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Evidence based climate risk management in health: the case of epidemic malaria

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EVIDENCE BASED CLIMATE RISK MANAGEMENT IN HEALTH: THE CASE OF EPIDEMIC MALARIA

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Sensitivity of VBD to Climate Change

HIGHLY SENSITIVE

MALARIA

DENGUE

CHIKUNGUNYA

RIFT VALLEY FEVER

LOW SENSITIVITY

SCHSTOSOMIASIS

FILARIASIS

LEISHMANIA

TRYMANOSOMIASIS

YELLOW FEVER

NTD SENSITIVITY TO CLIMATE CHANGE

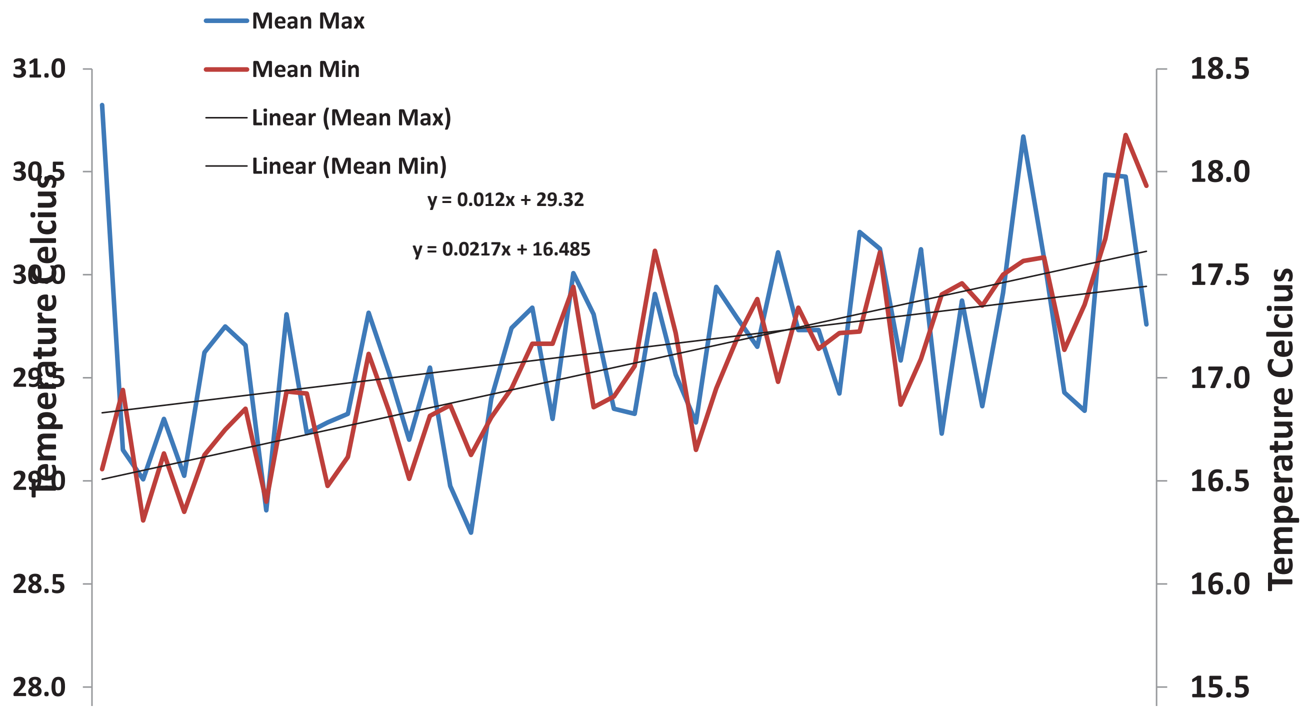
- Major NTDS in Kenya are schstosomiasis, soil helminths, filariasis, leishnaniasis hydatid disaese
- The above pathogens are compleex organisms that have low sensitivity to changes in temperature. They exisst in endemic forms
- Dengue and other viral pathogens are highly sensitive to temperature variations and exist in endemic and epidemic forms.

Effects of climate change and variability on VBD

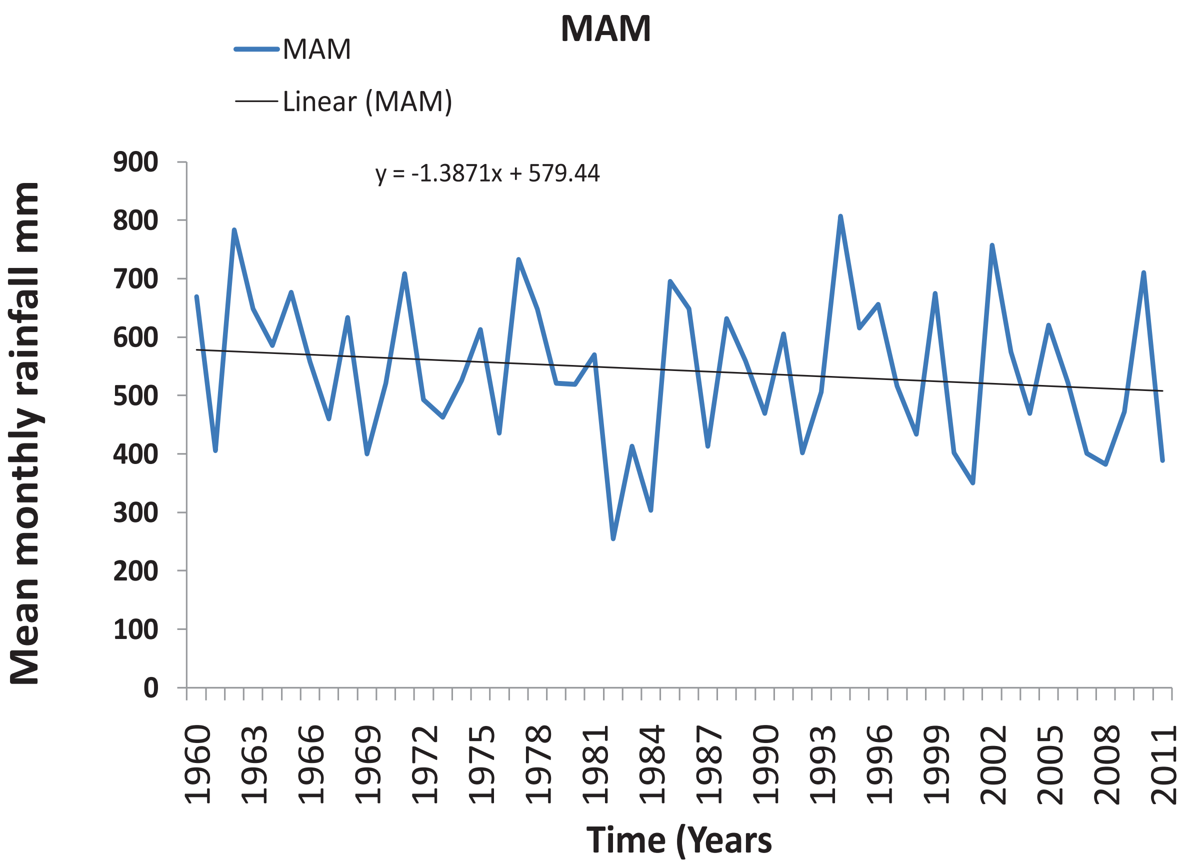
- Climate change increases the suitability of new areas to disease transmission

- Climate variability drives epidemics

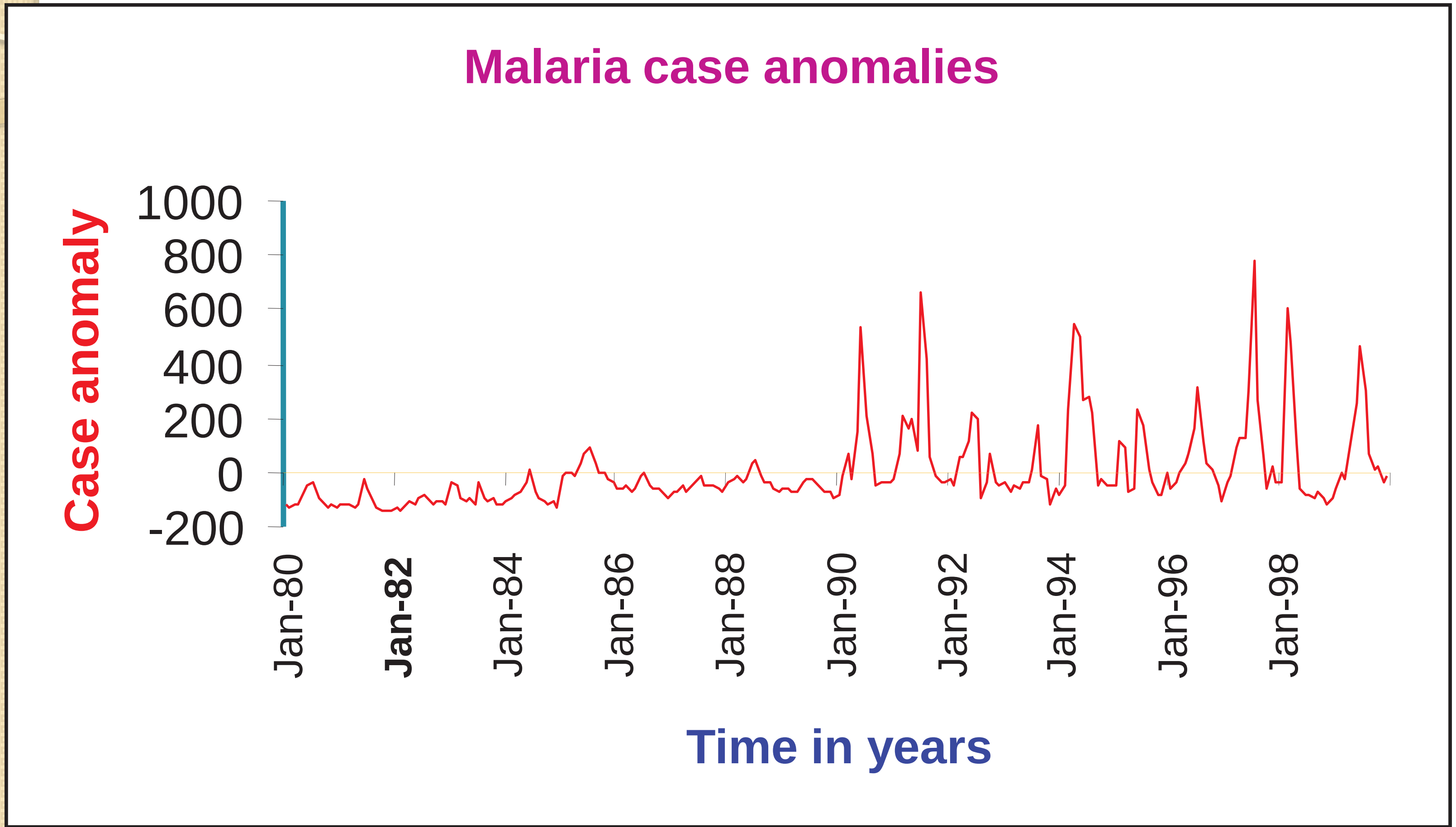
Mean annual temperature trends Kisumu



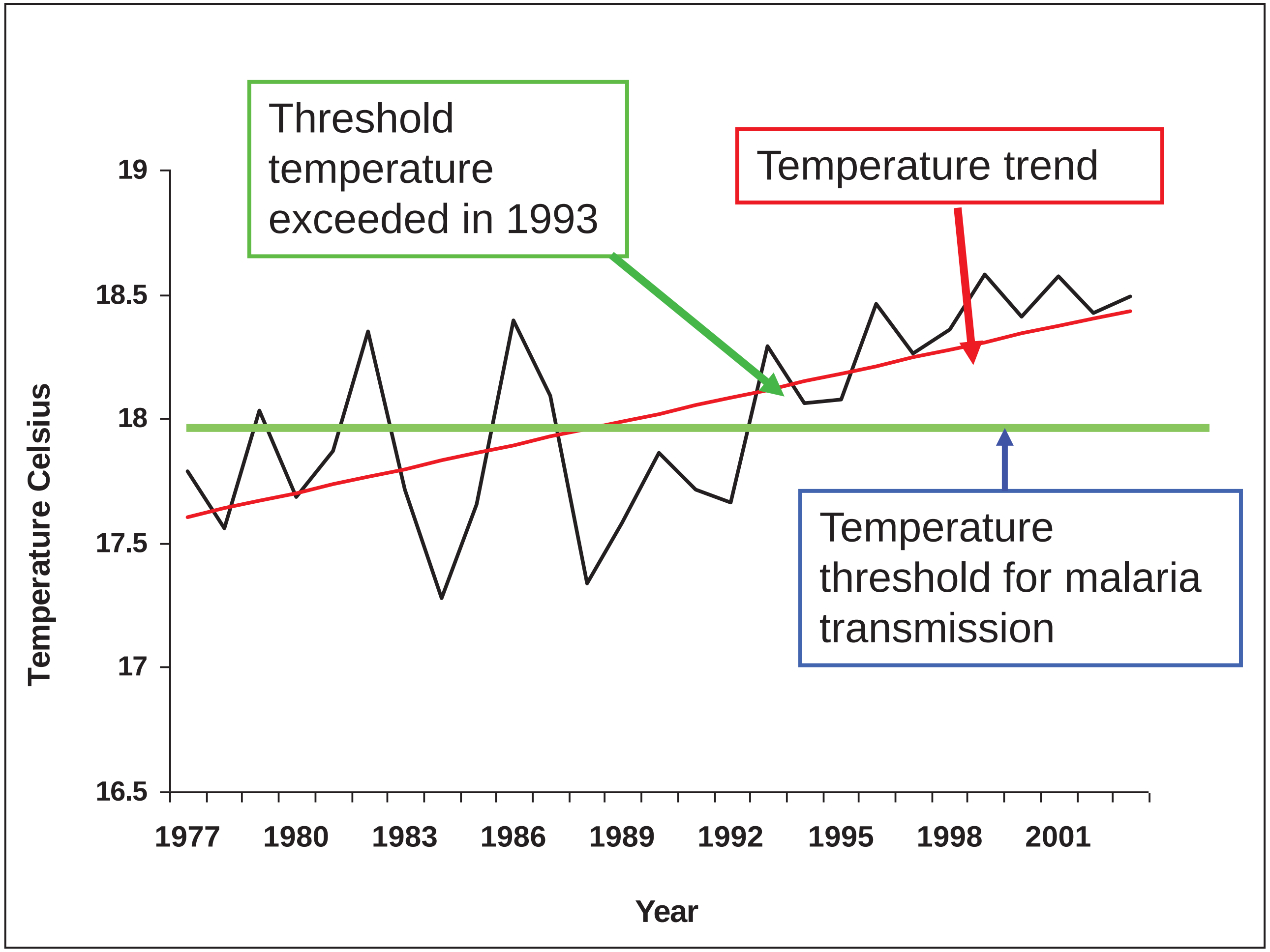
Rainfall trends March April May in Kisumu



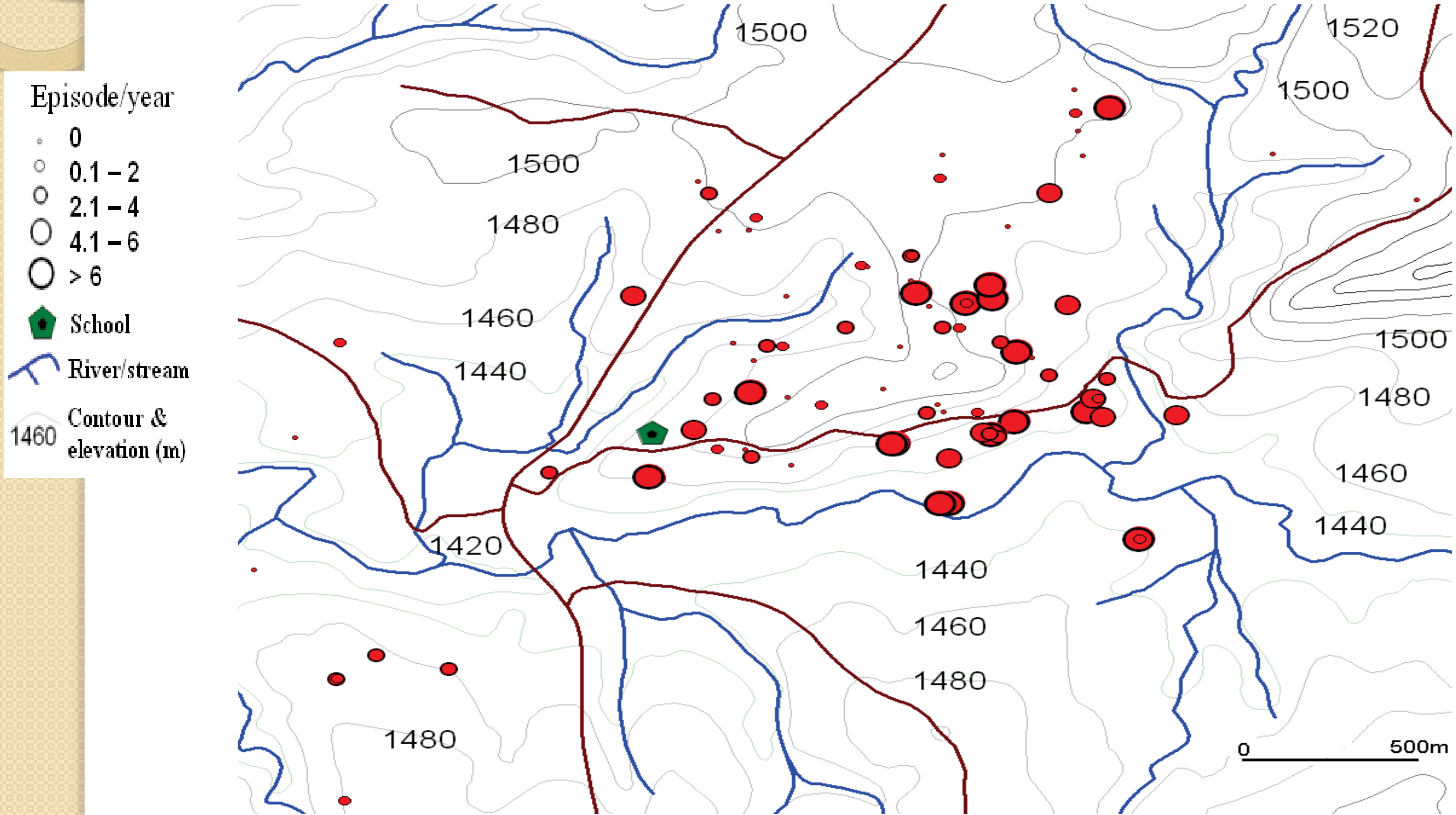
Malaria case anomalies in Nandi district western Kenya associated with El Nino weather



Malaria spreads to Central Kenya highlands because of climate change



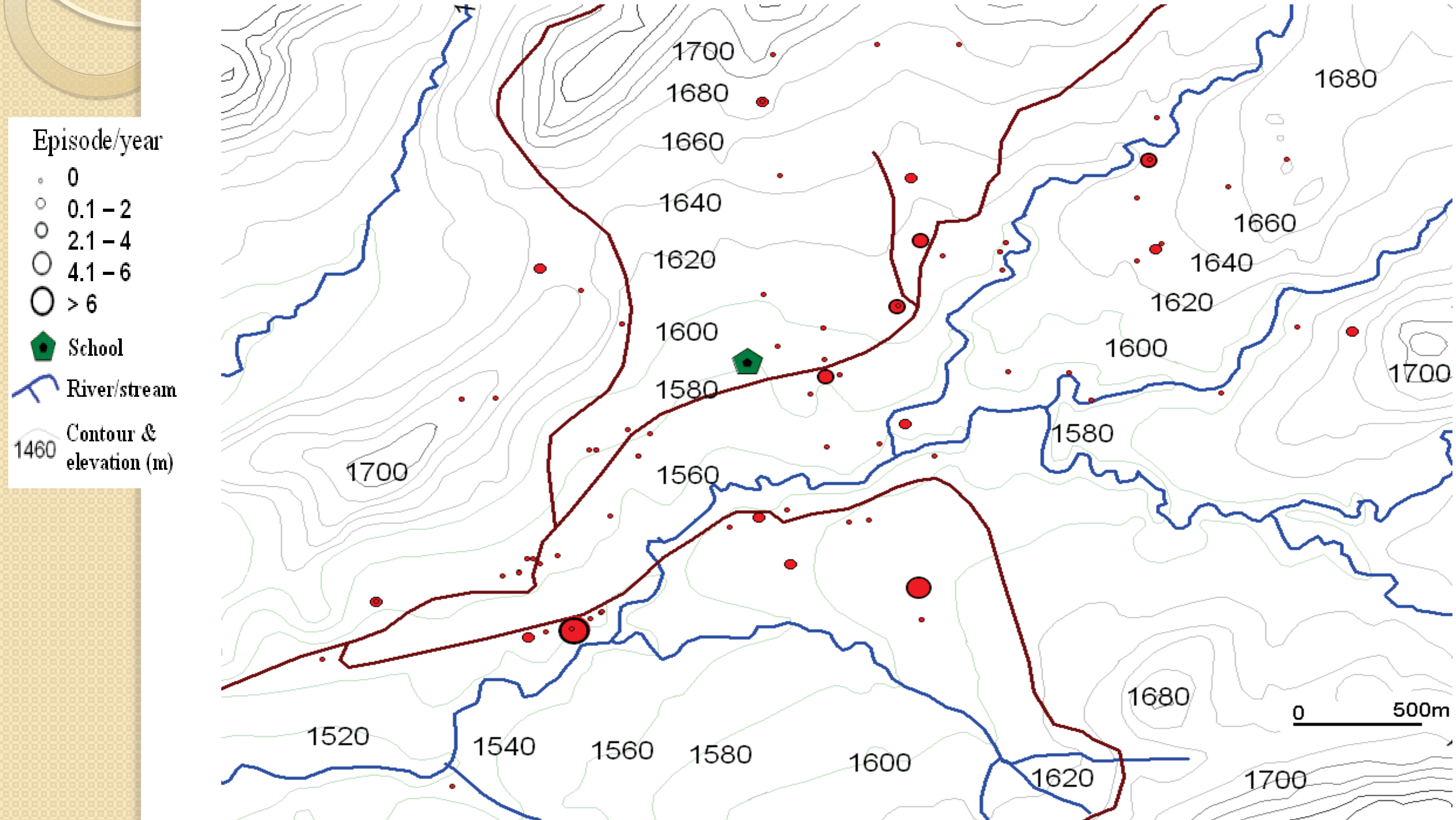
Many episodes of malaria per year in "U" shaped valley



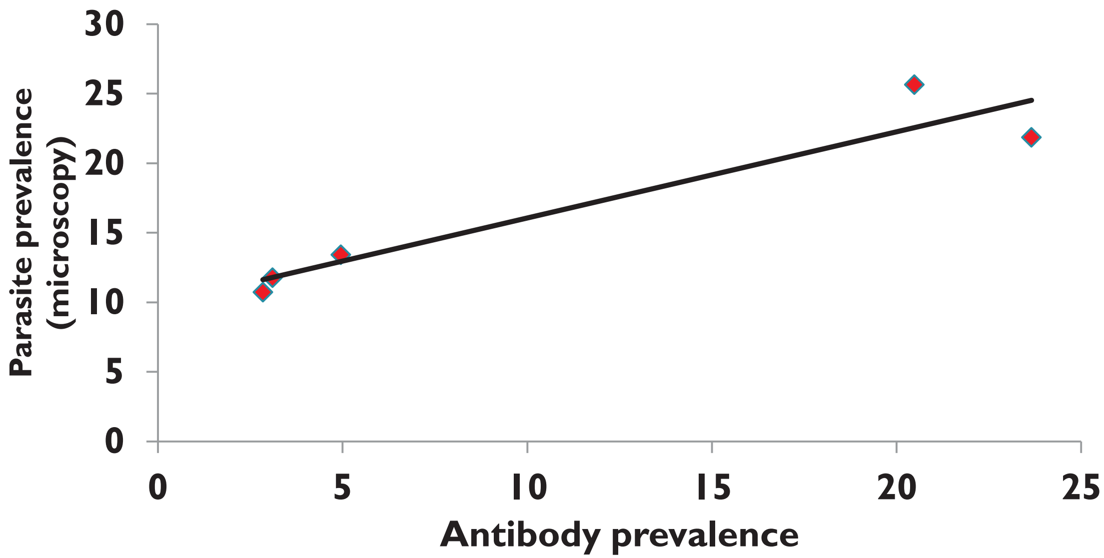
Many episodes of malaria per year in “U” shaped valley

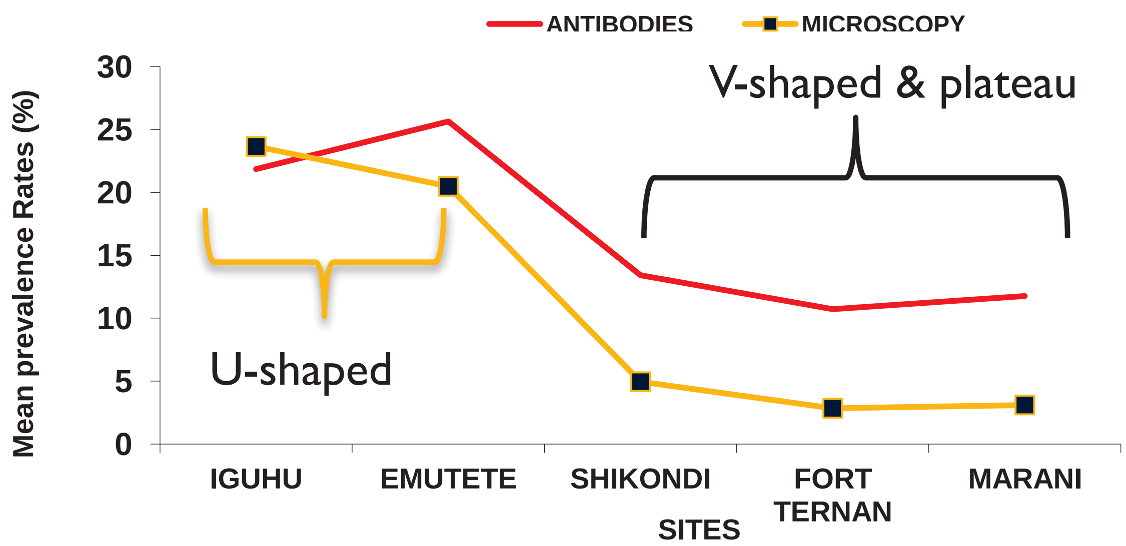
A V shaped valley with a good drainage: poor mosquito breeding

Few episodes of malaria in “V” shaped valley ecosystem

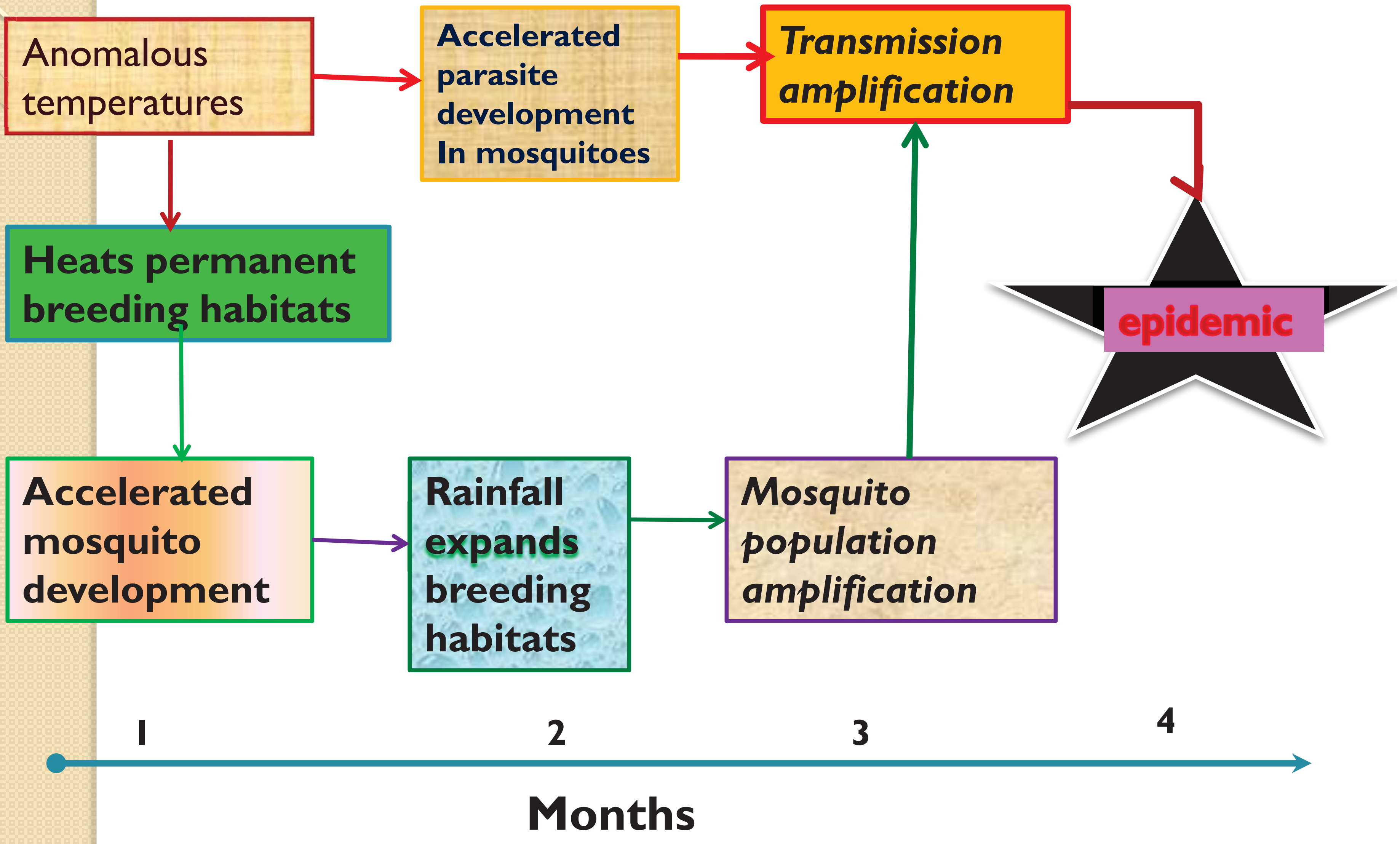


Low malaria prevalence low immunity: high epidemic risk





Evolution of malaria epidemics



Models using climate data

Additive model

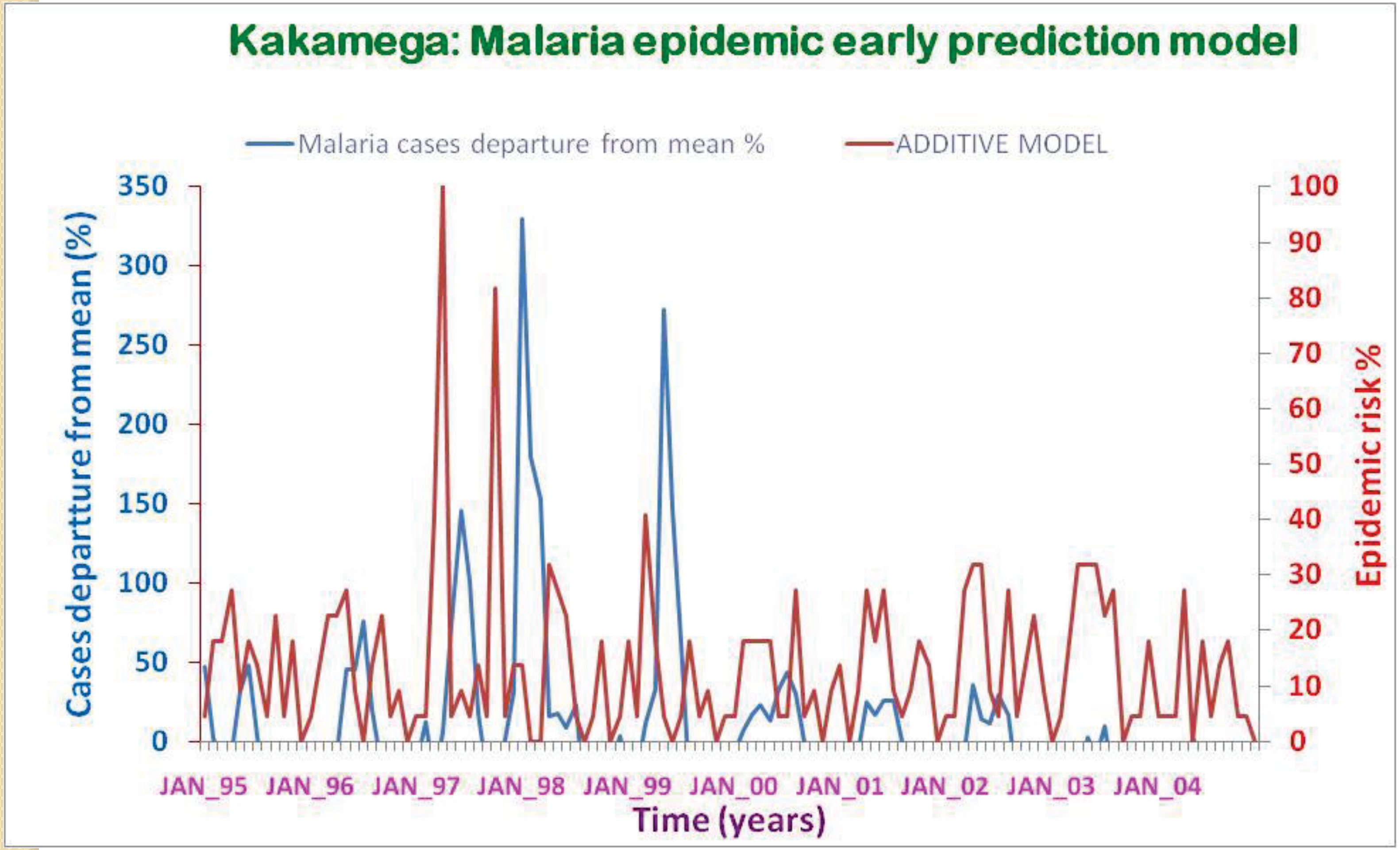
$$ER = \frac{T^{i} + R^{i+2}}{T^{m} + R^{m}} x100$$

Multiplicative model

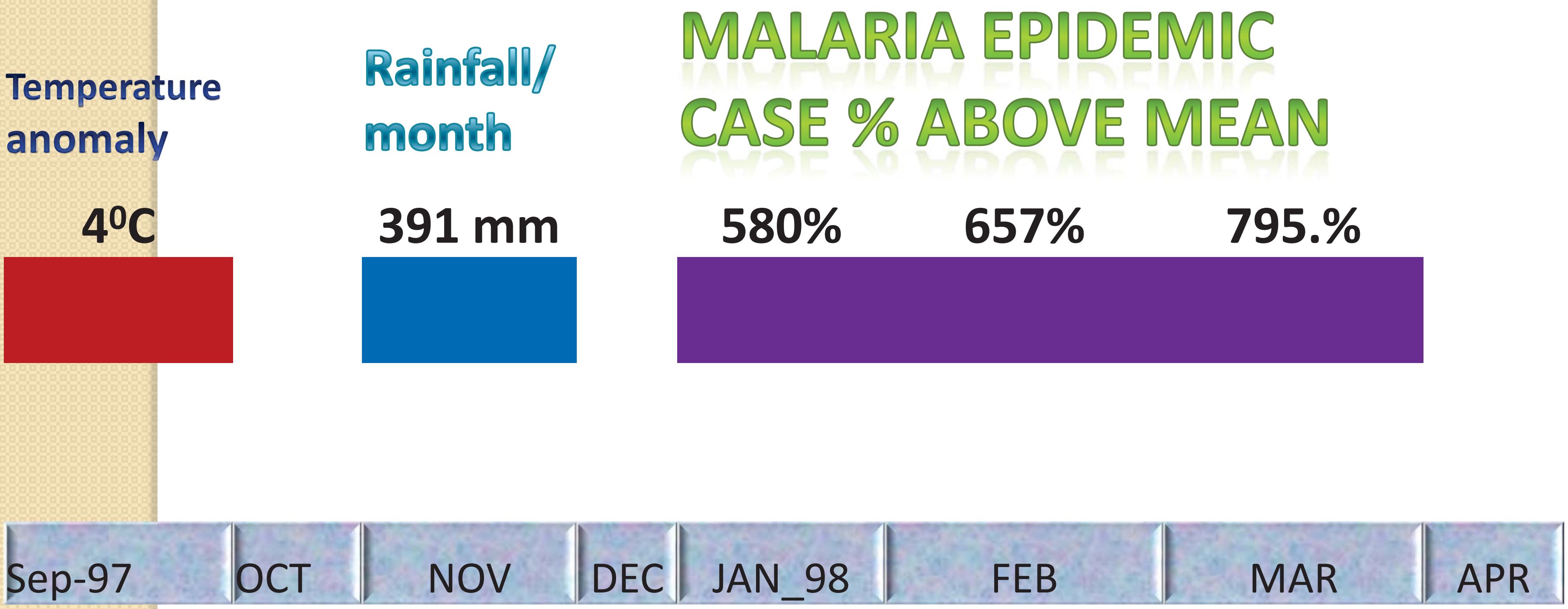
$$ER = \frac{T^{i} x R^{i+2}}{T^{m} x R^{m}} x100$$

18+C model

$$ER = \frac{18 - T^{i} x R^{i}}{T^{m} x R^{m}} x100$$


Kakamega: Malaria epidemic early prediction model
Malaria cases departure from mean %
ADDITIVE MODEL
Cases departure from mean (%)
350
300
250
200
150
100
50
0
100
90
80
70
60
50
40
30
20
10
0
Epidemic risk %
JAN_95 JAN_96 JAN_97 JAN_98 JAN_99 JAN_00 JAN_01 JAN_02 JAN_03 JAN_04
Time (years)

Evolution of an epidemic in Multiplicative model (Kericho)



Vector distribution and control

- In the highlands 98% of the malaria mosquitoes are found in houses less that 500 meters from breeding habitats at the valley bottom
- Targeting these houses for indoor resting spry is highly effective and efficient strategy for malaria epidemic control

Targeted IRS Iguhu Kakamega

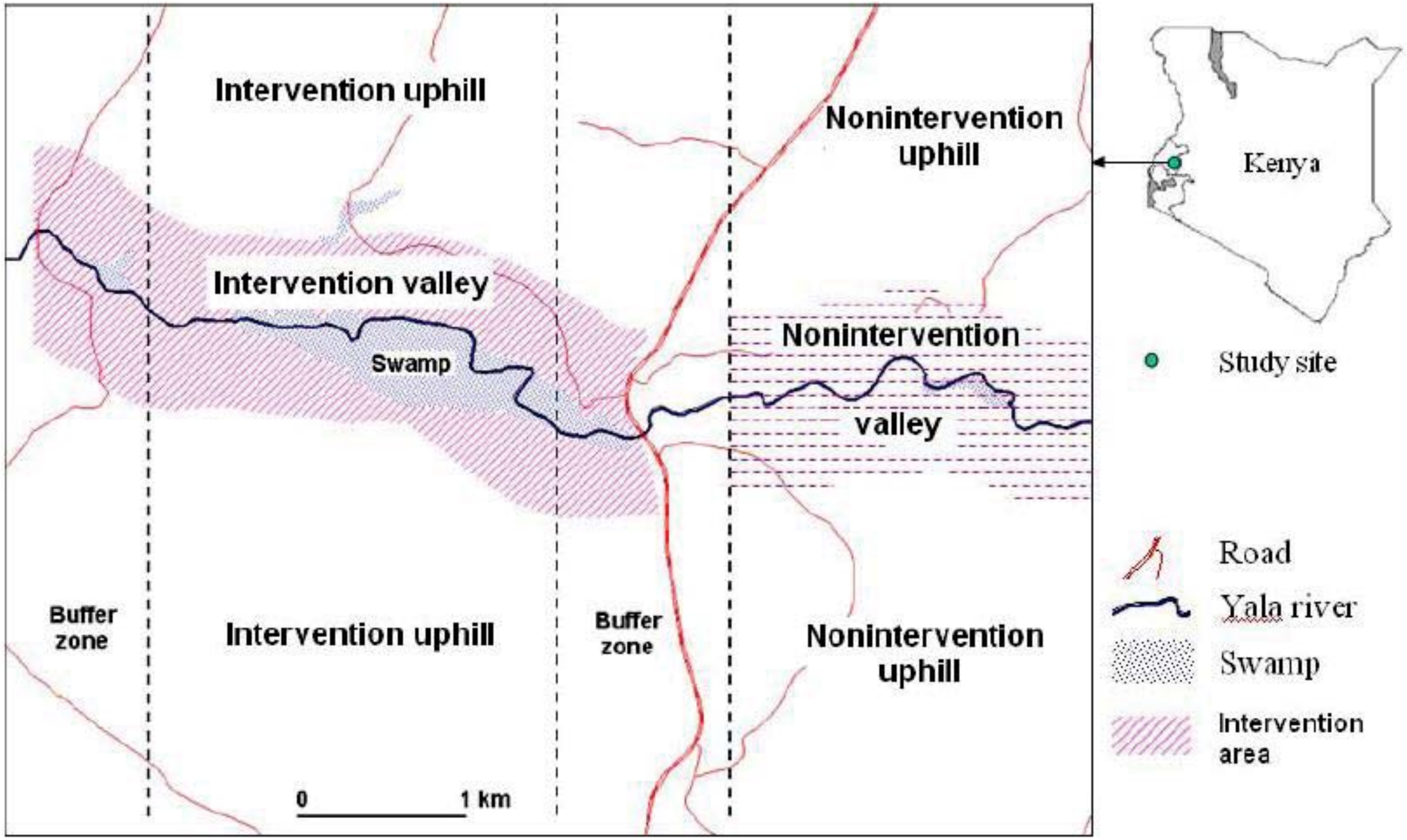


Figure 1 Study area and experiment design. Intervention and nonintervention valleys are defined as the area within 500 m of the Yala river in the intervention and nonintervention zones.


A
B
C
D
E
F

Impacts of house modification

- House modification can reduce the the numbers of indoor mosquitoes by 88%
- The modification stabilizes the indoor temperatures, cooling the houses during the day and keeping them warm at night.
- The ceiling improves the house esthetics
- This is local technology that is affordable and acceptable by the local populations

Malaria epidemics

- Climate variability can increase the number of malaria cases by 100-700% and mortality by 500%
- Areas are most affected by the epidemics are the highlands of Kenya Uganda, Tanzania Ethiopia, Rwanda and Burundi and Madagascar
- An early epidemic warning system was developed for early prediction and prevention of the epidemic

Adaptation to climate change Malaria

- Develop climate based early epidemic prediction models
- Identify new areas affected by malaria transmission
- Identify epidemic hotspots
- Use universal application of insecticide treated bed nets
- Apply targeted Indoor residual Spraying (IRS)

ADAPT

THANK YOU

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