Vector Hazard Report: Malaria Risk in Indonesia

Information gathered from products of The Walter Reed Biosystematics Unit (WRBU)

Systematic Catalog of Culicidae
VectorMap

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Climate Impacting Malaria Transmission
Climate of Indonesia

Month of maximum precipitation, WorldClim (50 year average)

Month of maximum temperature, WorldClim (50 year average)
Monthly Climate Maps

Click here to view the maps described below

Rainfall
This map shows the accumulated rainfall for the past month. Updated monthly.
-NASA Earth Observations

Consistent Above and Below Average Precipitation
Areas with consistent above average monthly rainfall over the past 3 months may indicate increased mosquito breeding sites which may lead to increased mosquito-borne disease transmission. Areas with consistent below average rainfall may also indicate increased water storage or ponding which can provide additional habitat for mosquito species that lay eggs in human containers, protected micro environments, or long lasting pools. Updated monthly. -NASA Earth Observations.

Drought Breaking Rain
Areas receiving above average rainfall for the past month and below average rainfall for the previous 12 months. Drought breaking rain may indicate recent suitable conditions for vectors and diseases in a stressed environment or human population. Updated monthly. -WorldClim, Giovanni online data system NASA GES DISC, Tropical Rainfall Measuring Mission (TRMM).

Temperature anomaly
This map shows where earth’s temperatures were warmer or cooler in the daytime for the past month than the average temperatures for the same month from 2001-2010. Updated monthly.
-NASA Earth Observations

Land Surface Temperature
This map shows the temperature of the earth’s lands during the daytime. Updated monthly.
-NASA Earth Observations

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Soil Drainage (Harmonized World Soil Database 1.1; 0.02 Deg resolution)
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Malaria Risk Maps

The number of infectious days (by month) in which the annual temperature regime could support malaria infection.

Gething et al. 2011

Plasmodium falciparum

Plasmodium vivax
Malaria Risk Maps

The normalized $Z(T)$ index of temperature suitability that incorporates the duration and degree of suitability across an average year

Gething et al. 2011

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Malaria Risk Maps

Stratified estimate proportion of 2-10 year olds in the general population that are infected with *P. falciparum* at any one time averaged over the 12 months of 2010. -Malaria Atlas Project
Malaria Risk Maps

Stratified estimate proportion of the general population that are infected with *P. vivax* at any one time averaged over the 12 months of 2010. -Malaria Atlas Project
Dominant Malaria Vectors
For a high resolution view of this map visit the Malaria Atlas Project

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Maxent model of *An. annularis*, Nyari, A. 2011
Primary Malaria Vectors: Bionomics and Medical Importance
Bionomics:
Larvae found primarily in flooded rice fields, grassy ponds and stream margins. Also found in Nippa palm swamps, stream pools, fresh water swamps, rock pools, seepage pools, and ditches. In Thailand, aconitus is found at elevations of 1 - 700m. In Indonesia, Java it is found up to 853m (Harrison 1980).

Medical Importance:
*An. aconitus* is a primary malaria vector (Harrison 1980).

[WRBU Species Page](#)
**Anopheles (Cel.) baimaii**
Sallum & Peyton, 2005

**Bionomics:**
Larval habitats of An. baimaii are usually temporary and well shaded, including small rocky pools, bamboo stumps, slit trenches, roadside puddles, cattle and domestic elephant prints, and stream pockets. This species is also reported from domestic wells, earthen pots, ceramic jars and cement tanks (Sallum, et al. 2005a,b).

**Medical Importance:**
*An baimaii* has been reported as an important vector of human malaria parasites (Sallum, et al. 2005a,b).

[WRBU Species Page]
Anopheles (Cel.) culicifacies
Giles, 1901

Bionomics:
An. culicifacies larvae are found in fresh water irrigation ditches, rain pools, pools in riverbeds, freshly dug pits or holes and wells. Females avoid oviposition sites with emergent vegetation.

Medical Importance:
An. culicifacies is considered a primary malaria vector (Harrison 1980).

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Anopheles (Cel.) dirus
Peyton & Harrison, 1979

Bionomics:
Immatures are abundant in rainy seasons and found in several small, shallow shady temporary ground pools, animal footprints, puddles on foot paths, pools in dry stream beds, springs, streams, ground pools, wheel ruts, rock pools, bamboo stumps, and depressions in hollow logs (Sallum et al. 2005b).

Medical Importance:
An. dirus is considered a primary vector of human Plasmodium parasites in forested and hilly-forested areas throughout its distribution range (Sallum et al. 2005b).

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Anopheles (Cel.) flavirostris
(Ludlow, 1914)

Bionomics:
Larvae are found in shaded and unshaded stream margins especially around roots, ground pools an shallow wells. Puri and Boyd 1949; Mendoza and Abinoja 1952. Females feed on both man and cattle and readily enter houses to bite (Puri in Boyd 1949).

Medical Importance:
An. flavirostris is considered a primary malaria vector (Puri in Boyd 1949).

WRBU Species Page
Anopheles (Cel.) maculatus
Theobald, 1901

Bionomics:
Larvae found in hilly areas in seepage springs and small streams with some sunlight. This species is frequently found in recently cleared areas with disturbed soil. The adults are primarily zoophilic (Reid 1968).

Medical Importance:
An. maculatus is considered a primary malaria vector and a vector of W. bancrofti (Reid 1968).

WRBU Species Page
Anopheles (Cel.) minimus
Theobald, 1901

Bionomics:
Larvae are found in small to moderate sized streams of clear, cool unpolluted water with partial shade and grassy margins. Other larval habitats include rock pools, sand pools next to streams, seepage pools and springs, stream pools and fallow rice fields with seepage. Females anthropophilic and endophagus (Harrison 1980).

Medical Importance:
An. minimus is considered a primary malaria vector (Harrison 1980).

WRBU Species Page
Anopheles (Cel.) subpictus
Grassi, 1899

Bionomics:
Larvae are typically found in muddy pools often near houses and in barrow pits, buffalo wallows and artificial containers (Puri in Boyd 1949, Reid 1968).

Medical Importance:
*An. subpictus* is considered a primary malaria in the Celebes but of minor importance elsewhere (Reid 1968).

[WRBU Species Page]
Anopheles (Cel.) sundaicus (Rodenwaldt, 1925)

Bionomics:
Primarily a coastal species, An. sundaicus larvae are found in sunlit brackish pools with algae. Adults bite primarily cattle but readily bite man indoors and out (Reid 1968).

Medical Importance:
An. sundaicus is considered a primary malaria vector (Reid 1968).

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Secondary Malaria Vectors: Bionomics and Medical Importance

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Anopheles (Cel.) karwari (James, 1902)

Bionomics:
Larvae of this species are found in seepages and small streams in hilly areas in the open and under light shade. Adults are primarily zoophilic (Reid 1968).

Medical Importance:
An. karwari is considered a secondary malaria vector (Reid 1968).

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Bionomics:
Larvae of this species are found in clear, still water with abundant vegetation. Habitats include ponds, swamps, rice fields. Adults are primarily zoophilic (Reid 1968).

Medical Importance:
An. *annularis* is considered a secondary vector of malaria (Reid 1968).
Human Density
People per sq. mile, LandScan 2011
References

Maxent model of predicted range for *Anopheles aconitis* Nyari, A. 2011
Maxent model of predicted range for *Anopheles baimaii* Nyari, A. 2011
Maxent model of predicted range for *Anopheles culicifacies* Nyari, A. 2011
Maxent model of predicted range for *Anopheles dirus s.l.* Nyari, A. 2011
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Maxent model of predicted range for *Anopheles sundaicus* Nyari, A. 2011
Maxent model of predicted range for *Anopheles karwari* Nyari, A. 2011
Maxent model of predicted range for *Anopheles annularis* Nyari, A. 2011

The Walter Reed Biosystematics Unit is part of the Walter Reed Army Institute of Research and is based at the Smithsonian Institution Museum Support Center. To access taxonomic keys, the Systematic Catalog of Culicidae or to learn more about WRBU visit www.wrbu.org.

VectorMap is only as good as the data you provide. If you have collection records, models or pathogen testing results please contact the VectorMap team to learn how to contribute data at mosquitomap@si.edu.

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