



# THE IMPACT OF CLIMATE CHANGE ON VECTORIAL CAPACITY OF MALARIA VECTORS OVER THE AGRO-ECOLOGICAL ZONES OF GHANA

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## ABSTRACT

Malaria is a deadly parasitic disease that is spread to humans via female Anopheles mosquito bites. Malaria is most prevalent in Sub-Saharan Africa, and the disease's transmission capability is determined by malaria vectors. The amount of evidence available on how climate change affects the transmission capacity and survival of malaria vectors in Ghana is limited. Using temperature related functions and temperature data from the Ghana Meteorological Agency, we investigated how seasonal temperature fluctuations influenced the capability and survival of malaria vectors across Ghana's agro-ecological zones. The findings demonstrated that as temperature increased, the vectorial capacity and vector survival probability both reduced, and vice versa. The vectorial capacity and survival rates were higher from July to September and low from February to April. The results also revealed that in the coastal and forest zones, such as Accra and Kumasi respectively, the vectorial capacity and survival probability were higher than in the other zones. This study's findings give crucial research data for malaria control program implementation.

## INTRODUCTION

- Malaria burden is highest in Africa caused by plasmodium parasites (WHO 2020).
- Children aged under 5 years are the most vulnerable group affected by malaria. In 2019, they accounted for 67% (274000) of all malaria deaths worldwide (WHO 2020).
- Malaria transmission intensity is highly dependent on the vectorial capacity and competence of local mosquitoes (Cohuet et al., 2010).

**Problem Statement:** Available research works provide limited information on how climate change influence the seasonal transmission capacity and survival of malaria vectors in Ghana.

### Study Question:

1. How does seasonal changes in temperature influence the seasonality of the survival and vectorial capacity of malaria vectors over the agro-ecological zones of Ghana?
2. Does survival and vectorial capacity of malaria vectors differ from one agro-ecological zone to the other?

**Main objective:** To assess the impact of climate change on the survival and vectorial capacity of malaria vectors over the agro-ecological zones of Ghana.

### Specific Objectives:

1. Determine the influence of seasonal temperature change on the survival and malaria transmission capacity of malaria vectors.
2. Determine whether the survival and vectorial capacity of malaria vectors differ as a function of climate and environment in Ghana.

## MATERIALS AND METHODS

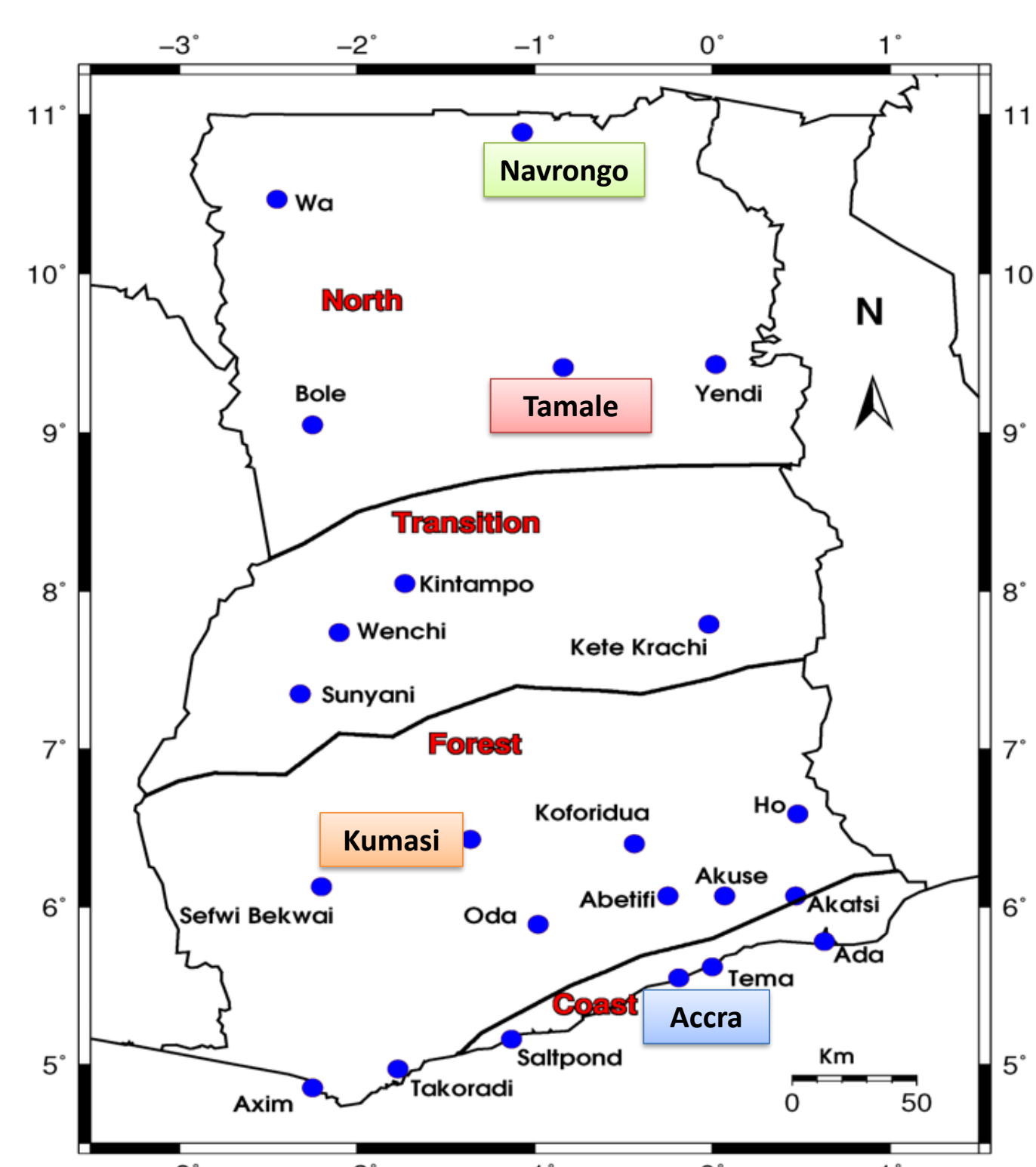


Fig1. The agro-ecological zones map of Ghana showing the Study areas (Source: Amekudzi et al.,2015)

Table1: Data used and their source

DATA	SPATIAL RESOLUTION	TEMPORAL RESOLUTION	DURATION	SOURCE
Maximum, Minimum and Mean Temperature	Point Data	Monthly	1981-2020	GMET

## Analysis

$$vc = \frac{ma^2bcp^{Eip}}{-\ln(p)}$$

(Source: Paaijmans et al., 2012)

where;

vc = vectorial capacity

m = vector: human ratio

a = vector biting frequency

b = probability of a person being infected

c = probability of a vector being infected

$$p = -0.000828T^2 + 0.0367T + 0.522$$

(Source: Lunde et al., 2013)

where; p = daily survival probability

T = temperature

$$Eip = \frac{111}{T - 16}$$

(Source: Detinova et al., 1962)

where;

Eip = Extrinsic incubation period

T = temperature

## CONCLUSION

- Increasing temperature decreases the vectorial capacity and the survival probability of malaria vectors and vice versa.
- Survival probability and Vectorial capacity of malaria vectors are expected to be lower during dry season and higher during wet/rainy season.
- The vectorial probability and survival of malaria vectors are higher in coastal and forest zones of Ghana.

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