

Title:	Modeling malaria transmission in Thailand and Indonesia
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<p>Abstract: (Your abstract <u>must</u> use Normal style and <u>must</u> fit in this space. Your abstract should be no longer than 300 words. This space will 'expand' over 2 pages as you add text/diagrams into it.)</p>	<p>Malaria Modeling and Surveillance is a project in the NASA Applied Sciences Public Health Applications Program. The main objectives of this project are: 1) identification of the potential breeding sites for major vector species; 2) implementation of a malaria transmission model to identify the key factors that sustain or intensify malaria transmission; and 3) implementation of a risk algorithm to predict the occurrence of malaria and its transmission intensity. Remote sensing and GIS are the essential elements of this project. The NASA Earth science data sets used in this project include AVHRR Pathfinder, TRMM, MODIS, NSIPP and SIESIP.</p> <p>Textural-contextual classifications are used to identify small larval habitats. Neural network methods are used to model malaria cases as a function of precipitation, temperatures, humidity and vegetation. Hindcastings based on these environmental parameters have shown good agreement to epidemiological records. Examples for spatio-temporal modeling of malaria transmissions in Southeast Asia are given.</p> <p>Discrete event simulations were used for modeling the detailed interactions among the vector life cycle, sporogonic cycle and human infection cycle, under the explicit influences of selected extrinsic and intrinsic factors. The output of the model includes the individual infection status and the quantities normally observed in field studies, such as mosquito biting rates, sporozoite infection rates, gametocyte prevalence and incidence. Results are in good agreement with mosquito vector and human malaria data acquired by Coleman <i>et al.</i> over 4.5 years in Kong Mong Tha, a remote village in western Thailand.</p> <p>Application of our models is not restricted to Southeast Asia. The model and techniques are equally applicable to other regions of the world, when appropriate epidemiological and vector ecological parameters are used as input.</p>

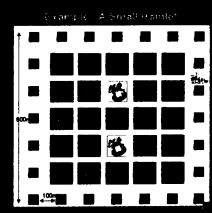


Modeling Malaria Transmission in Thailand and Indonesia

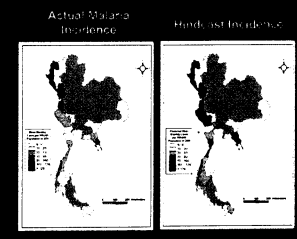
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Remote Sensing Satellite Observations
Malaria is a major public health problem in Thailand and Indonesia. Malaria is a mosquito-borne infectious disease that affects humans and other animals. Malaria is caused by parasites that are transmitted to humans through the bites of infected female Anopheles mosquitoes. The parasites multiply in the liver and then travel to the red blood cells.



Example of a 5x5 grid map showing transmission indicators. The grid is divided into 25 cells, with some cells shaded to represent different transmission levels.



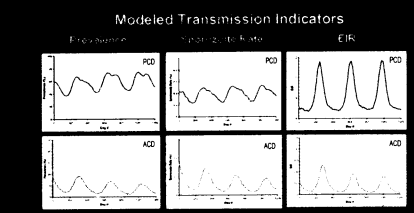
Actual Malaria Incidence and Highest Incidence maps of Thailand. The maps show the geographical distribution of malaria cases in Thailand.



Satellite image of a landscape with a legend for vegetation indices. The legend includes: NDVI, NDWI, NDBI, NDMI, NDSI, NDSI2, NDSI3, NDSI4, NDSI5, NDSI6, NDSI7, NDSI8, NDSI9, NDSI10, NDSI11, NDSI12, NDSI13, NDSI14, NDSI15, NDSI16, NDSI17, NDSI18, NDSI19, NDSI20, NDSI21, NDSI22, NDSI23, NDSI24, NDSI25.



Detection of Ditches using Tometer Data. Tometer data is used to detect ditches in a landscape, which are important for malaria transmission.



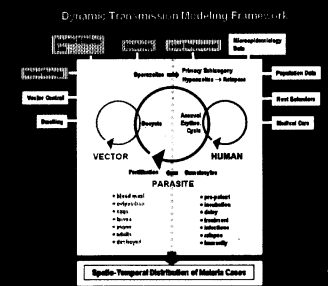
Modeled Transmission Indicators showing graphs for EIR, PCD, and ACD. The graphs show the temporal dynamics of these indicators over time.



Ban Kong Mung Tha study site. The site is a rural area in Thailand, used for malaria transmission studies.



Comparison of Transmission Indicators. The map shows the spatial distribution of transmission indicators across the study site.

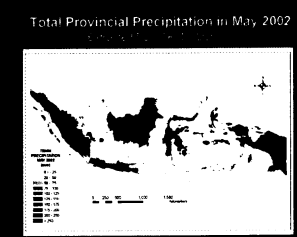


Dynamic Transmission Modeling Framework. The diagram illustrates the complex interactions between the vector, parasite, and human host in the transmission cycle.

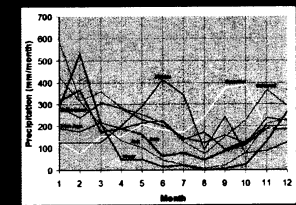
The model is a dynamic transmission model that takes into account the spatial and temporal dynamics of malaria transmission. It is used to predict the impact of different interventions on malaria transmission.



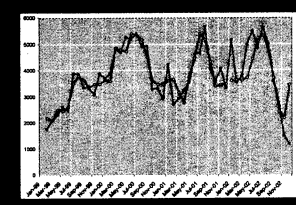
Satellite images of the study site showing vegetation and a pond. The images are used to analyze the environmental factors that influence malaria transmission.



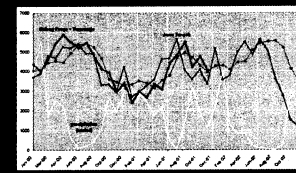
Total Provincial Precipitation in May 2002. The map shows the distribution of precipitation across the provinces of Thailand.



Precipitation patterns graph showing monthly precipitation in millimeters. The graph shows the seasonal variation in precipitation.



Actual observed modeled time series plot of malaria incidence. The plot compares the actual observed incidence with the modeled incidence over time.



Time series plot of malaria incidence showing observed and modeled data. The plot shows the temporal dynamics of malaria incidence.

We seek collaboration for malaria studies in other parts of the world. Please contact Richard.Kiang@NASA.gov if you are interested.