense, Mampong, Obuasi and Mampong districts recorded medium incidence of malaria in 2007, while Kumasi municipal recording the highest incidence in the study area. The above districts and Kumasi municipal were coded medium and high risks of malaria because incidence of malaria were more that 5%, according to the risk indicators set for the study areas in appendix 2. On the other hand, New Edubiase, Agona, Mankranso, Tapa, Manso Nkwanta, Konongo Odumasi, Juaso, Ejisu Juabeng, Ejura Sekyere-Dumasi, Offinso and Efiduase were coded low incidence because the districts recoded less than 5% of the total malaria incidence in the study area as in Figure 2.

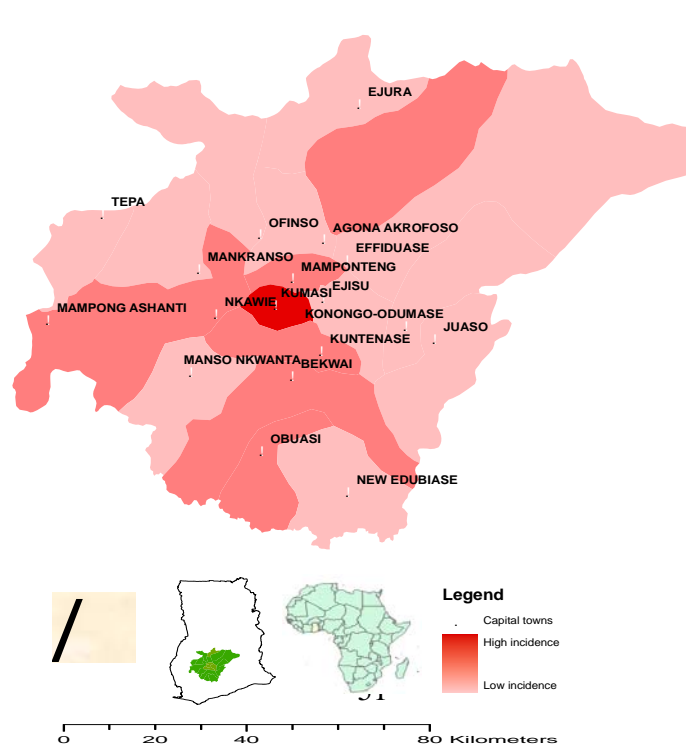
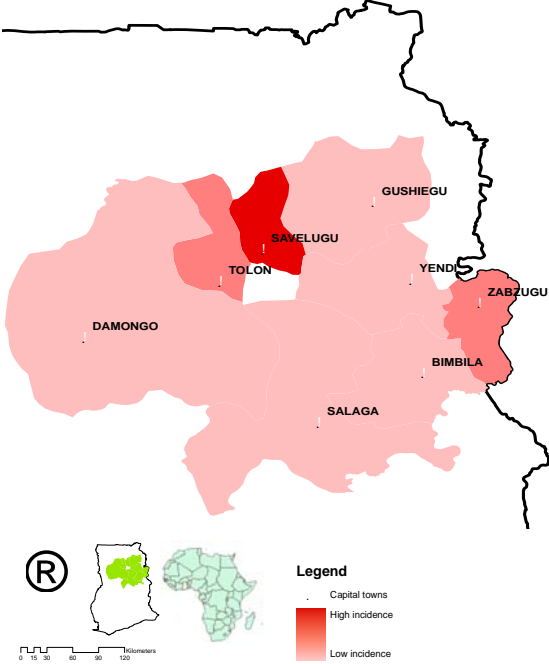


Figure 2: Incidence of Malaria in Ashanti Region



## Percentage guinea worm infestation in Northern Ghana

9

District	% infestation in northern Ghana	Level of risks to Guinea worm infestation
East Gonja	3.4	Low
Gushegui Karaga	2.1	Low
Nanumba North	1.9	Low
Savelugu/ Nanton	63.2	High
Tolon/ Kumbungu	12.6	Medium
West/Central Gonja	1.9	Low
Yendi	3.3	Low
Zabzugui Tatale	11.6	Medium

5th EGU Alexander von Humboldt International Conference. Cape Town, South Africa.

Jan. 2009

## Percentage incidence of Malaria in Ashanti Region

11

District	% incidence of malaria in Ashanti Region	Level of Risk to Malaria infestation
New Edubiase	1.3	Low
Agona	3.7	Low
Mankranso	2.9	Low
Tepa	2.1	Low
Bekwai	4.5	Medium
Manso Nkwanta	0.9	Low
Konongo Odumasi	1.9	Low
Juaso	2.2	Low
Nkawie	9.2	Medium
Kuntenase	5.2	Medium
Ejisu Juabeng	4.4	Low
Ejura Sekyere-Dumasi	2.8	Low
Kumasi	35.7	High
Mampong	5.7	Medium
Obuasi	4.9	Medium
Offinso	4.0	Low
Efiduase	3.8	Low
Mampong	4.7	Medium

5th EGU Alexander von Humboldt International Conference. Cape Town, South Africa.

Jan. 2009

### (4) Future projections of malaria incidence with different climate scenarios

From the results indicated in figure 9, observed historical mean annual temperature increased by 1.3°C while mean annual rainfall decline from 1,158mm to 1,028mm between 2001 and 2007. Within the same period, GW infestation reduces by 812 with an annual rate of change of 133. This could definitely due to government intervention such drilling of bore holes, construction of community water and sanitation facilities among others in the GW prone communities rather than climate variability. If these interventions are continued, and

affected communities have access to water from bore holes and stand pipes for domestic use, GW infestation could be eradicated by 2020 in the study areas even in the face of climate variability (figure 9).

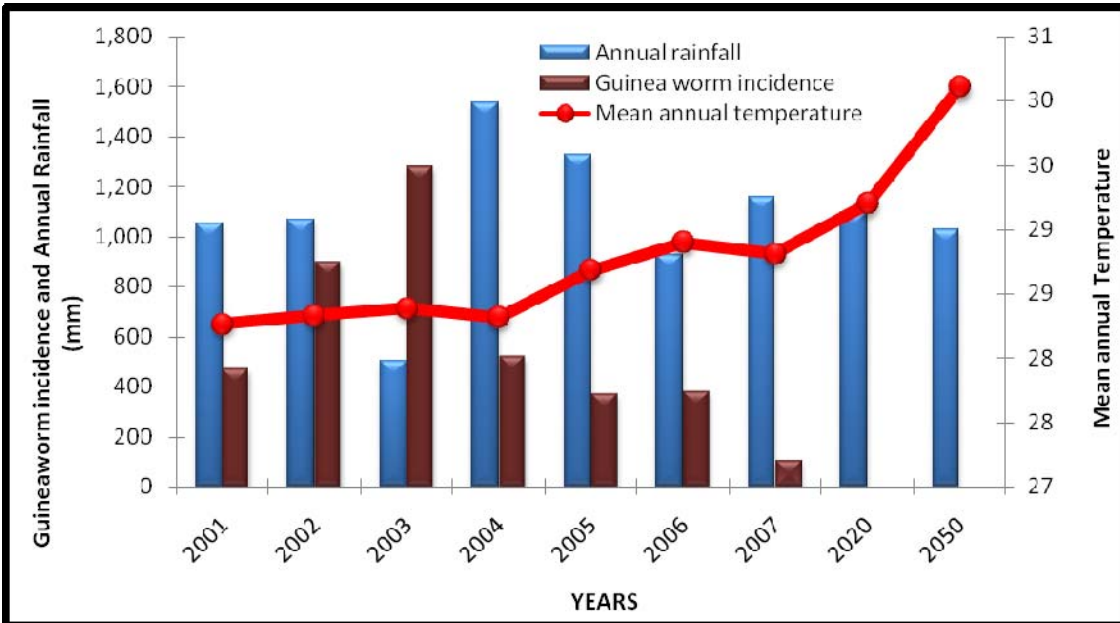


Figure 9: A graph showing observed and future trends of guinea worm in 2020 and 2050 under “business as usual” (BaU) scenario

#### (5) Future projections malaria incidence with different climate scenarios

From the results indicated in figure 10, 11 and 12, increase in mean annual temperature of 1.3°C and decline of rainfall from 1,790mm to 1,272 mm between 2007 and 2050 could result to increase of malaria incidence from 855 to 2,267 using 2007 baseline incidence malaria coupled with climate scenarios. However, with government intervention such awareness creation, use of insecticides bed nets, clearing and spraying of mosquitoes, among others, incidence of malaria could reduce from 2,267 to about 453 representing 80% reduction in malaria incidence by 2050 on “business as usual” scenarios (figure 10).

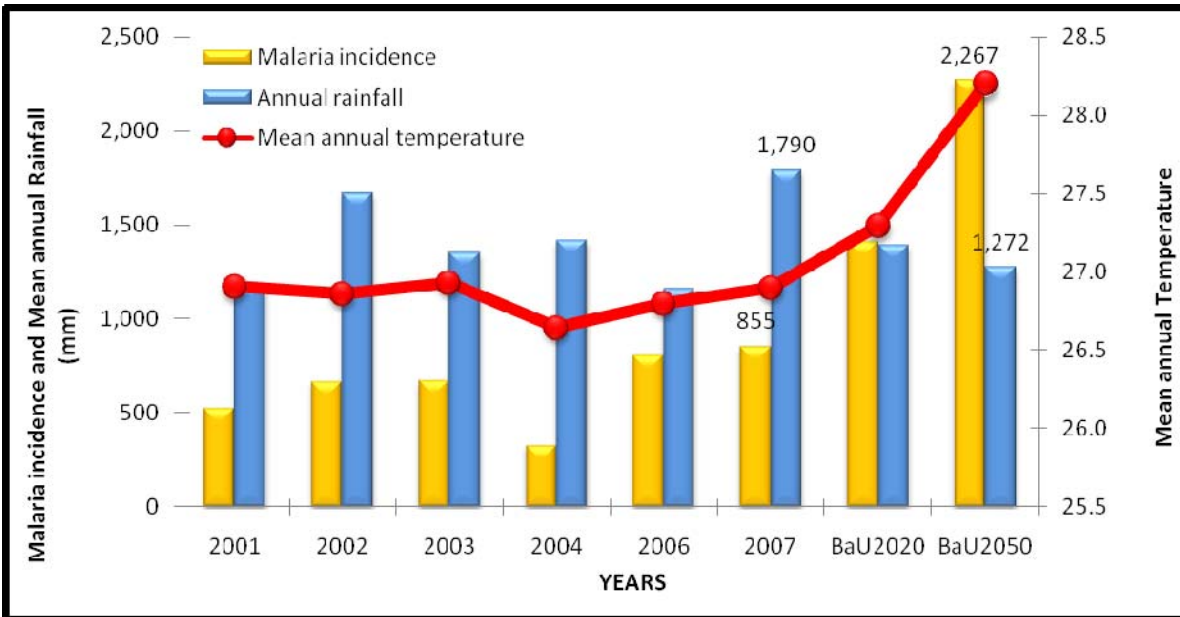


Figure 10: A graph showing incident of malaria in 2020 and 2050 under BaU scenario

Using 2001-2007 baseline information on “business as usual scenarios” malaria incidence will increase to 1,411 and 2,267 in 2020 and 2050 respectively. However, with appropriate government interventions (as stated above), malaria incidence could decrease to 453 representing 80% reduction in 2050 scenarios in Figure 11.

Monthly malaria incidence is shown in figure 12. From the figure high malaria incidence is recorded between April and November, which also coincide with the rainy season. Scenarios for 2020 and 2050 were also generated on monthly basis. February, which recorded the minimum of 41,000 incidence of malaria in 2007, will increase to 47,000 and 61,000 in 2020 and 2050 respectively. However, policy interventions in the face of climate change will help reduce incidence of malaria to 12,000 in 2050. Each of the months have varied incidence of malaria and 80% reduction scenarios using appropriate policy interventions in 2050 (Figure 13).

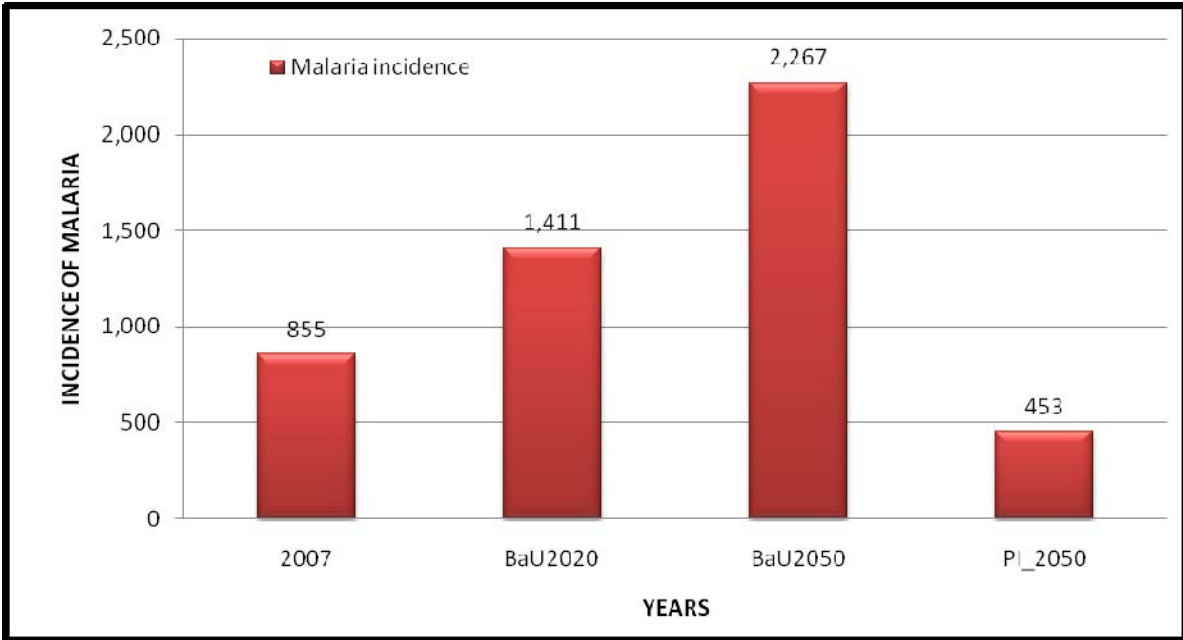


Figure 11: A graph showing annual malaria incidence under 2020 and 2050 “business as usual” (BaU) and policy intervention (PI) scenarios

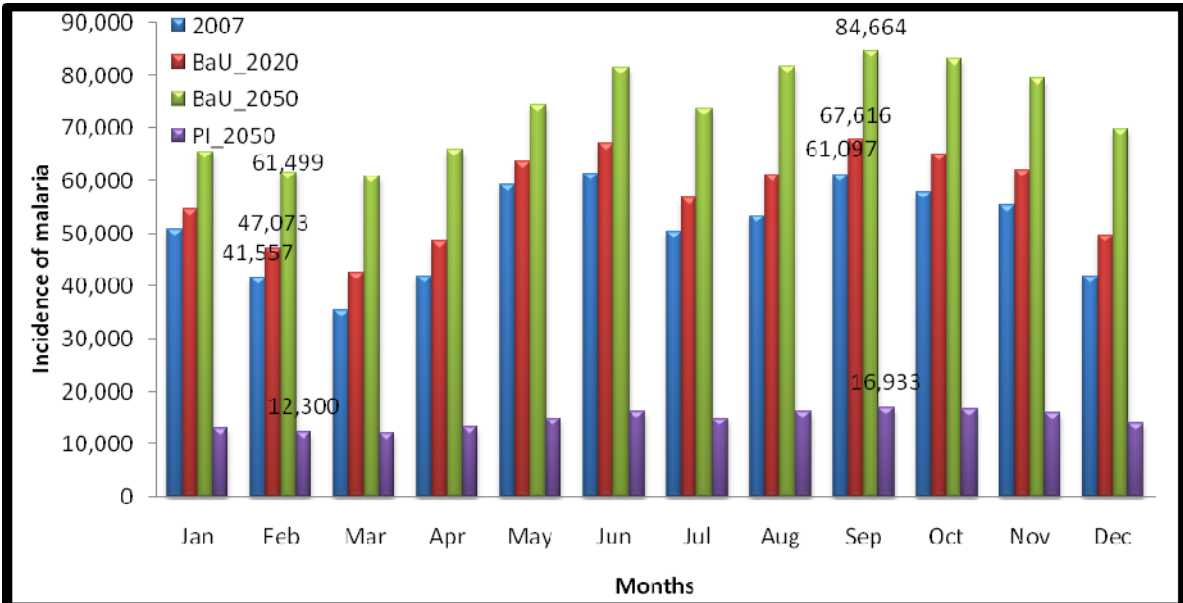


Figure 12: A graph showing monthly malaria incidence under 2020 and 2050 “business as usual” (BaU) and policy intervention (PI) scenarios



**(6) Relationship of mean monthly rainfall and temperature with death from of malaria**

From figure 13 and 14 increase or decrease in mean monthly rainfall result in consequent increase or decrease in death of malaria. From above monthly climate variability has direct influence on death from malaria. Optimum rainfall is required incidence and death of malaria and very high rainfall as in September and October do not necessary results in high number of deaths or incidence.

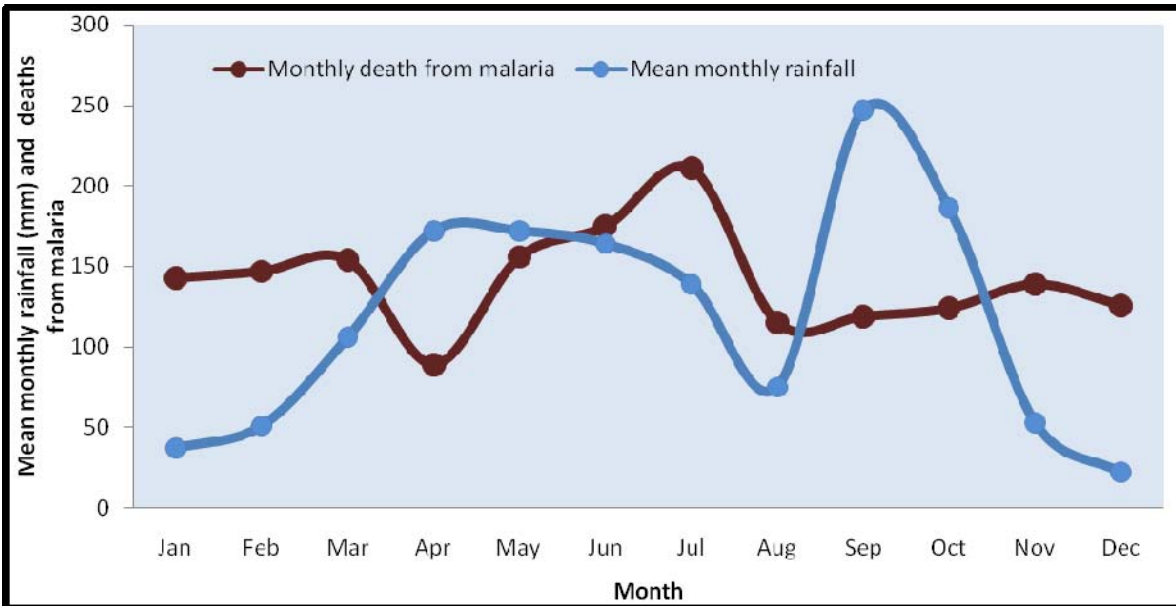


Figure 13: Mean monthly rainfall and death from malaria

From Figure 13, gradual increase in monthly rainfall from January to July (37mm to 139mm) resulted in increase in death from malaria (143 to 211). The period between January and July coincide with the major rainy season of the year. Decline in rainfall in August resulted in further decline in malaria death. Again, death from malaria begins to rise from September to November due to rainfall in the minor season. Rainfalls in the minor and major seasons have direct influence to death from malaria.

However, increase in temperature resulted in increase of death from malaria only during the dry season. Decrease in temperature also resulted in decrease in death from malaria only in the dry season. Increase in death from malaria coincided with decline in mean monthly temperature between February and August due to influence of rainfall on temperature. Rainfall has direct on death from malaria

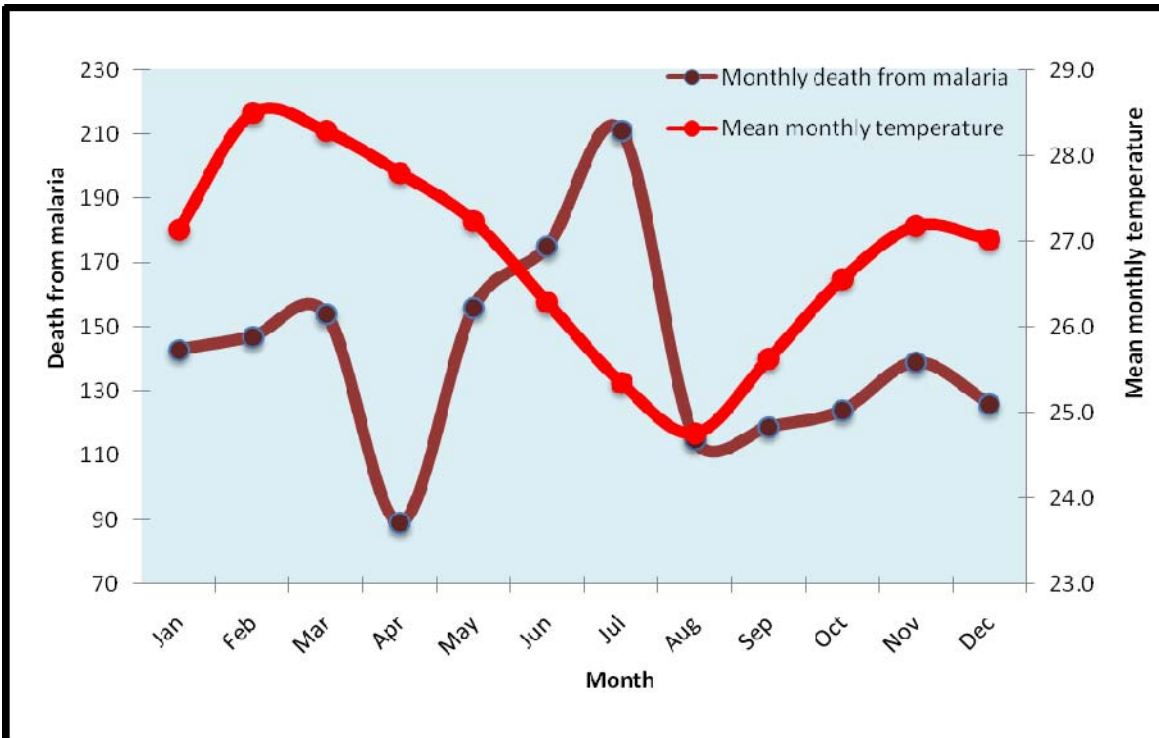


Figure 14: Mean annual temperature and death from malaria

**(7) Relationship of mean monthly rainfall and temperature with incidence of malaria**

From figure 15 and 16 increase or decrease in mean monthly rainfall result in consequent increase or decrease in incidence of malaria. Monthly rainfall amount has direct influence on incidence from malaria. From figure 15, low monthly rainfalls in December to March resulted in low malaria incidence. Optimum rainfall is therefore required for incidence of malaria. High rainfall between April and November resulted in consequent increase in malaria incidence. Decline in rainfall from July and August consequently resulted in decline of malaria incidence. However, high temperature in the dry season recorded low incidence in malaria (December to March), compared to that of the rainy season (April to November).

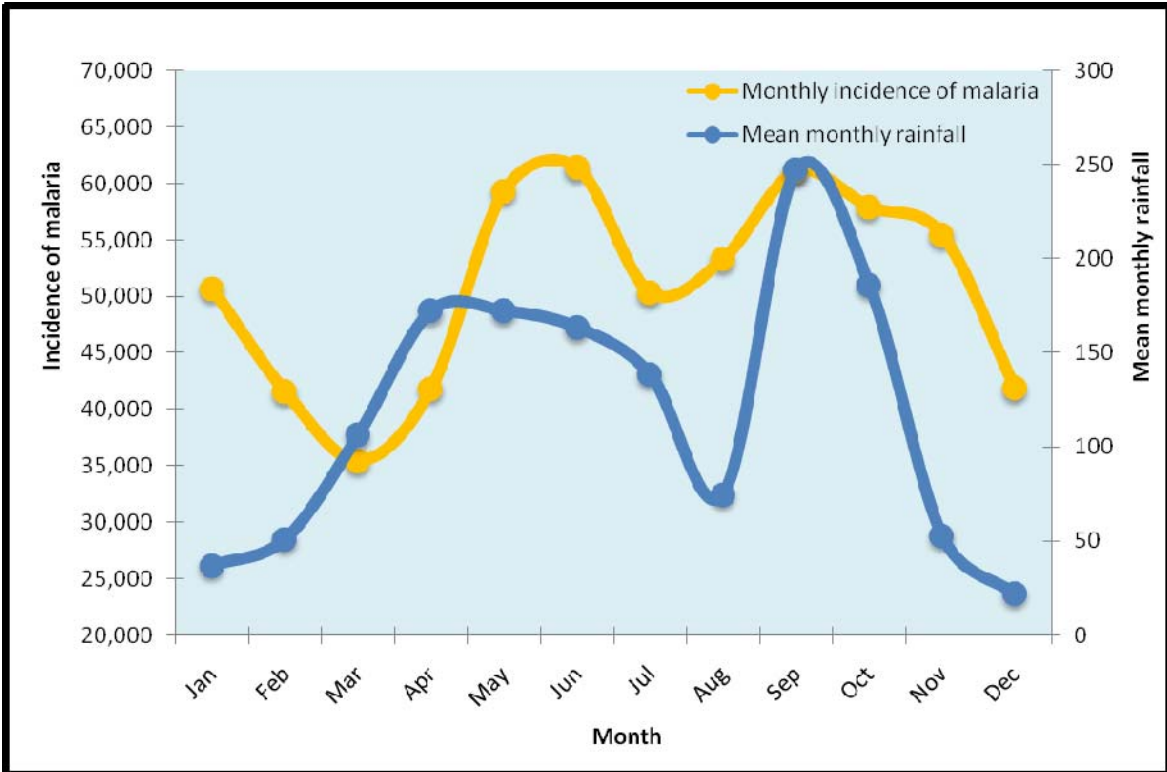


Figure 15: Mean monthly rainfall and incidence of malaria

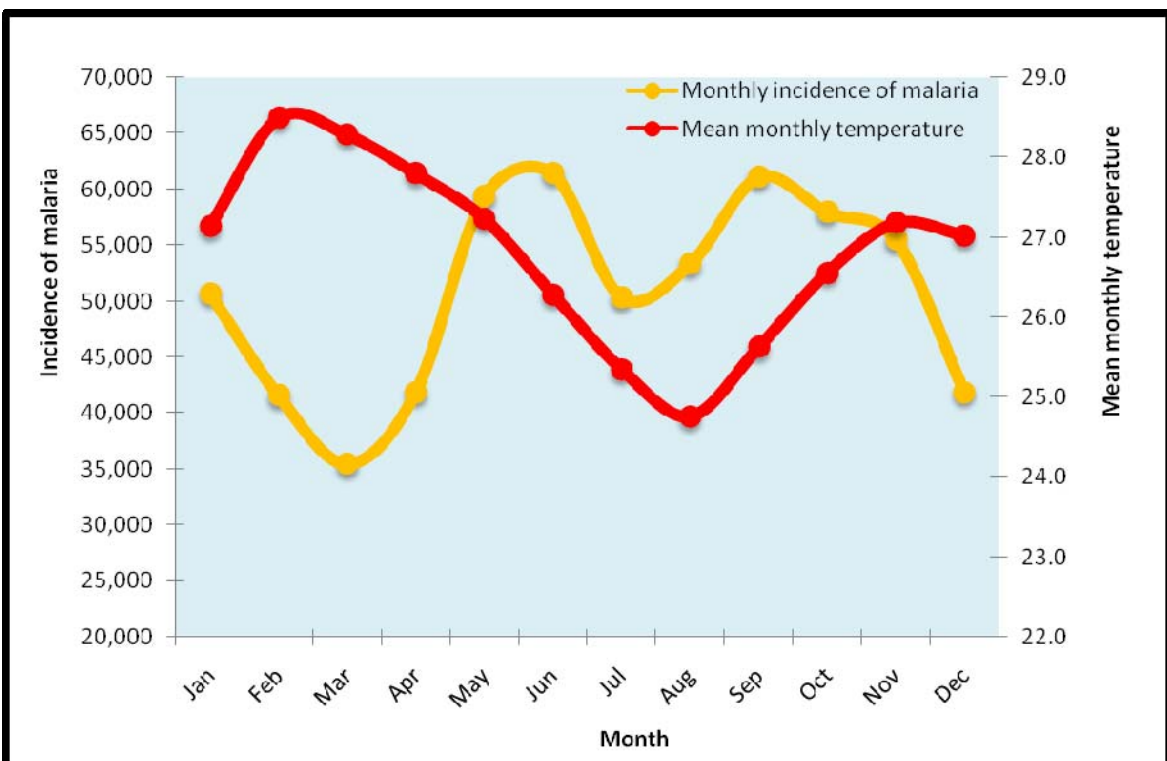


Figure 16: Mean monthly temperature and incidence of malaria

**(8) Relationship of mean monthly rainfall and temperature with guinea worm infestation**

From figure 17 and 18, increase in mean monthly temperature resulted in decrease in guinea worm infestation, while decrease in temperature results in increase in GW infestation only in the dry season. On the other hand, decrease in rainfall result in increase in GW infestation while increase in rainfall or availability of water result in decrease in guinea worm infestation. Climate variability therefore has direct influence on guinea worm infestation.

Decline in GW infestation were only recorded between April and October which is the period of the major rainy season in the study area and where there is enough water for community use.

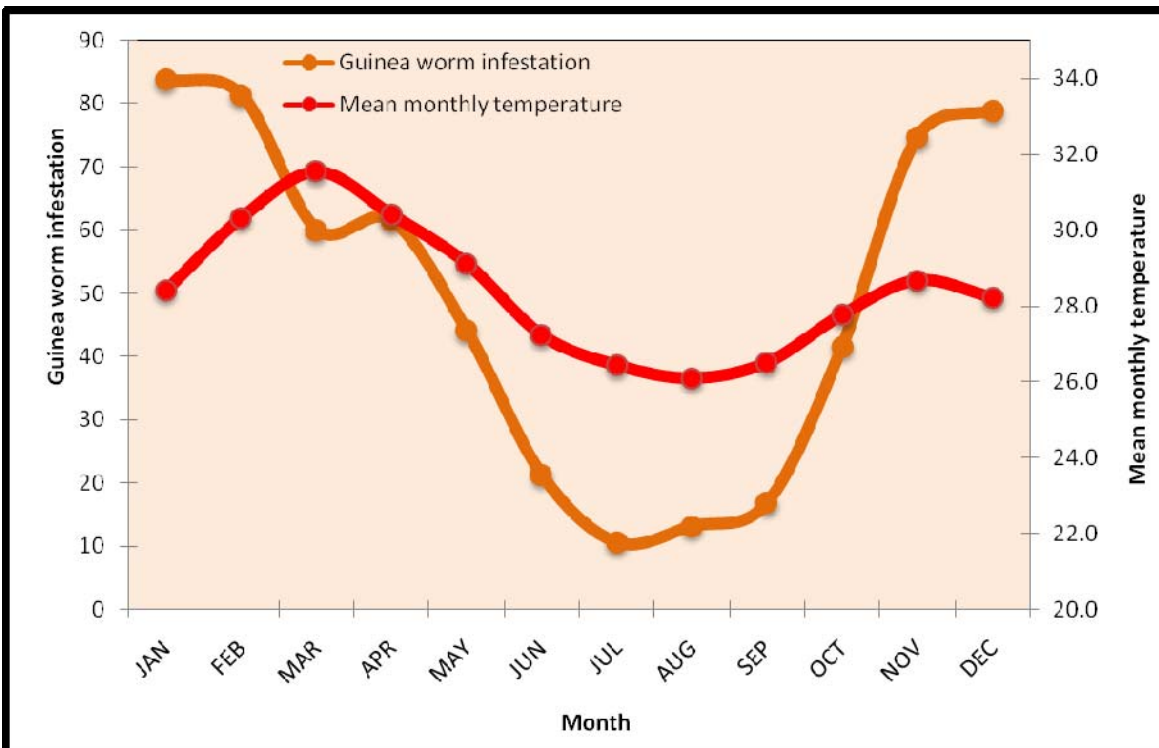


Figure 17: Mean monthly temperature and guinea worm infestation

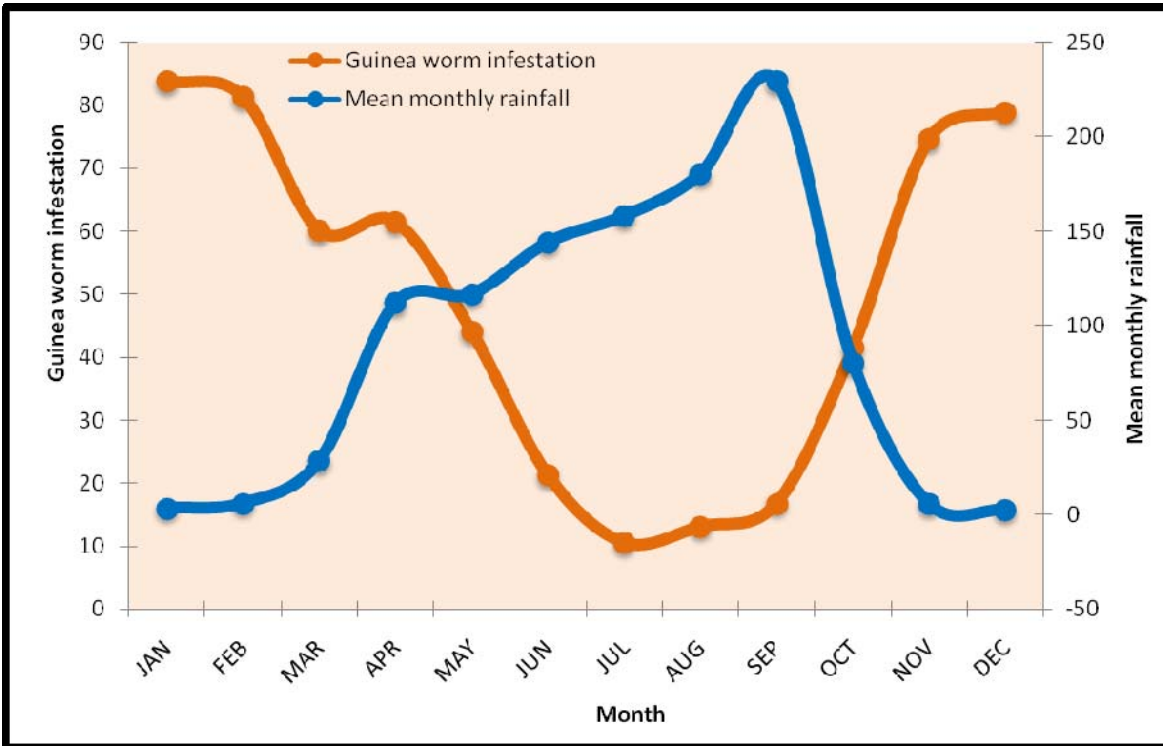


Figure 18: Mean annual rainfall and guinea worm infestation

## APPENDIXES

Appendix 1: Percentage guinea worm infestation in Northern Ghana

District	% infestation in northern Ghana	Level of risks to Guinea worm infestation
East Gonja	3.4	Low
Gushegui Karaga	2.1	Low
Nanumba North	1.9	Low
Savelugu/ Nanton	63.2	High
Tolon/ Kumbungu	12.6	Medium
West/Central Gonja	1.9	Low
Yendi	3.3	Low
Zabzugui Tatale	11.6	Medium

Appendix 2: Percentage malaria incidence in Ashanti region

District	% incidence of malaria in Ashanti Region	Level of Risk to Malaria infestation
New Edubiase	1.3	Low
Agona	3.7	Low
Mankranso	2.9	Low
Tepa	2.1	Low
Bekwai	4.5	Medium
Manso Nkwanta	0.9	Low
Konongo Odumasi	1.9	Low
Juaso	2.2	Low
Nkawie	9.2	Medium
Kuntenase	5.2	Medium
Ejisu Juabeng	4.4	Low
Ejura Sekyere-Dumasi	2.8	Low
Kumasi	35.7	High
Mampong	5.7	Medium
Obuasi	4.9	Medium
Offinso	4.0	Low
Efiduase	3.8	Low
Mampong	4.7	Medium

### **III. Summary and Recommendations**

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Guinea worm and Malaria are among two of the important Climate-sensitive health risk in Sub-Saharan Africa with increased drought likely to magnify exposure to Guinea worm and increased flooding and higher temperatures to Malaria. The focus of this project was to formulate, develop and implement sustainable measures that will reduce the burden of Climate-related disease, promote public capacity development, educate the community on pre-disaster and preventive measures, and build the capacity to health practitioners in early detection and management. Through the pilot actions, Climate risks have been communicated through practices that is available and acceptable including radio bulletins, posters and leaflets targeted at local leaders, school teachers, district assemblies and various stakeholders both at local and national levels. The Pilot Actions have demonstrated that spreading awareness of Climate risks requires committed program to train trainers, with medium and long term strategic plan of implementation which should involve the community, opinion leaders, traditional rulers and various stakeholders working in synergy and harmony to achieve a desirable effects.