Malaria Modeling and Surveillance
In Thailand and Indonesia

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Meteorological & Climatological Parameters

THE PROBLEM
- 40% of the world’s populations at risk
- 300-500 million cases per year
- 1-3 million deaths per year
- Highest risks for children, pregnant women, and people with depressed immunoresponse
- One death every 30 seconds
- Counterfeit and substandard antimalarials drugs abound.
- ACT is becoming less sensitive.
- Previously unaffected regions may have outbreaks due to climate change.

OBJECTIVES
- Risk detection: Detection of larval habitats
- Risk prediction: Prediction of current and future endemicity
- Risk reduction: Identification of key factors that sustain or promote transmissions

BENEFITS
- Applying larval control as a preventive measure
- Strengthening and mobilizing public health support
- Cost-effectively curtailing malaria transmission

In Collaboration With
- WHO SEARO
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  Dr. Russell Coleman
  Dr. Gabriela Zollner
- AFRIMS
  Dr. James Jones (retired)
  Dr. Jetsumon Sattabongkot
- NDVECC
  Dr. Craig Stoops
- USDA APHIS
  Dr. Bimo Wicaksana

NASA’s Earth Observing System

Vector Ecology
Predator Ecology
Anthropogenic Factors
Local Environment

AGRICULTURAL PRACTICE
ROAD BUILDING
DEFORESTATION
MILITARY CONFLICT
REFUGEE
ECONOMIC CRISIS
MEDICAL CARE

http://ntrs.nasa.gov/search.jsp?R=20090006631 2020-06-29T05:10:03+00:00Z
The Greater Mekong Subregion is the world’s epicenter of multi-drug resistant falciparum malaria.

Most Thai provinces endemic with malaria are border provinces.

40% of the 245M Indonesians Live in Malarious Regions

Malaria Incidence in Aceh Increased Significantly After the Tsunami Disaster in December 2004

Detection of Ditches using Pan-sharpened Ikonos Data

(Anwil Habitats of Anopheles sinensis in Korea)
Classification Accuracy using Pan-Sharpened Ikonos Data (1 meter resolution)

Satellite-Observed Meteorological & Environmental Parameters For Four Thailand Seasons

- Surface Temperature: MODIS Measurements
- Vegetation Index: AVHRR & MODIS Measurements
- Rainfall: TRMM Measurements

Actual Malaria Incidence vs Hindcast Incidence

Satellite-Observed Meteorological & Environmental Parameters For Four Thailand Seasons

Kong Mong Tia Test Site, Kanchanaburi, Thailand

In Collaboration with AFRIMS and WRAIR

Kong Mong Tia Test Site, Kanchanaburi, Thailand

Example: A Small Hamlet

23 houses
2 cattle sheds
24 clusters of larval habitats
69 adults
23 children
8 cows

Modeled and Observed Prevalence

Modeled and Observed Sporozoite Rates

Modeled and Observed Entomological Inoculation Rates

Well Placed Farm Animal Sheds and Zoonotic Prophylaxis May Significantly Reduce Malaria Transmission

Sensitivity Studies and Simulations Performed

Using Agent-Based Discrete Event Simulation Model

- Abundance of larval habitats
- Access to health care and appropriate treatment
- Asymptomatic cases
- Acquired immunity
- Active and passive case detections
- Bednets or personal protections
- Improved dwelling construction
- Parasite infectivity in mosquitoes
- Zoonotic prophylaxis
- Arrival of non-immune populations (such as migrant workers, refugees, foreign military forces)
With over 18,000 islands and a decentralized government, it is challenging to implement malaria control policy.

**Rainfall Pattern, Which Drives Malaria Transmission, Varies Significantly from Island to Island**

Average Monthly Precipitation for the Major Cities on the 8 Islands 2000-2005

**Precipitation Based on TRMM Measurements**

Hindcasting Malaria Cases in Jawa Tengah, Indonesia

Actual (red), Modeled (blue), and Hindcast (green) Malaria Cases

**Districts Involved in Menoreh Hills Project**

- A MOH-WHO-NAMRU2-USAID Collaboration

**Comparison of Kulong Progo and Purworejo ACD Cases (blue) with Jawa Tengah PCD Cases (red)**
Thank you!

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