

## Climate Impacts on Malaria Transmission and the Development of an Early Warning System

(supported by the *Climate Variability and Human Health Program*)

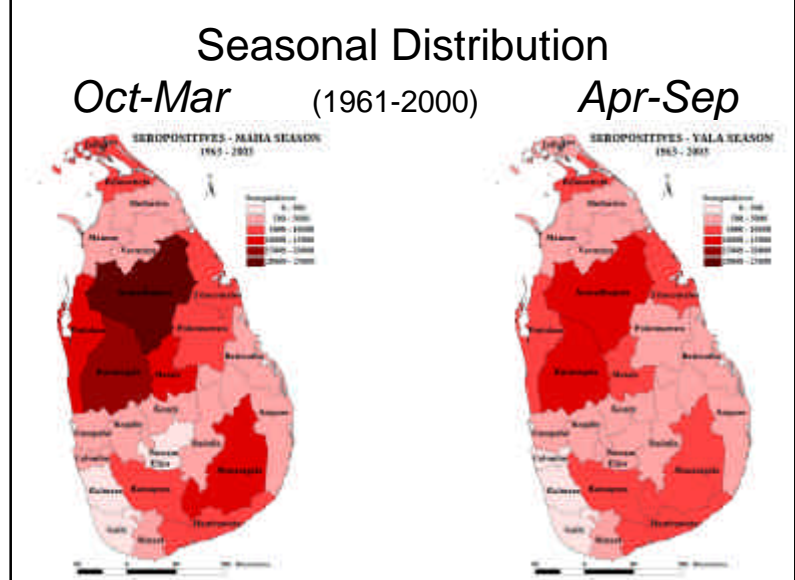
Lareef Zubair

International Research Institute for Climate and Society

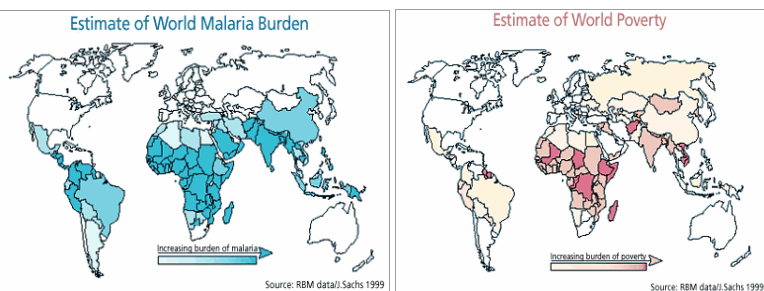
+ many others

Partners in Collaborative Project:

- International Water Management Institute
- Anti-Malaria Campaign, Sri Lanka
- University of Kelaniya, Sri Lanka
- Columbia University Climate Group
- Land Surface Modeling Group, NASA/GSFC
- Foundation for Environment, Climate and Technology, Sri Lanka.



## Malaria Burden and Poverty

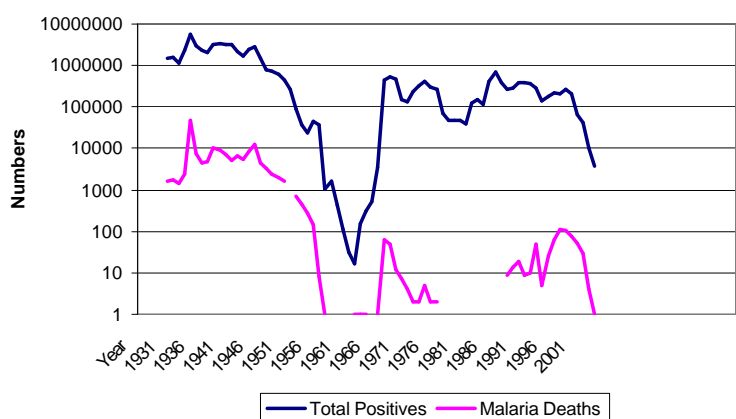


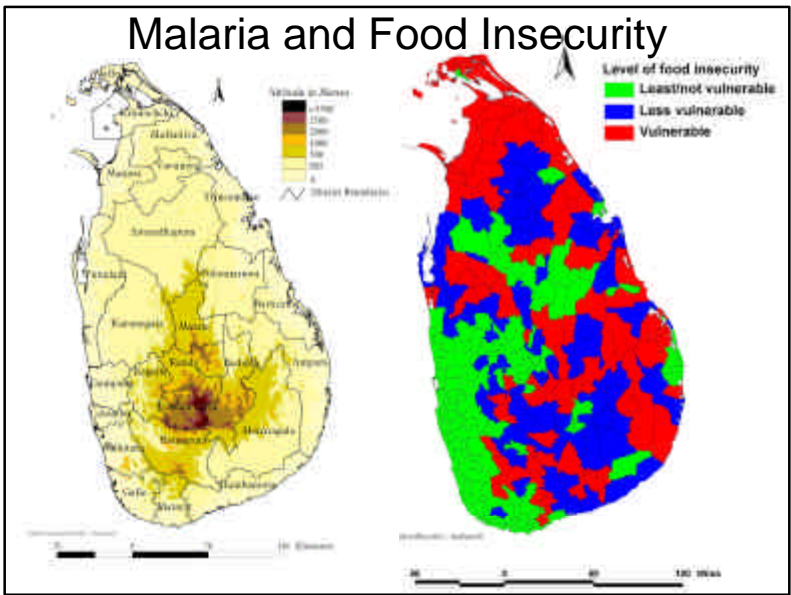
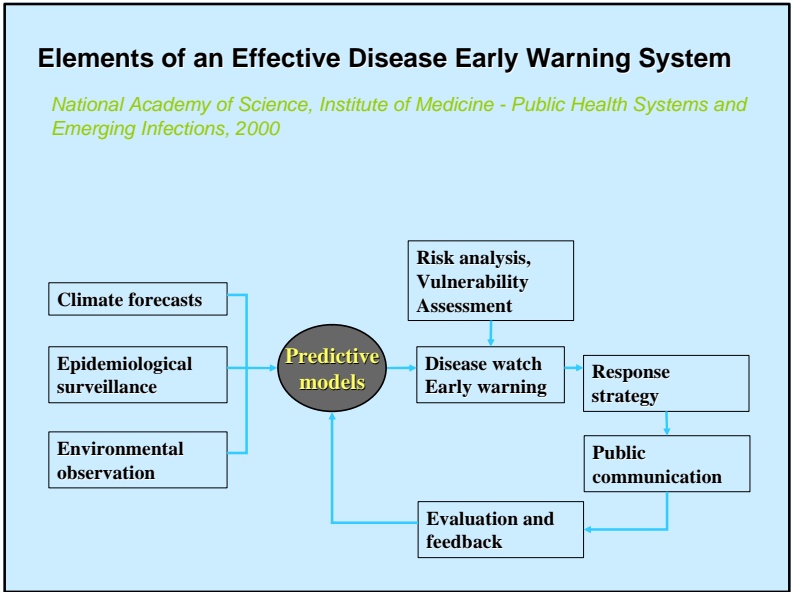
Source: Sachs, 1999

## Epidemiology of malaria

- Annual Average case load ~ 500,000 for 20 million persons.
- Parasites
  - *Plasmodium vivax* (75%, 2003 – 88%)
  - *Plasmodium falciparum* (25%, 2003 –12%)
- Vector mosquitoes
  - *Anopheles culicifacies*
  - *Anopheles subpictus*
  - *Anopheles annularis*

## Annual Morbidity and Mortality (1931-2002)



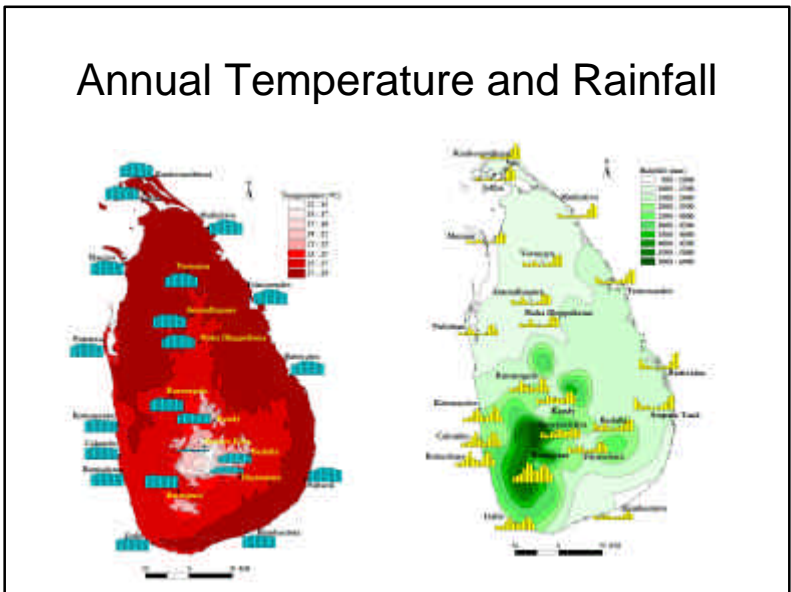


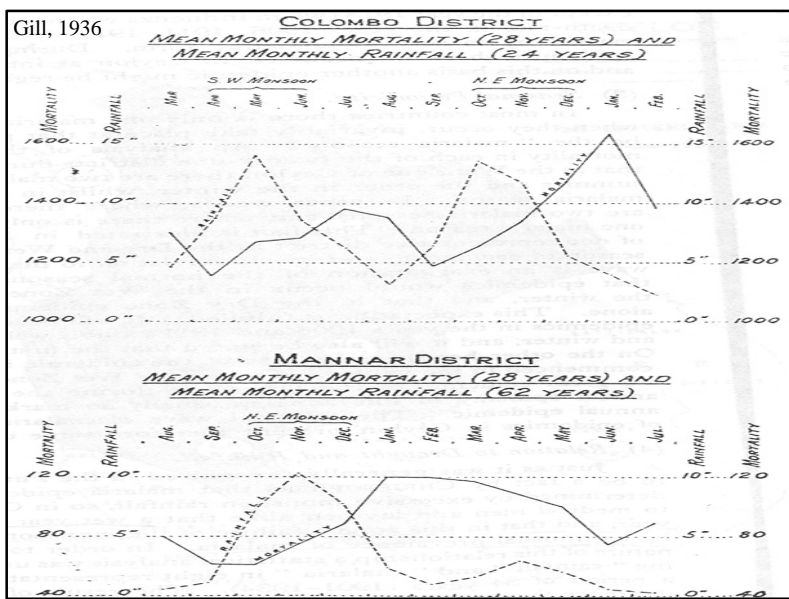
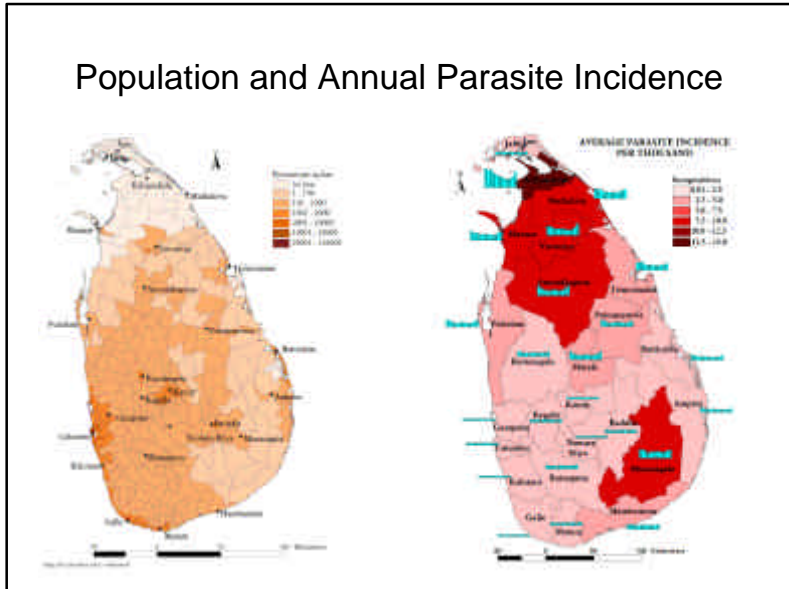
### Workshop on “The development of an early warning system”

09<sup>th</sup> December 2003

Uva Management Development Training Institute, Passara

Regional Malaria Officers,  
Department of Health,  
Provincial government,  
University researchers,  
Department of Meteorology  
Aurelia Micko/OGP





### HURULUWEWA, SRI LANKA

Amerasinghe et al

- Watershed forest and ancient tank-cascade rice and slash-and-burn agricultural system
- 3000 people live in the watershed area within 3 km. of the stream

Research in 1994-1999 established that the Yan oya stream was the major malaria vector breeding habitat

### CLIMATE FACTORS IN MOSQUITO-BORNE VIRUS TRANSMISSION

**Temperature**

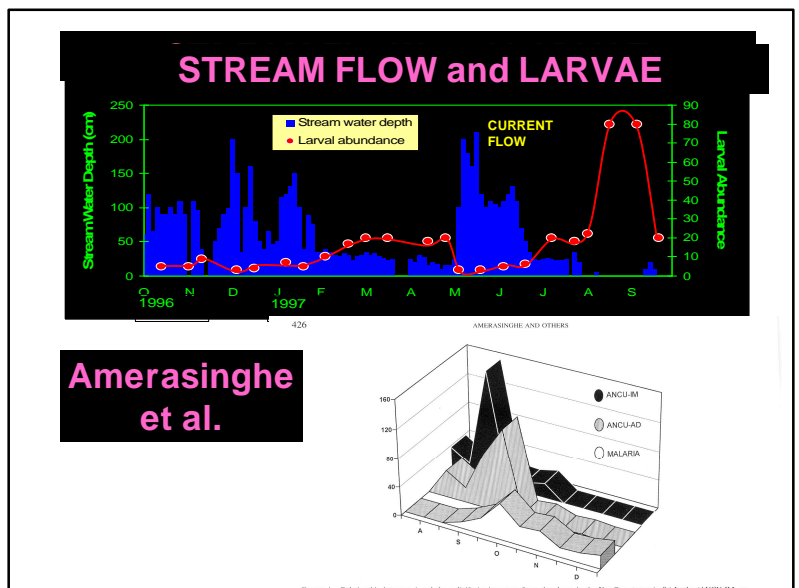
- <Mosquito generation times [>Pop. growth rate]
- <Mosquito survivorship [<Life expectancy]
- <Extrinsic incubation period of virus [>Transmission rate]

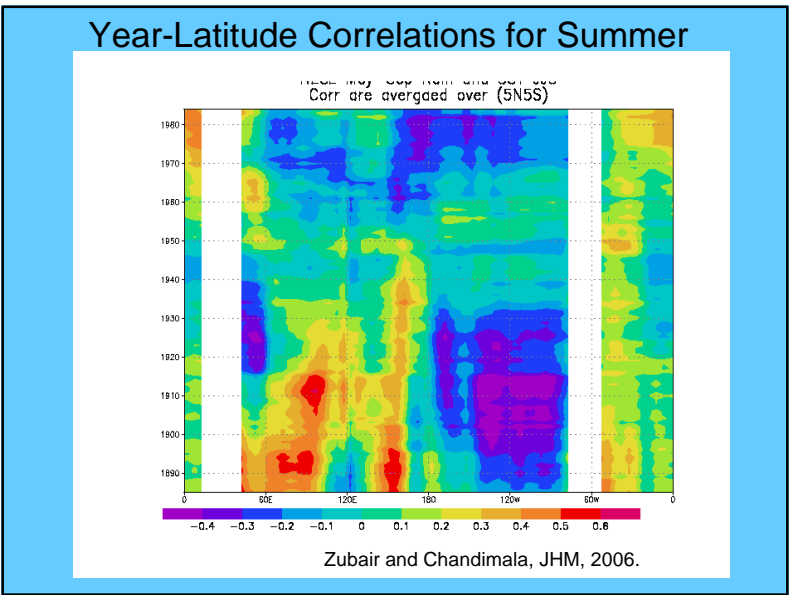
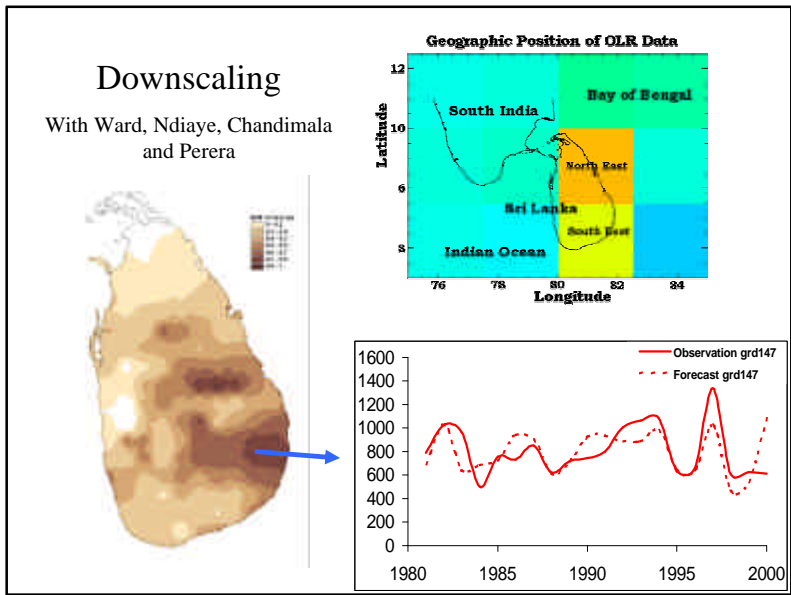
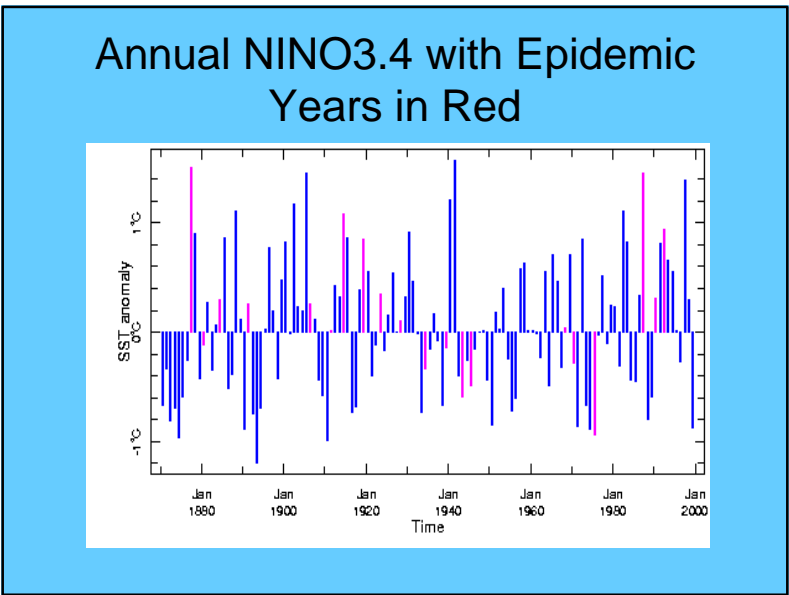
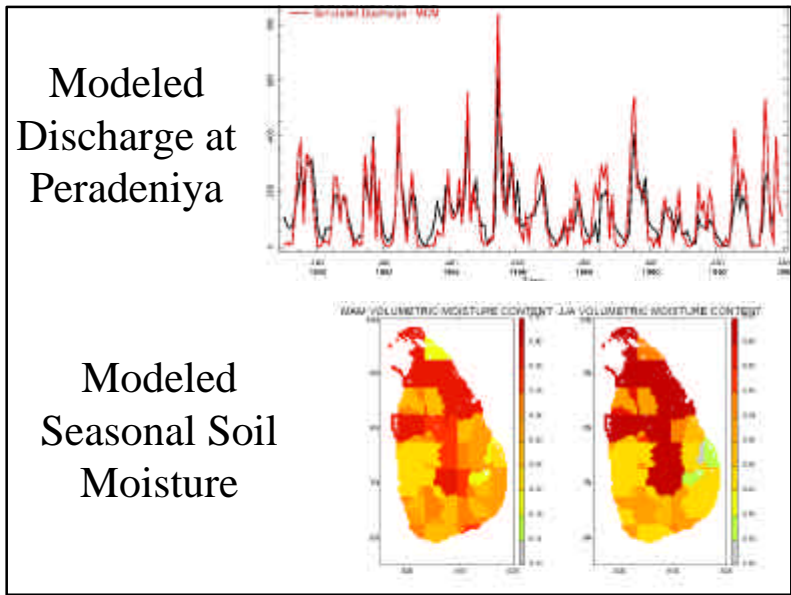
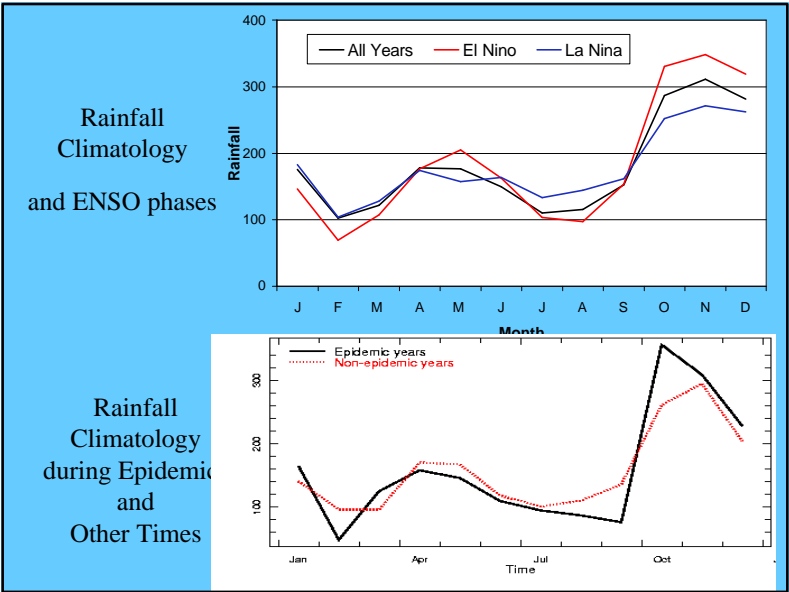
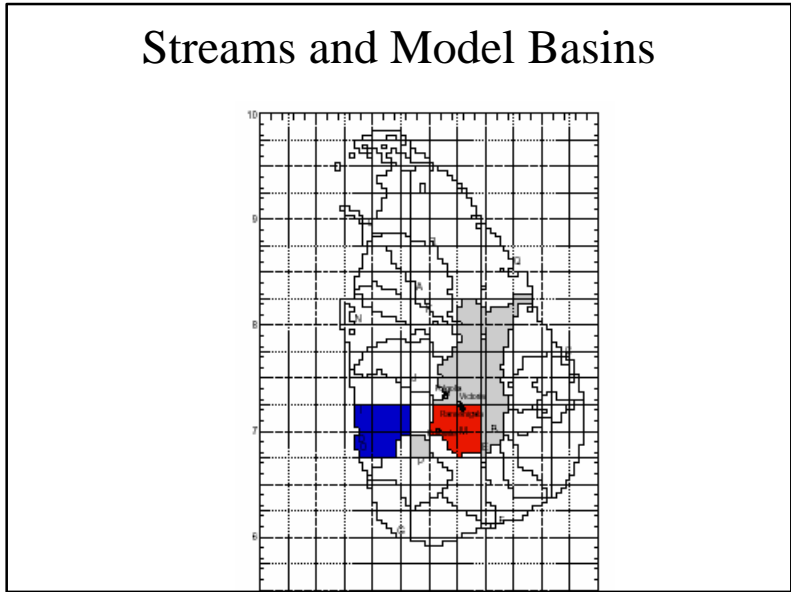
**Water**

- >Mosquito oviposition and larval habitats
- >Mosquito population size [immediate]
- >Vertebrate host population size [time delay]

**Relative Humidity**

- >Survivorship





## What have we learned?

- Climate related information is useful.
  - Ecosystems can be responsive to climate.
  - Need to work at relevant time scale
- Weather/Climate information is needed.
- In-depth place-specific, fine-scale hydro-meteorological information and research needed.
- Climate information has to be transformed to the salient attributes incorporating environmental, epidemiological and vulnerability information
- Partnership, technology development.
- This work is labor intensive.

## IRI's Mahaweli River Basin Projects

THE EARTH INSTITUTE  
AT COLUMBIA UNIVERSITY

January 2000 onwards

IRI  
International Research Institute  
for Climate Prediction  
and Data Interpretation

CLIMATE ANALYSIS

CLIMATE & WATER MANAGEMENT

CLIMATE & TEA

CLIMATE & RICE

CLIMATE & HUMAN-ELEPHANT CONFLICT

CLIMATE & MALARIA

CLIMATE & NATURAL DISASTERS

CAPACITY BUILDING

<http://iri.columbia.edu/~mahaweli>