Vector Hazard Report:

Malaria, Leishmaniasis and Dengue Risk in Honduras

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

Systematic Catalog of Culicidae

VectorMap

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Climate Impacting Vector-born Disease Transmission

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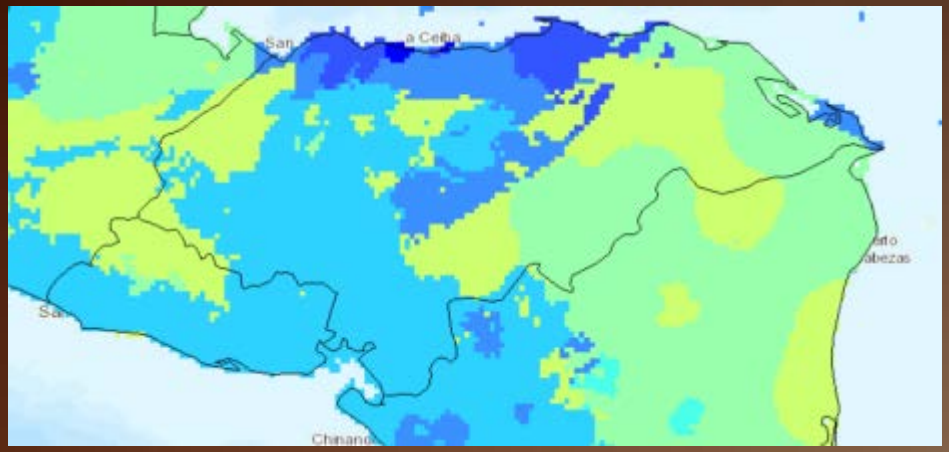
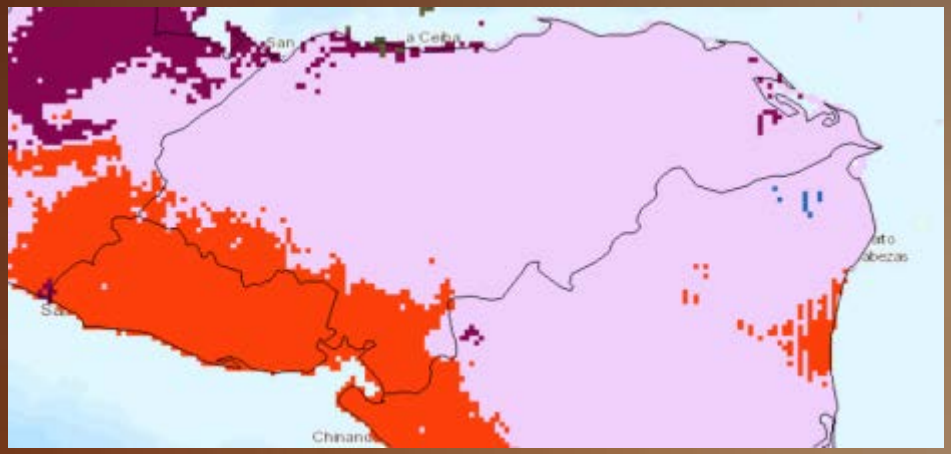
Climate of Honduras



Month of maximum precipitation, WorldClim (50 year average)



Month of maximum temperature, WorldClim (50 year average)

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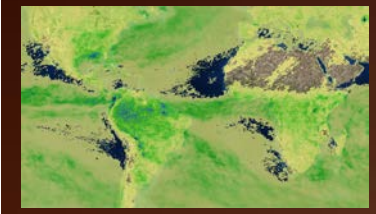
Monthly Climate Maps

Click here to view the maps described below



Rainfall

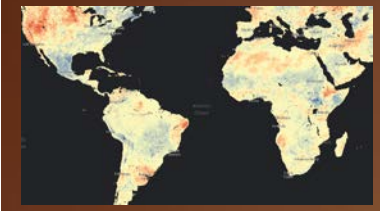
This map shows the accumulated rainfall for the past month. Updated monthly.
-NASA Earth Observations

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.

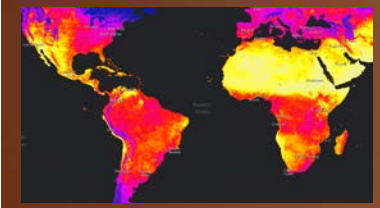
Drought Breaking Rain

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

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

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Malaria Risk Maps

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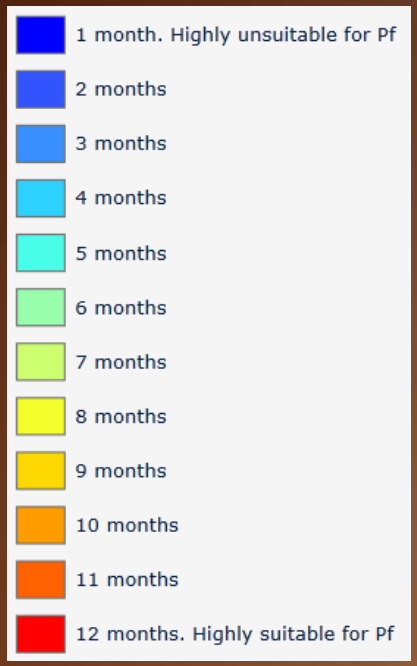
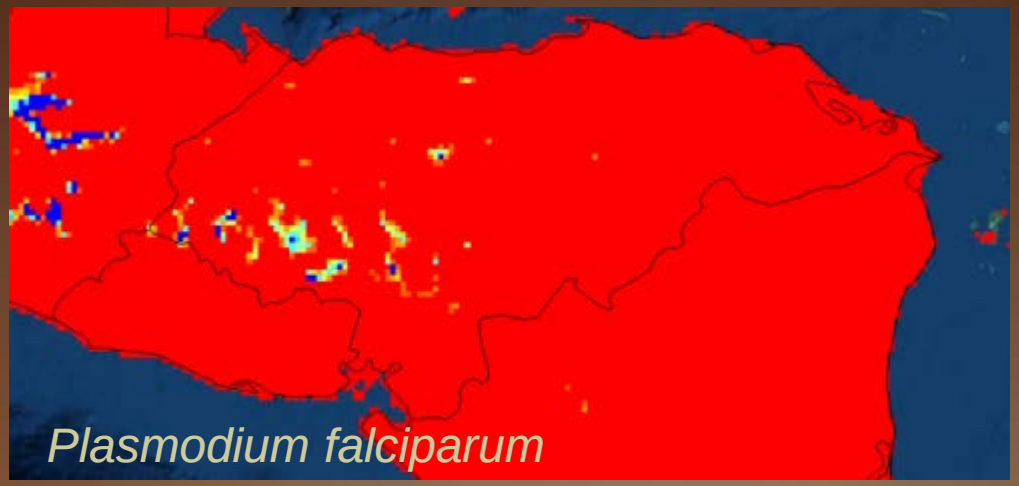
Malaria Risk Maps

The number of infectious days (by month) in which the annual temperature regime could support malaria infection.
Gething et al. 2011





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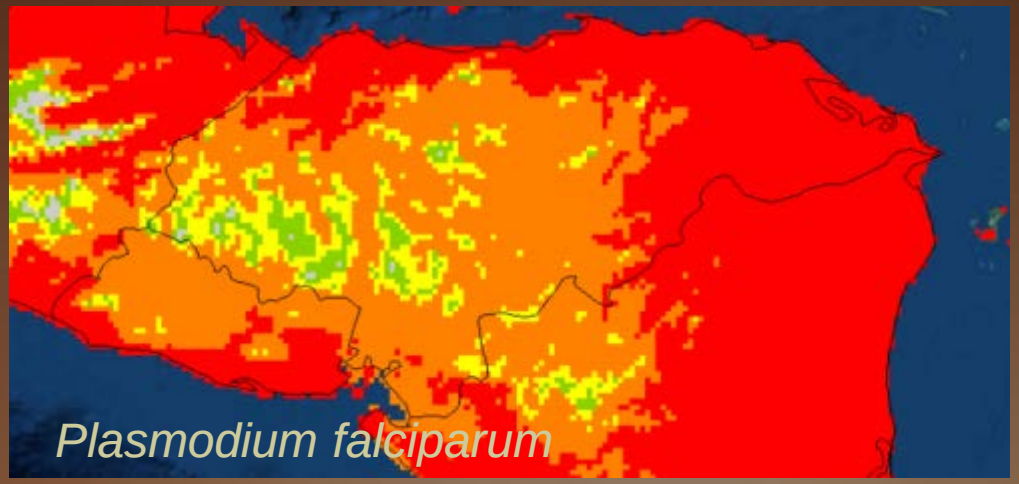
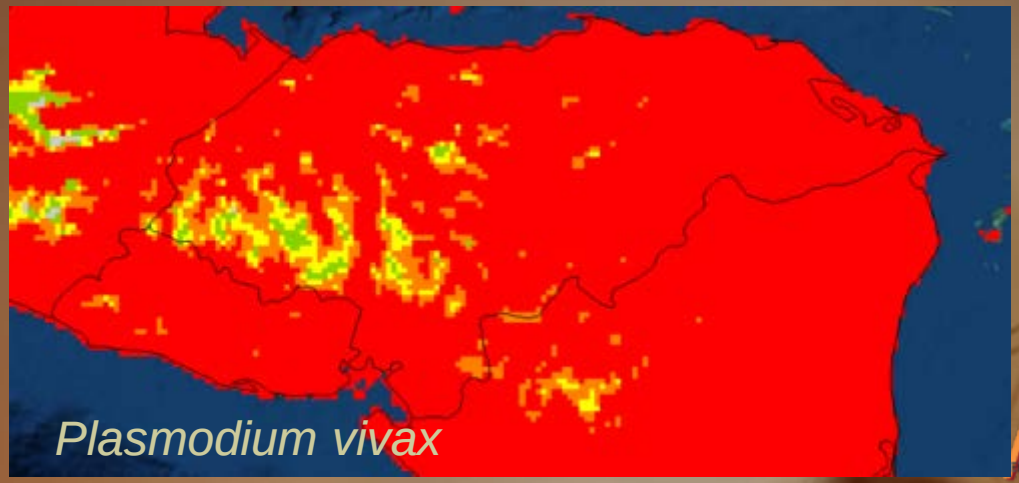
Malaria Risk Maps

The normalized Z(T) index of temperature suitability that incorporates the duration and degree of suitability across an average year
Gething et al. 2011





- Not suitable
- Low suitability
- Low to intermediate suitability
- Intermediate to high suitability
- High suitability

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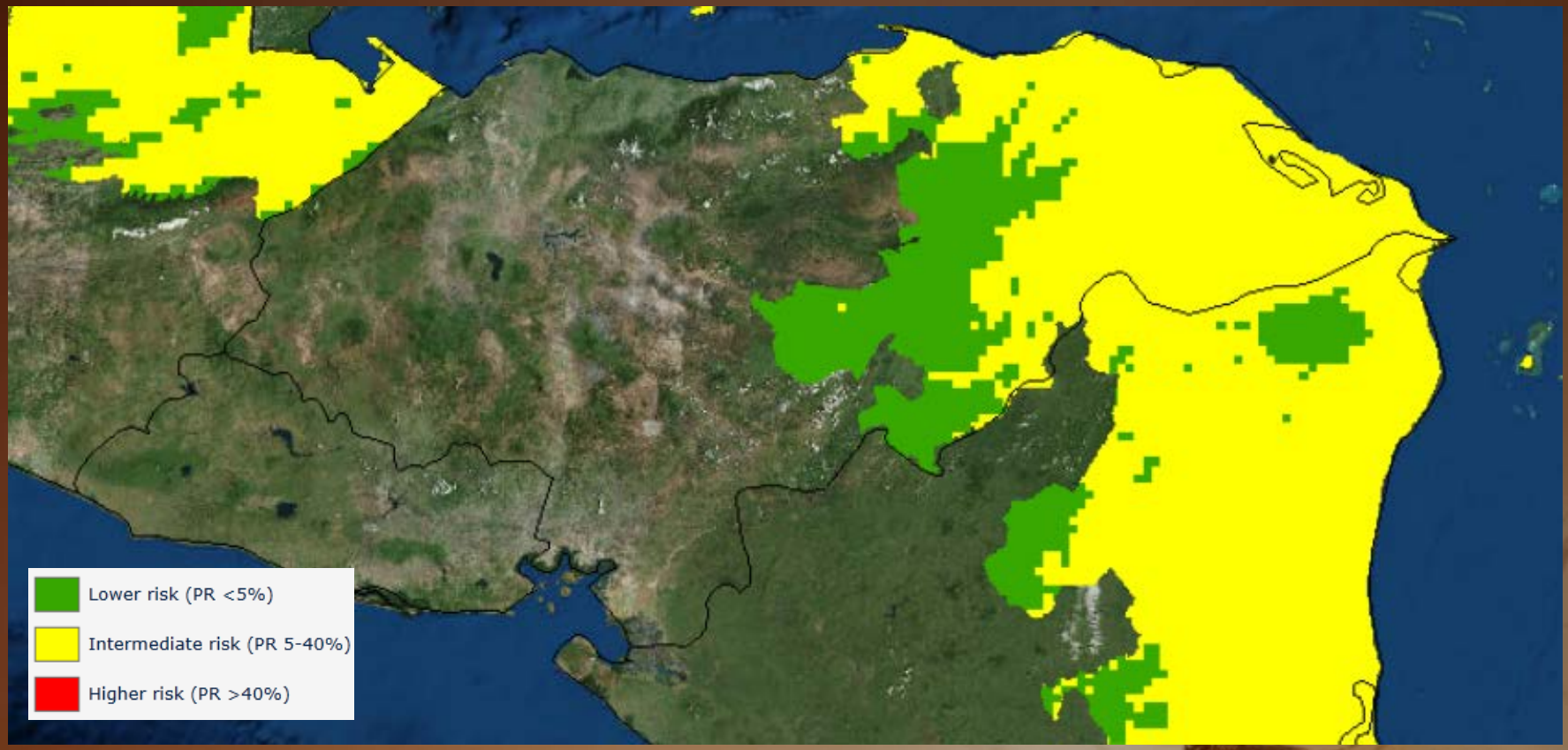
Malaria Risk Maps

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



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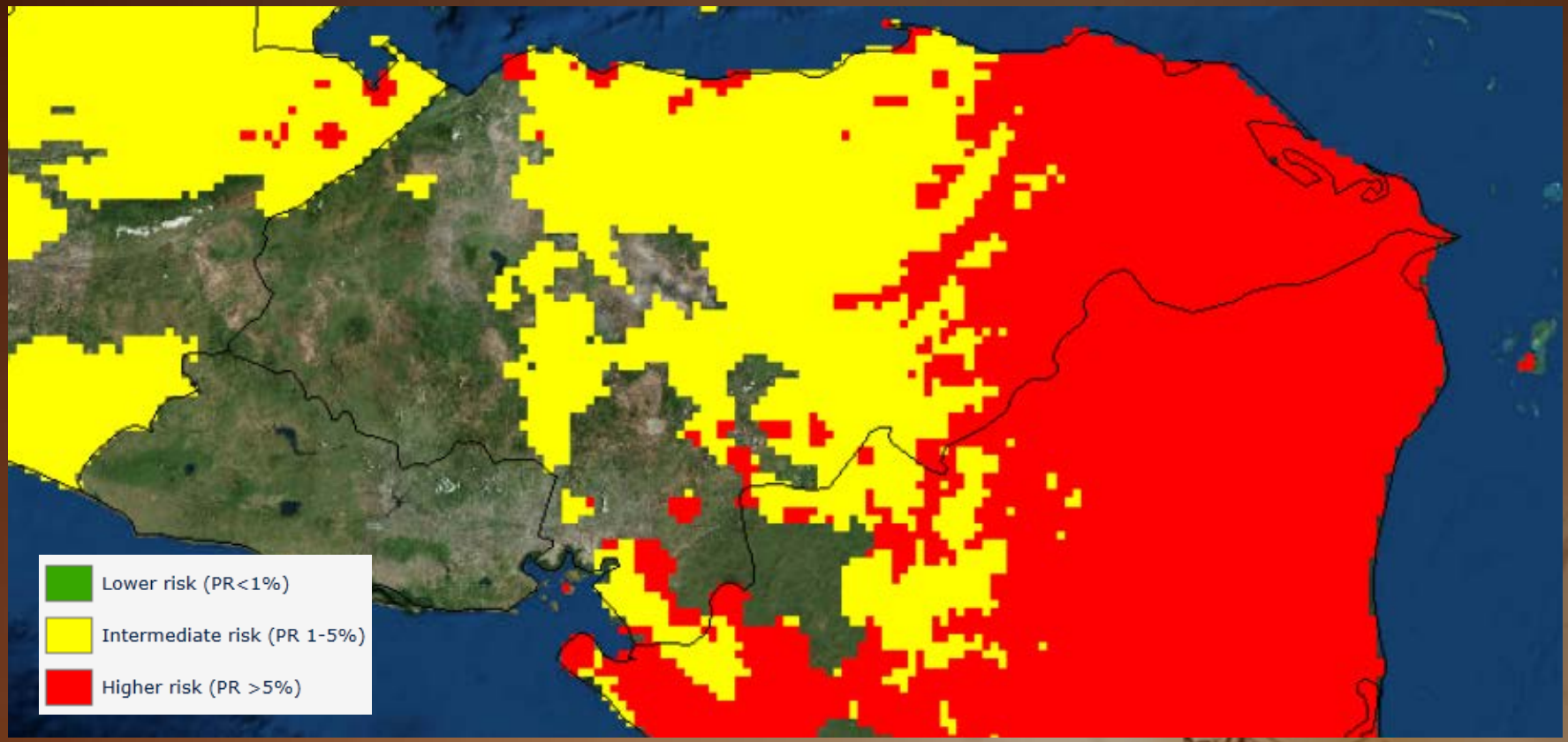
Malaria Risk Maps

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



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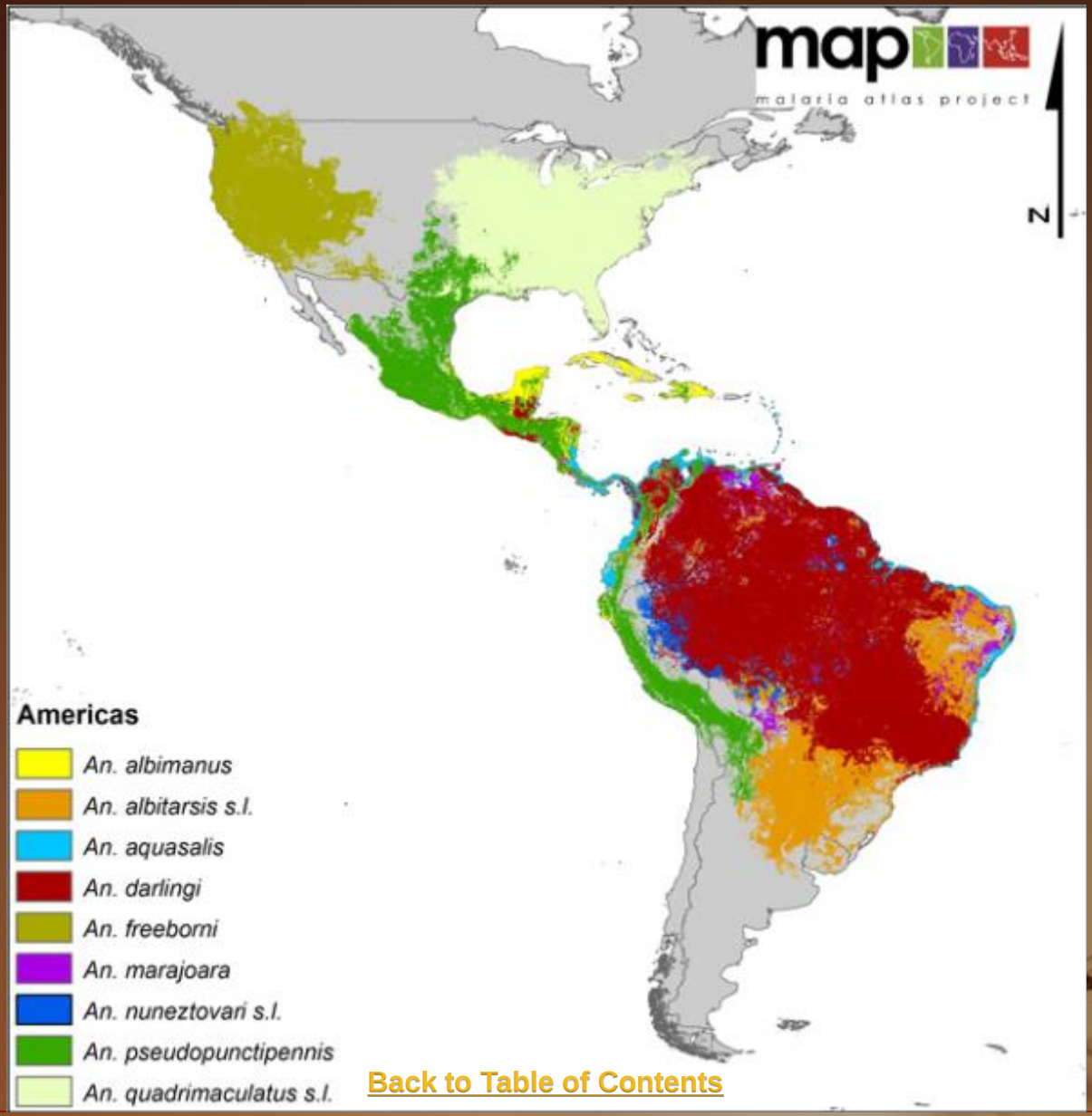
Dominant Malaria Vectors

-Sinka, et al. 2012

For a high resolution view of this map visit the Malaria Atlas Project



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Malaria Vectors of Honduras: Habitat Suitability Models

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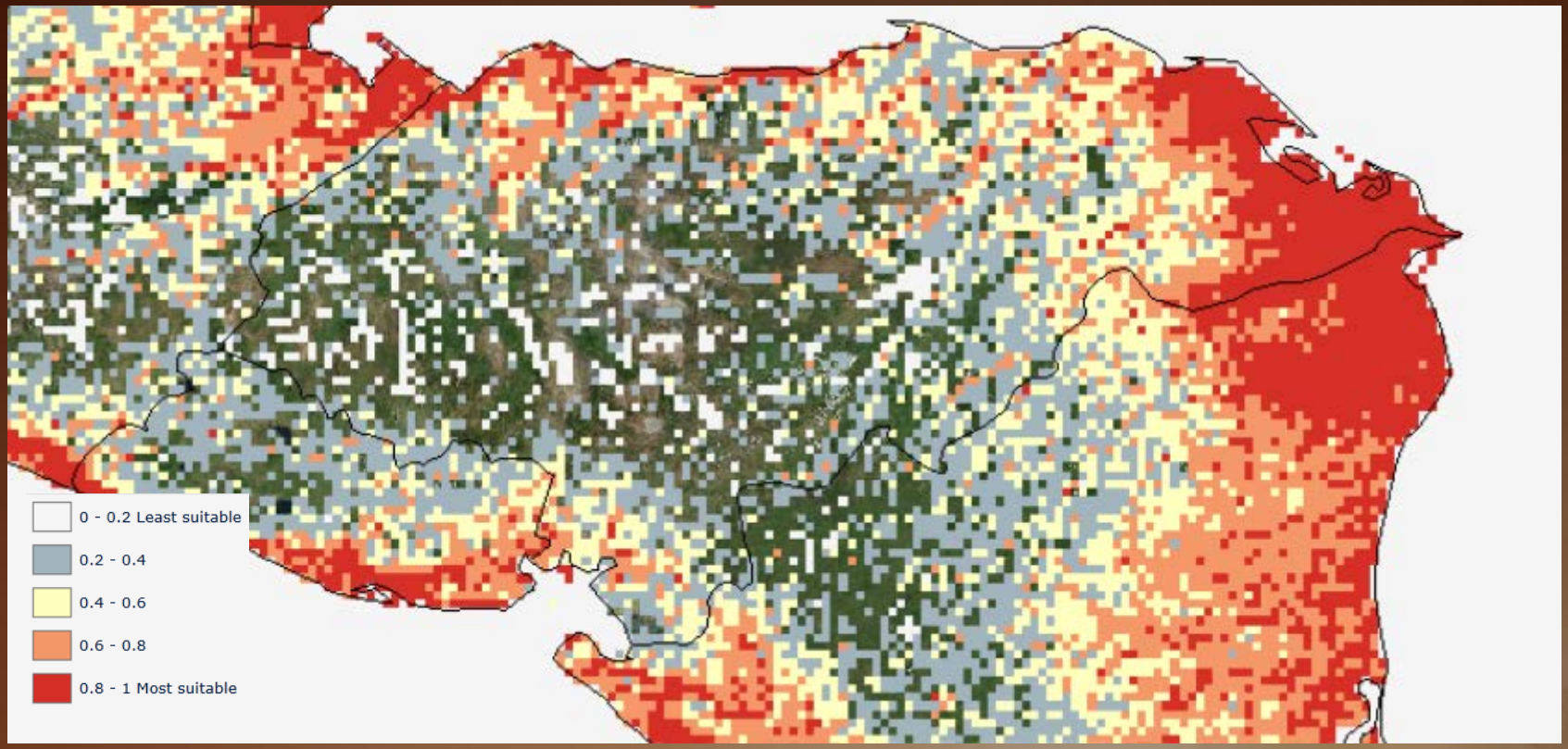
Anopheles albimanus



Maxent model of *An. albimanus*, Nyari, A. 2011

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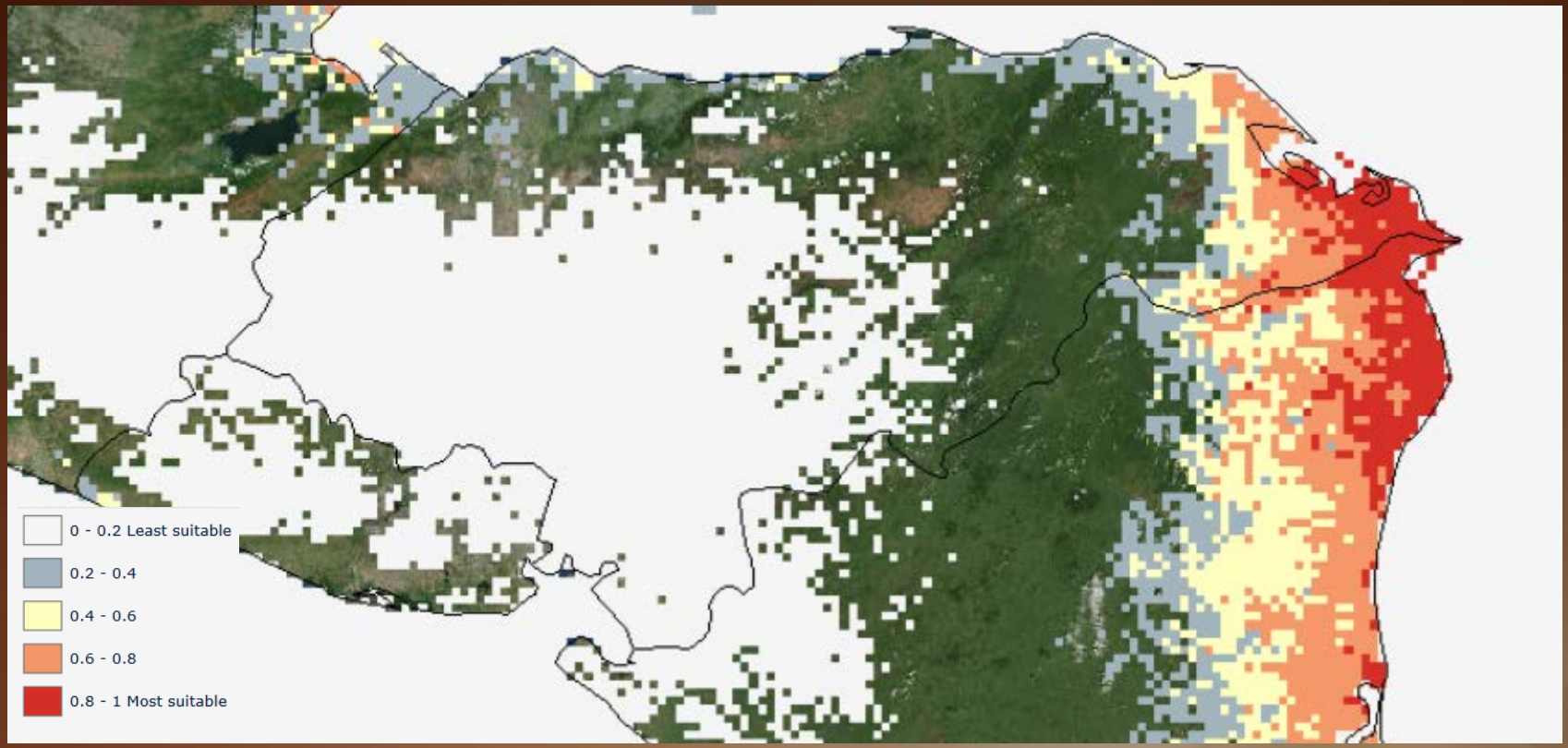
Anopheles aquasalis



Maxent model of *An.aquasalis*, Nyari, A. 2011

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Anopheles crucians

Maxent model of *An. crucians*, Nyari, A. 2011

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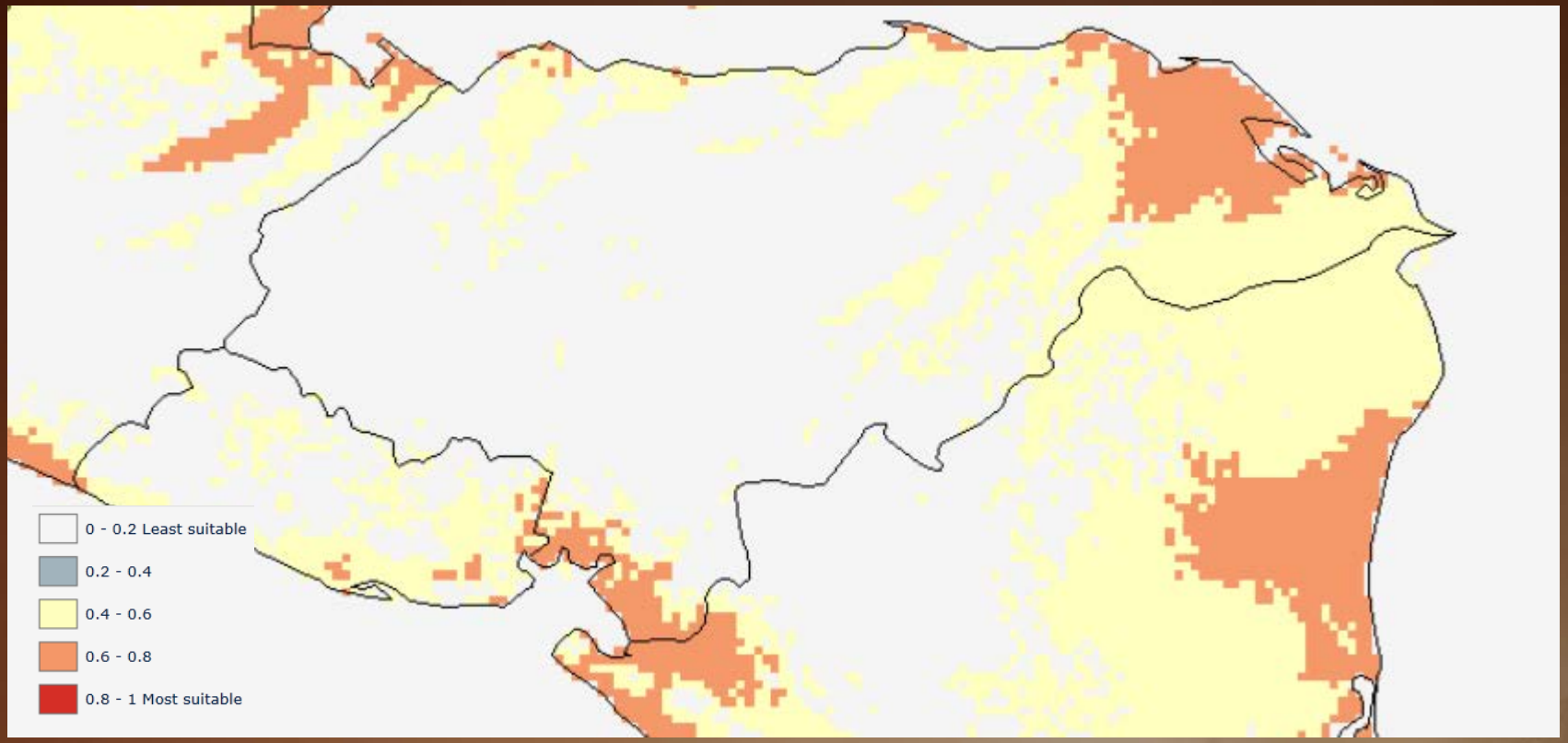
Anopheles darlingi



Maxent model of *An. darlingi*, Nyari, A. 2011

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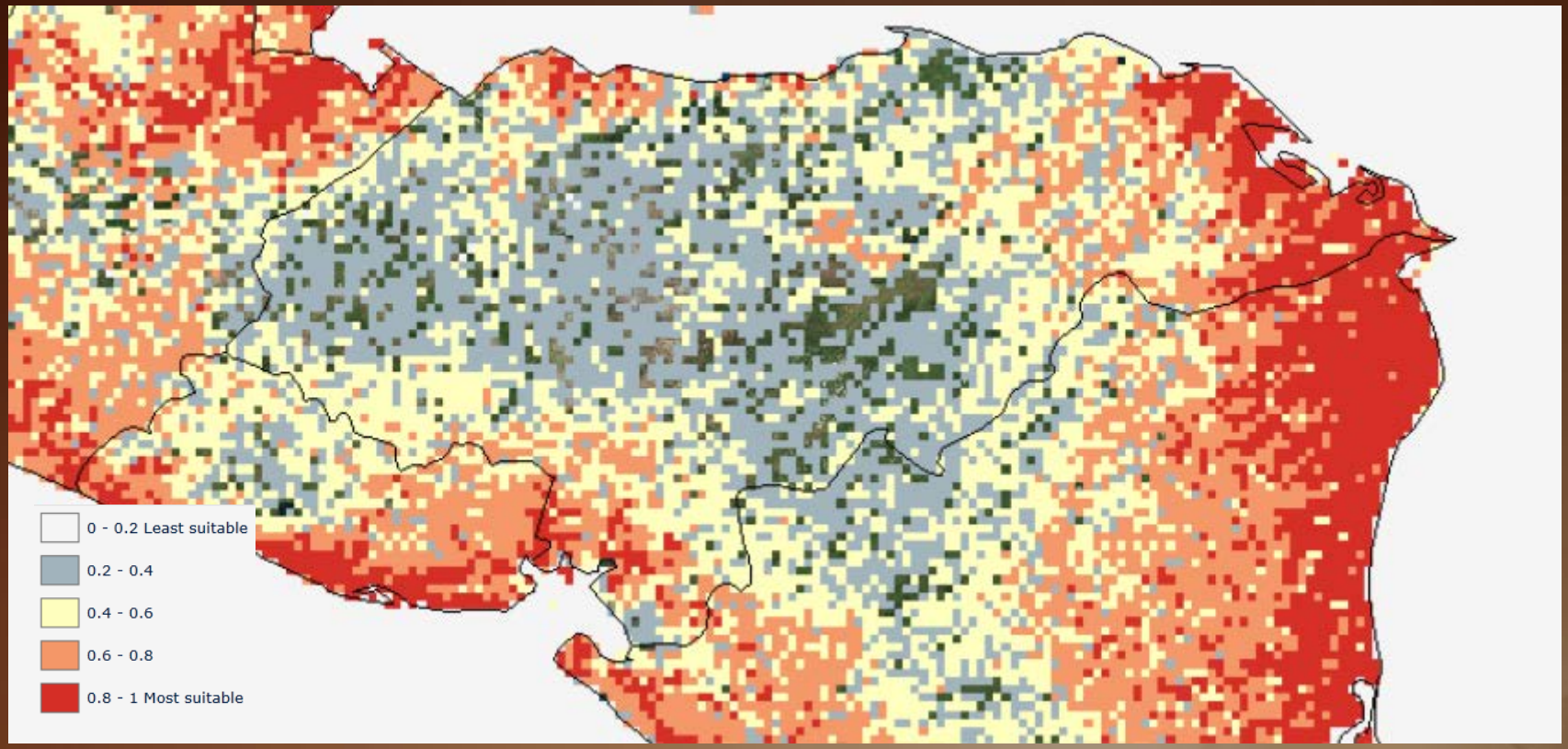
Anopheles pseudopunctipennis



Maxent model of *An. pseudopunctipennis*,Nyari, A. 2011

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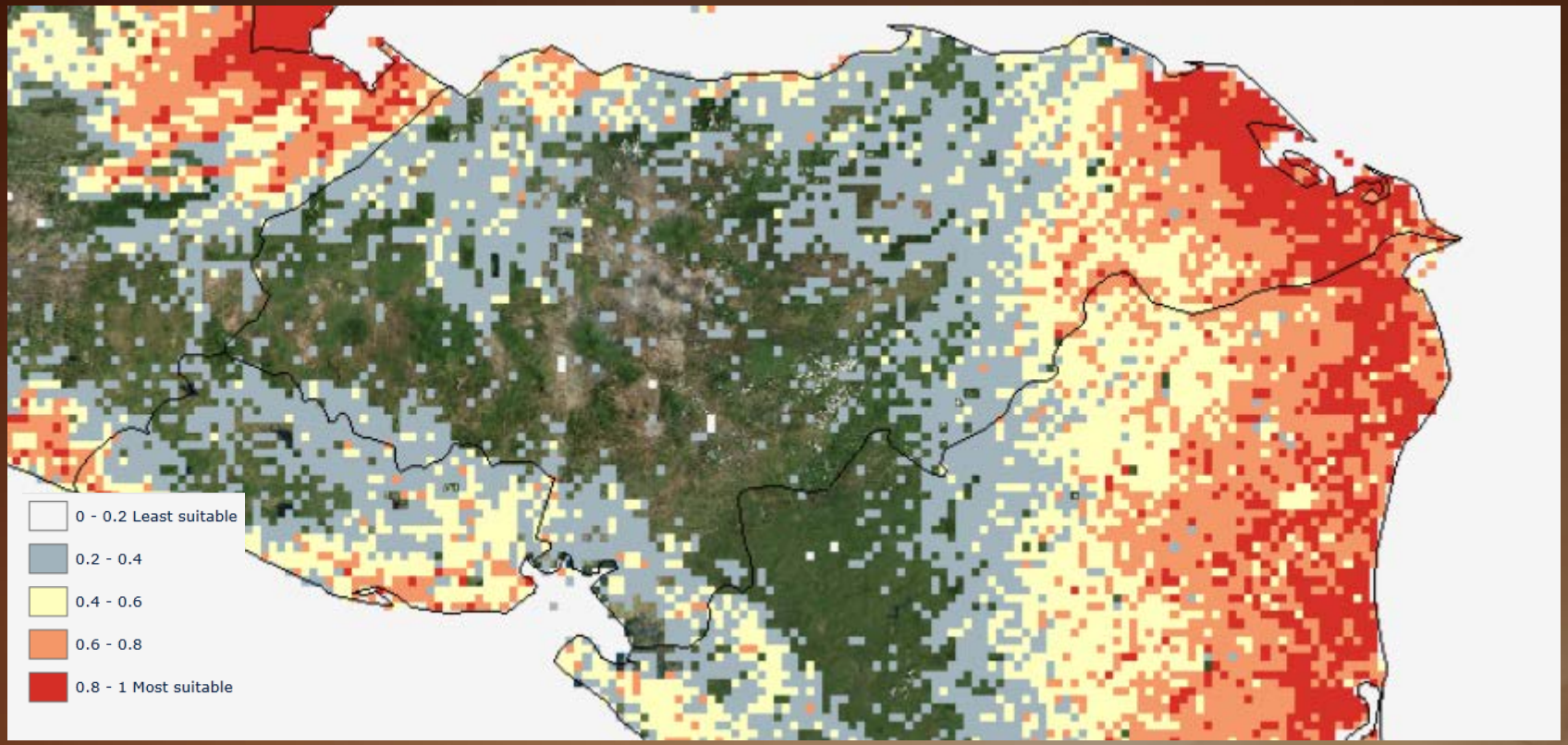
Anopheles punctimacula



Maxent model of *An. punctimacula*, Nyari, A. 2011

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Malaria Vectors of Honduras: Bionomics and Medical Importance

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Anopheles (Nys.) albimanus Wiedemann, 1820

Bionomics:

Larvae of *An. albimanus* are found in a wide variety of permanent water habitats. They are salt tolerant. Habitats are usually in full sunlight or partial shade containing abundant floating, emergent vegetation and floating scum and algae. Habitats frequently have muddy bottoms and turbid or polluted water.

Medical Importance:

In 17 of 20 Caribbean region countries, *An. albimanus* is the principal malaria vector.

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Anopheles (Nys.) aquasalis Curry, 1932

Bionomics:

An. aquasalis is the only species primarily restricted to the coast. This species primarily occurs in brackish water such as in mangrove swamps and coastal ground pools. However, aquasalis is capable of living in fresh water and is often collected several kilometers from the coast. (Faran and Linthicum 1981:8)

Medical Importance:

An. aquasalis is a primary vector of malaria in the Lesser Antilles, and in Trinidad and Tobago. Along the coast of Brazil, the Guianas and possibly Venezuela, it is always a potential vector but usually only important when it occurs in large numbers. *An. aquasalis* feeds readily on man and is commonly collected in houses. In the past it has been an important vector of malaria in coastal Brazil. (Faran and Linthicum 1981:9)

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Anopheles (Ano.) crucians Wiedemann, 1828

Bionomics:

The larvae of *An. crucians* are found in semi-permanent and permanent pools, pond, lakes and swamps. Acidic water with emergent and floating vegetation is preferred. Females are outdoor night biters but will bite during the cloudy day and in the shade. Both sexes are attracted to lights.

Medical Importance:

An. crucians has been found to be naturally infected with malaria. Infection rates of 3.28% have been observed. This species may serve as an important malaria vector.

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Anopheles (Nys.) darlingi Root, 1926

Bionomics:
The immatures of *An. darlingi* have been collected in streams and ponds with mud bottoms, ground pools, and swamps. Most of the immatures were in partially shaded areas. All the sites contained grassy or floating vegetation and sometimes green algae. The water was clear, never turbid or polluted. The sites were usually in areas of secondary growth such as plantations or cultivated fields. *An. darlingi* is definitely an endophilic species. A number of workers have verified that when a bait animal is used as a form of mosquito control outside houses, more specimens of darlingi are still found inside the houses than on the bait animal. (Faran and Linthicum 1981:36)

Medical Importance:
An. darlingi is a very efficient vector of malaria in northern and northeastern Brazil as well as in numerous other areas in South America. Wherever this species occurs along with malaria, daringi females are almost always found naturally infected. An. darlingi is highly endophagous and anthropophilic. In addition to malaria, this species has also been suspected of being a vector of human filariasis. It has transmitted Wuchereria bancrofti (Cobbold) in the laboratory and has been collected naturally infected with this parasite. (Faran and Linthicum 1981:9)

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Anopheles (Cel.) pseudopunctipennis Theobald, 1901

Bionomics:
The larvae are found in sunny habitats including stream pools and margins. Females feed at night and will enter houses to take a blood meal.

Medical Importance:
This species is considered an important vector of malaria in Central America.

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Anopheles (Ano.) punctimacula
Dyar and Knab, 1906

Bionomics:

Larvae of *An. punctimacula* were taken in deep or sometimes partial shade in the following types of water: stream pool with clear water, in grass along a clear slow-moving stream with abundant vegetation, along a swamp margin, and in deep water of a large swamp. Adult females bite man and domestic animals and have been collected in Shannon traps, stable traps, horse traps, in corrals, and from human bait. (Wilkerson 1990:235)

Medical Importance:

An. punctimacula is a confirmed malaria vector (pers. comm. Wilkerson 2009)

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Leishmaniasis Risk Maps

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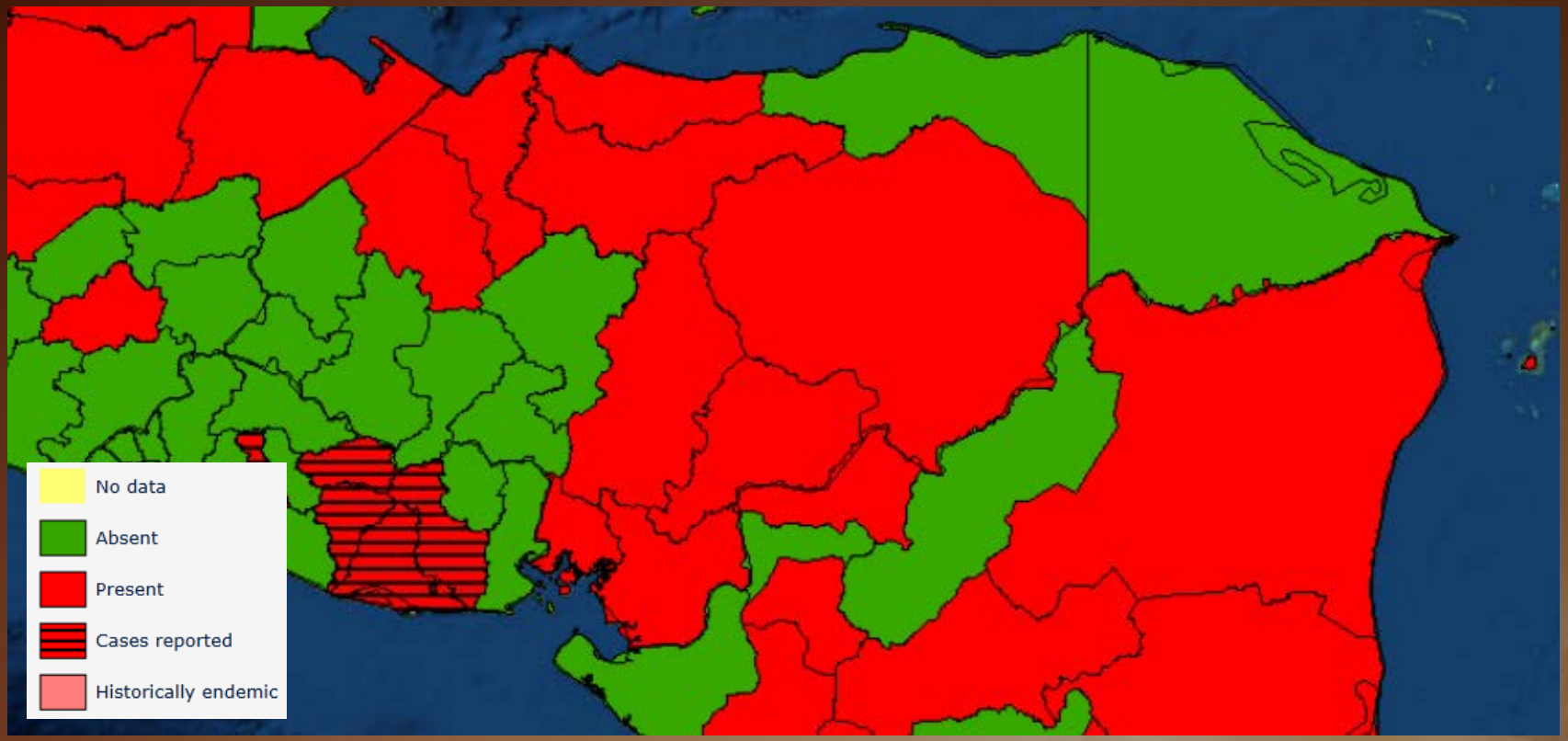
Leishmaniasis Risk Maps

Cutaneous Leishmaniasis presence/ absence 2012
Alvar J. et al. 2012.



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Leishmaniasis Risk Maps

Cutaneous Leishmaniasis estimates of the maximum number of cases, 2012
Alvar J. et al. 2012.

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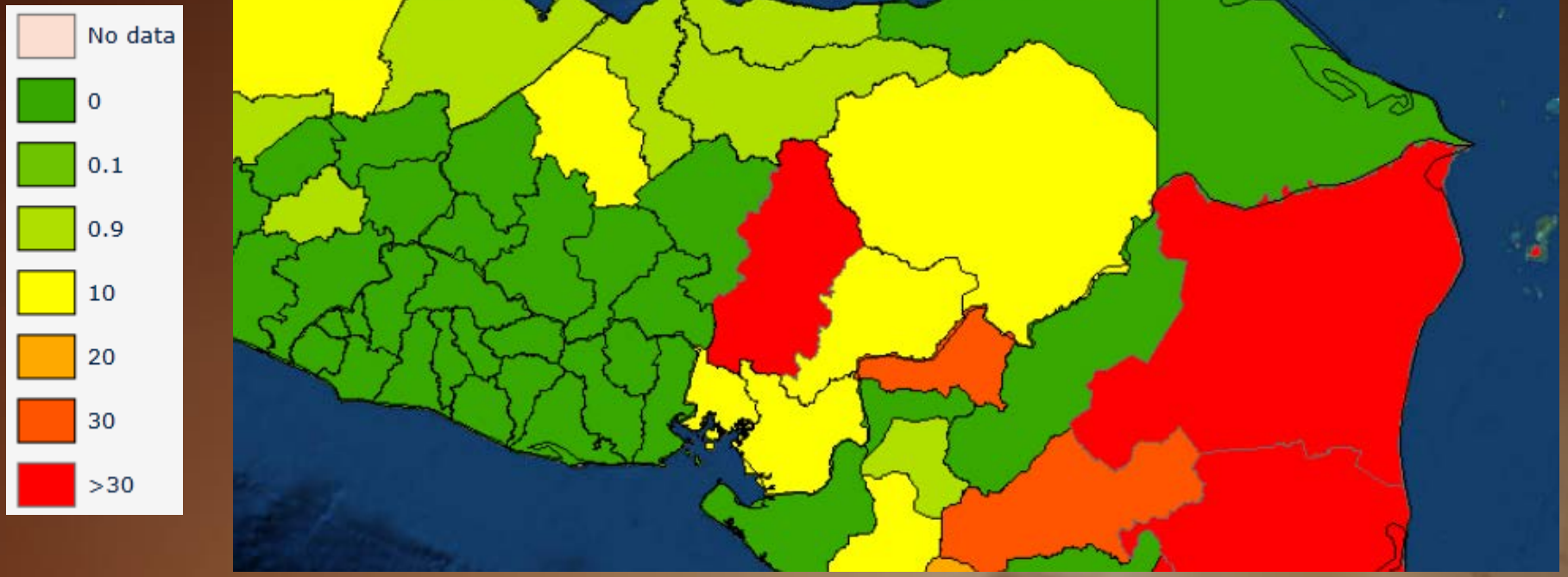
Leishmaniasis Risk Maps

Cutaneous Leishmaniasis estimated incidence 2012
Alvar J. et al. 2012.



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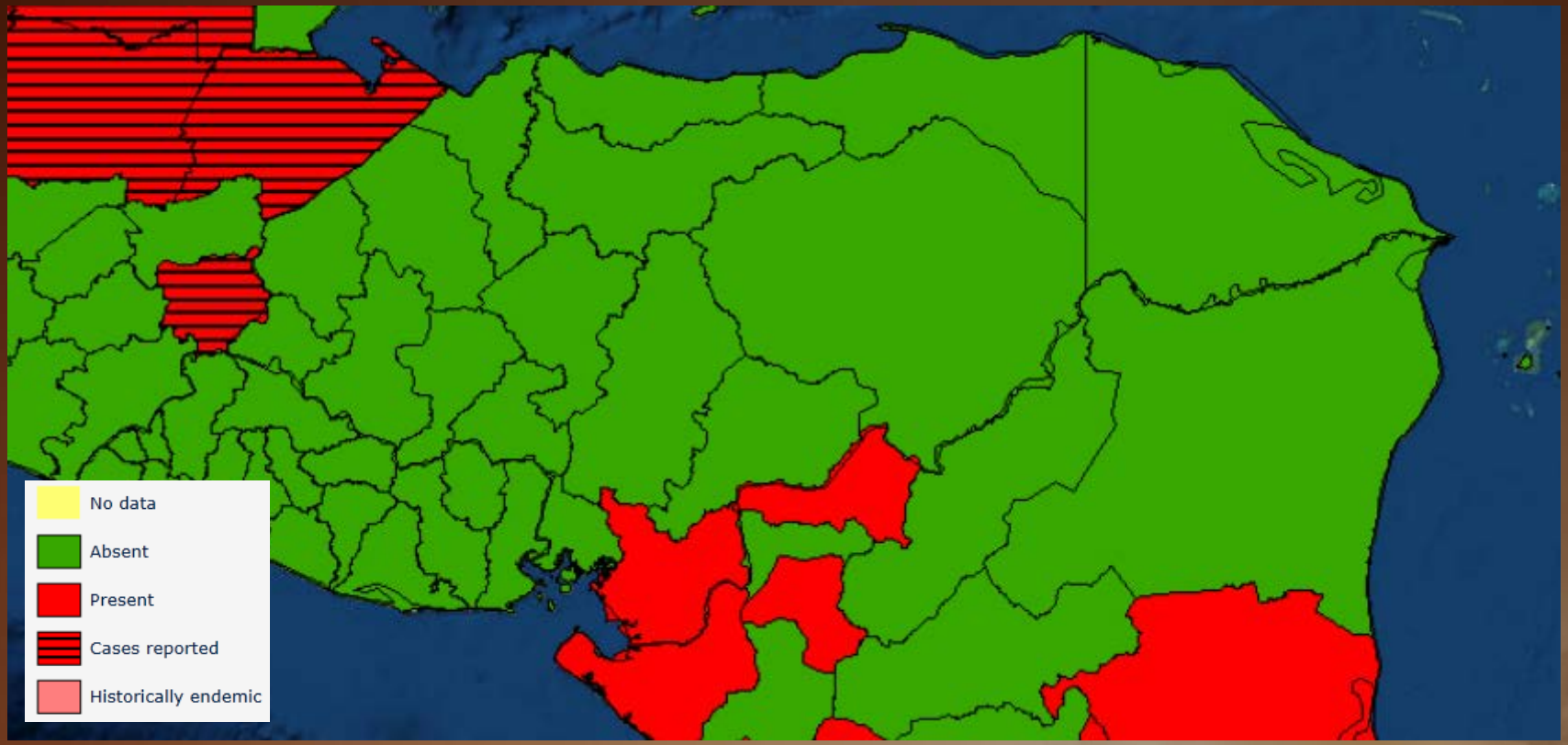
Leishmaniasis Risk Maps

Visceral Leishmaniasis presence/ absence 2012
Alvar J. et al. 2012.



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Cutaneous Leishmaniasis estimates of the maximum number of cases, 2012
Alvar J. et al. 2012.

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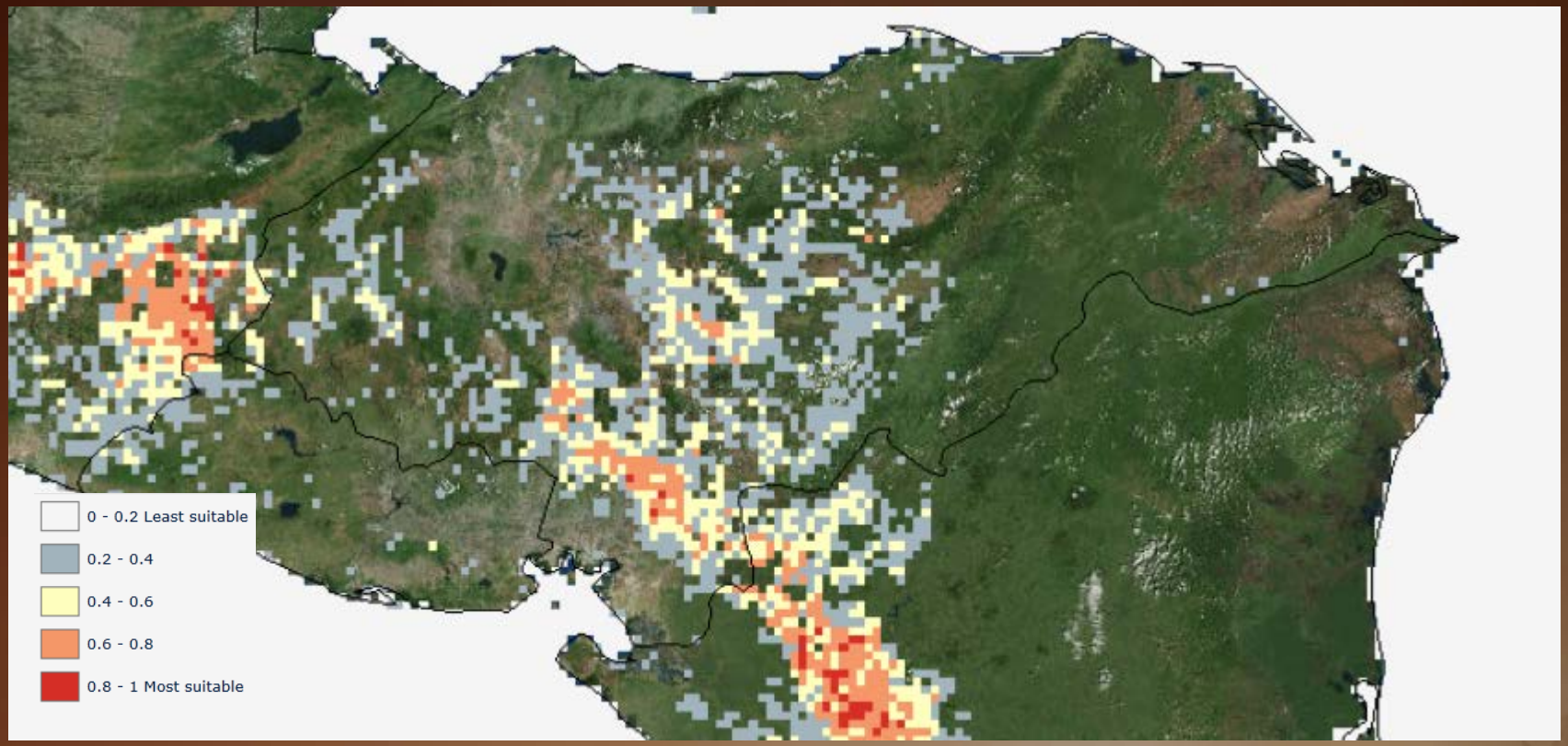
Lutzomyia longipalpis



Maxent model of *L. longipalpis*, Dornak, L. 2011

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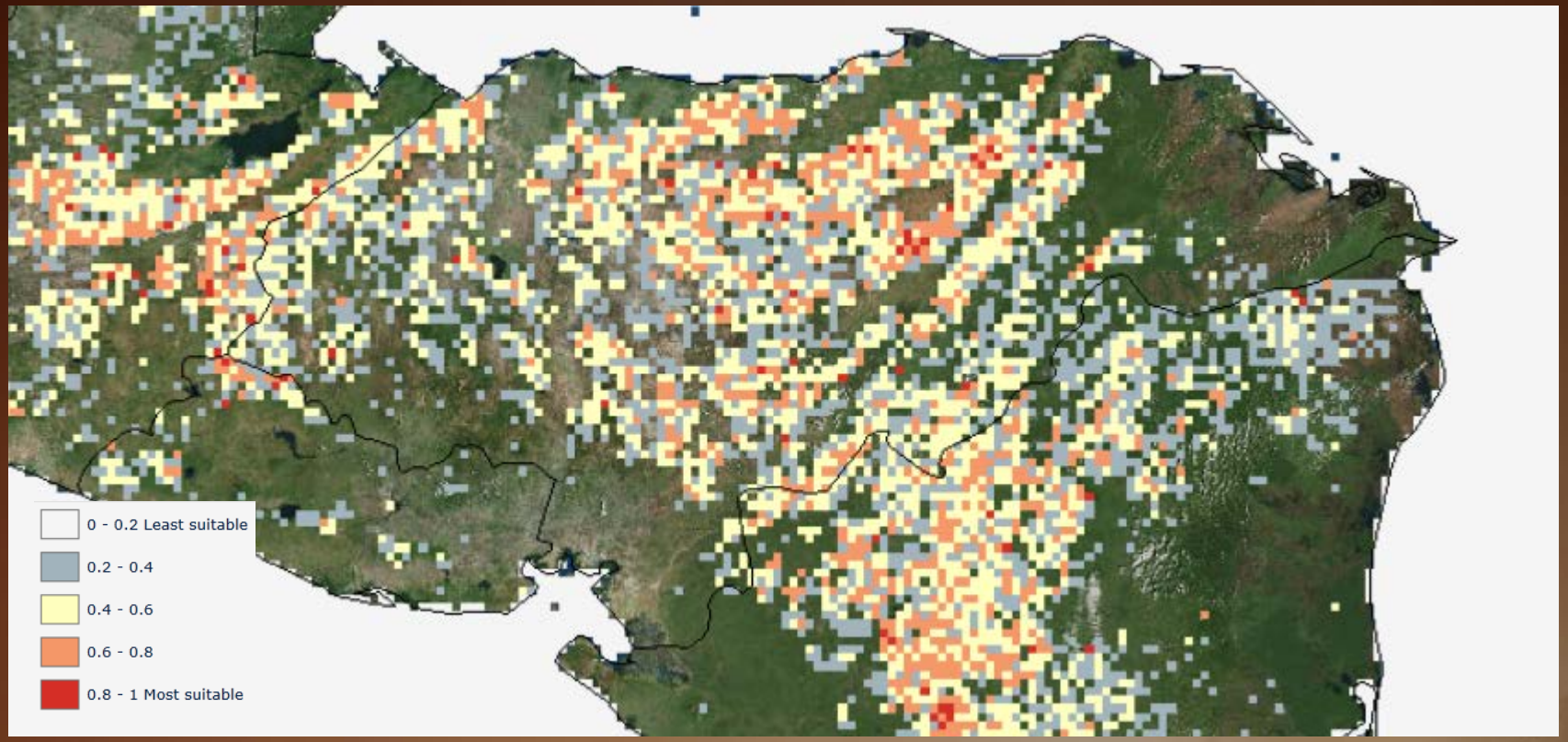
Lutzomyia ovallesi



Maxent model of *L. ovallesi*, Dornak, L. 2012

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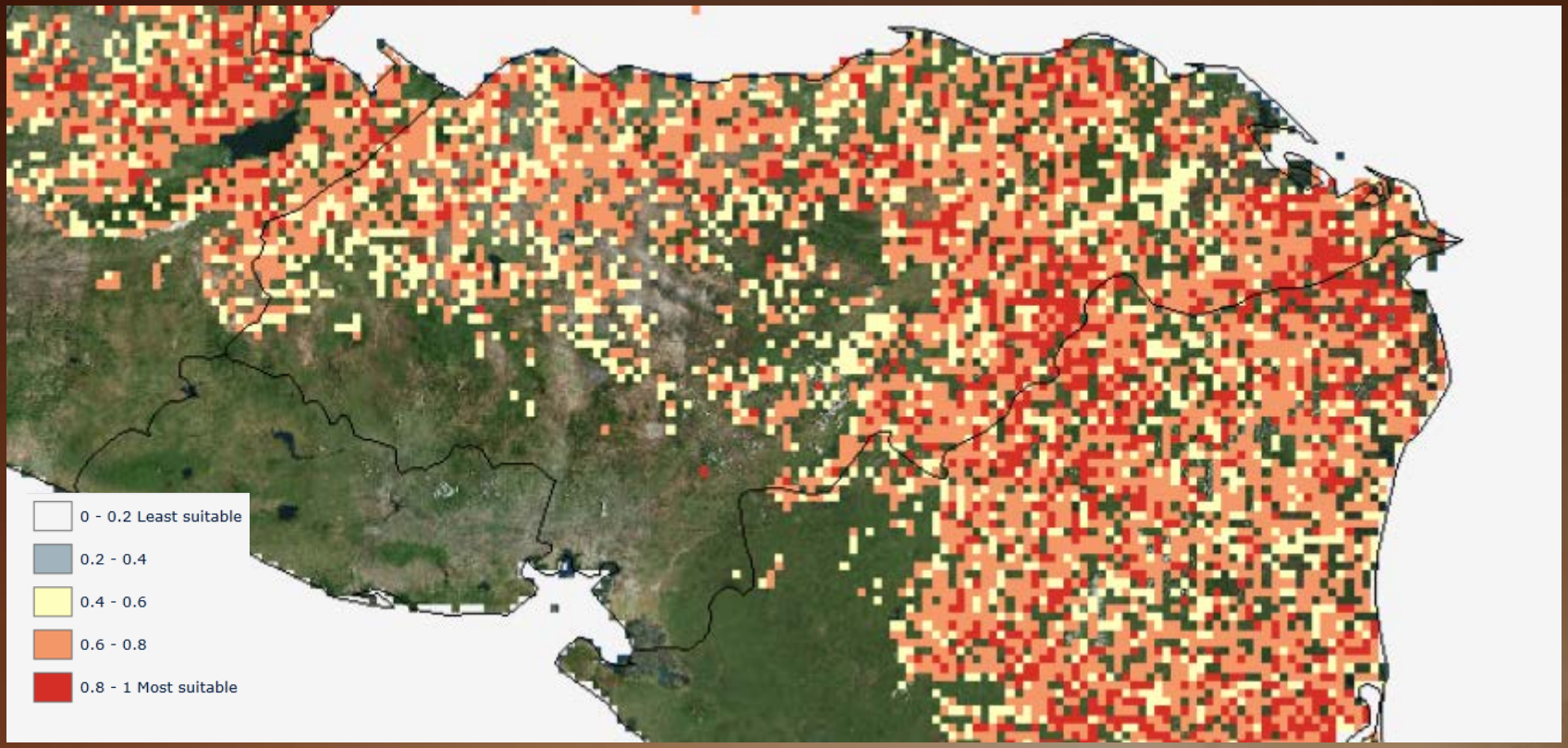
Lutzomyia panamensis



Maxent model of *L. panamensis*, Dornak, L. 2012

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Sand Fly Vectors: Medical Importance

Maroli, M. et al 2012

- *Lutzomyia longipalpis:* A proven vector of *Leishmaniasis infantum* which can cause visceral leishmaniasis in humans.
- *Lutzomyia ovallesi:* A suspected vector of *Leishmaniasis braziliensis* which can cause localized cutaneous leishmaniasis in humans.
- *Lutzomyia panamensis:* A suspected vector of *Leishmaniasis braziliensis* and *Leishmaniasis panamensis* which can cause localized cutaneous leishmaniasis in humans.
- *Lutzomyia ylephiletor:* A suspected vector of *Leishmaniasis braziliensis* and *Leishmaniasis panamensis* which can cause localized cutaneous leishmaniasis in humans.
- *Lutzomyia trapidoi:* A suspected vector of *Leishmaniasis braziliensis* which can cause localized cutaneous leishmaniasis in humans.

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Dengue Virus Risk Maps and Vector Bionomics/ Medical Importance

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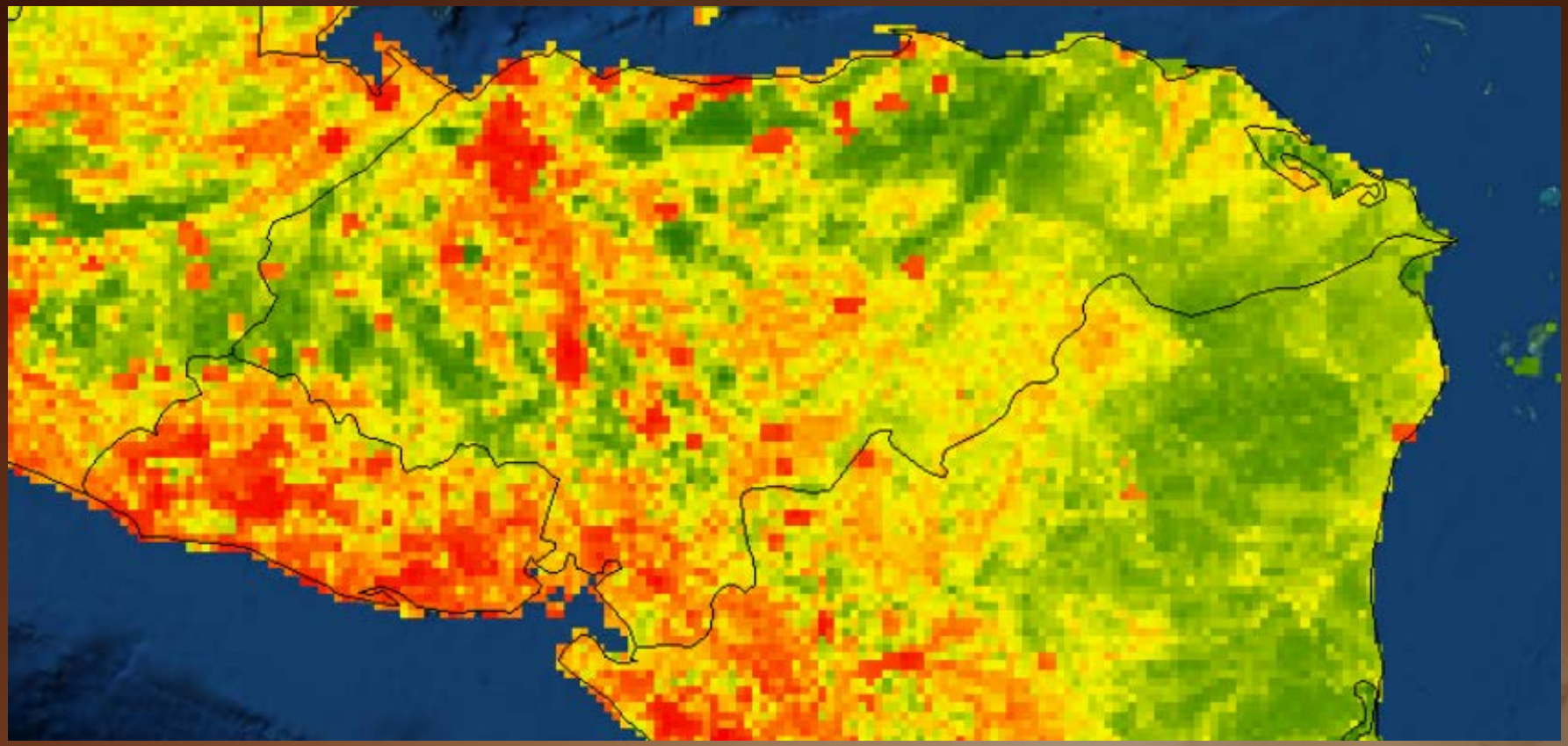
Dengue Virus Prediction Model

Bhatt, S. et al. 2013



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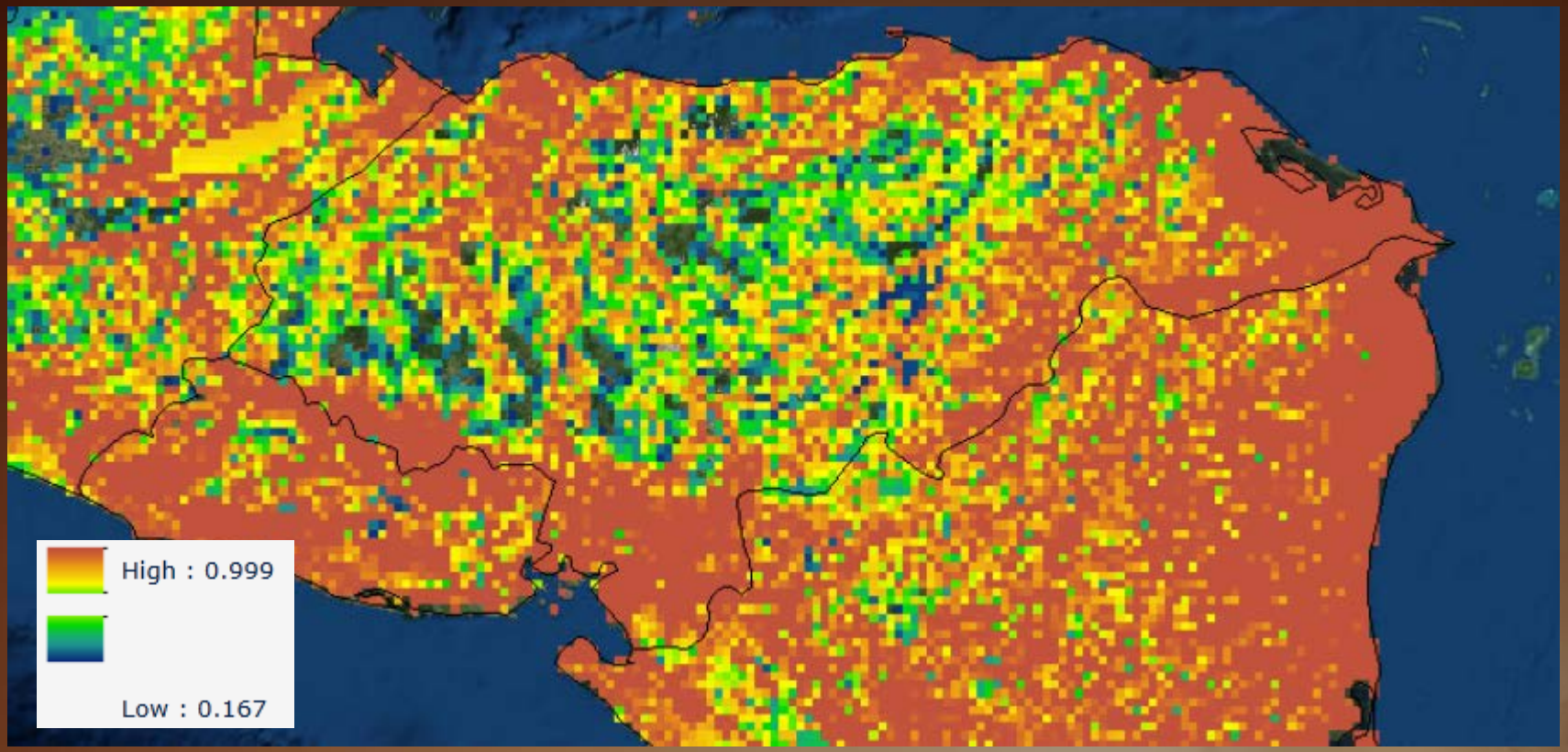
Aedes aegypti



Maxent model of *Ae. aegypti*, Nyari, A. 2011

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Aedes (Stg.) aegypti
(Linnaeus, 1762)

Bionomics:
In association with man, aegypti will use any and all natural and artificial containers. Away from urban areas this species tends to favor pools in river beds, tree stumps, tree holes and natural containers. Females are primarily day biters and readily enter buildings to feed. They have also been taken in lesser numbers at night (Christophers 1960).

Medical Importance:
Ae. aegypti is a primary vector of dengue, chikungunya virus and yellow fever (Christophers 1960).

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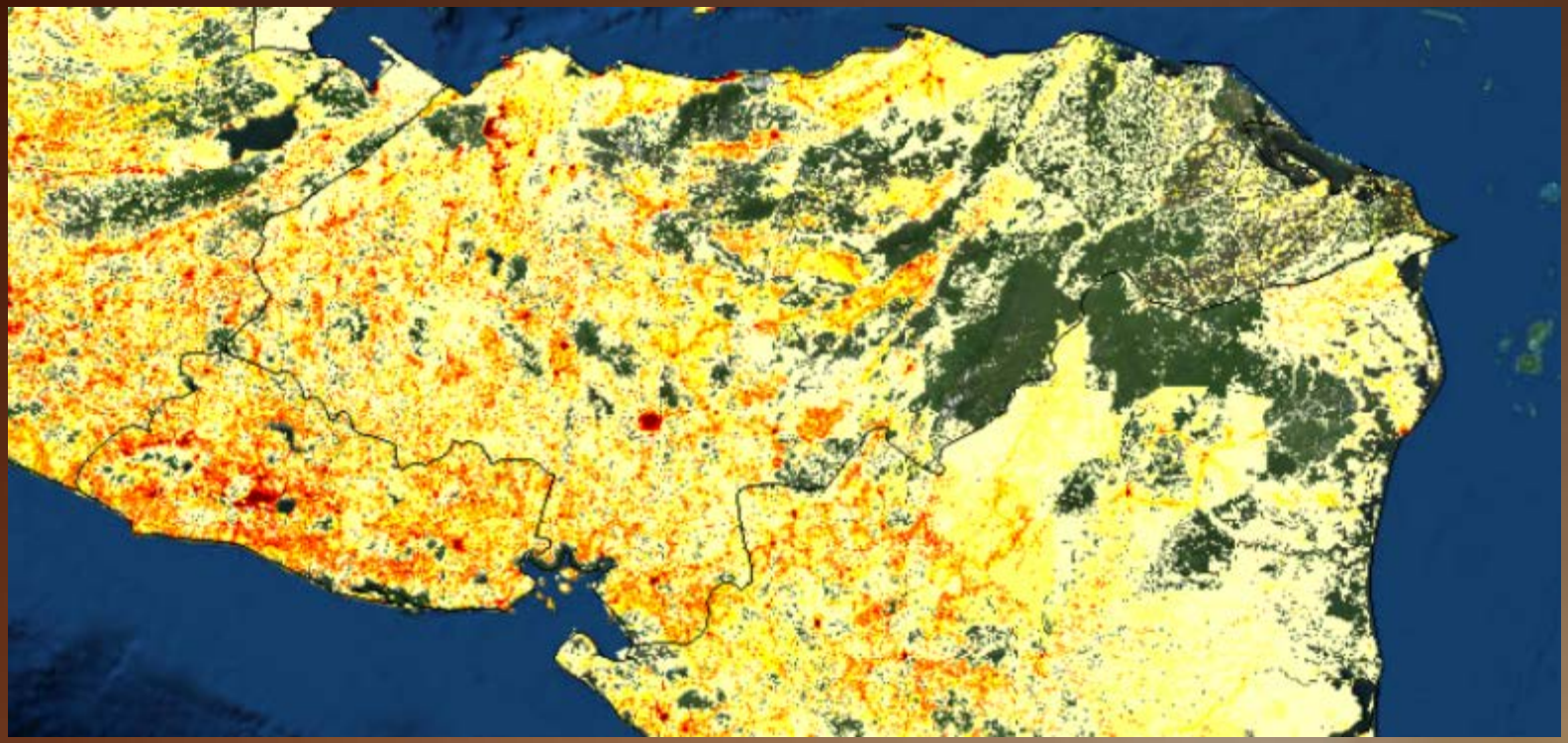
Human Density

People per sq. mile, LandScan 2011



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References

- People/1 Sq Km. This Product Was Made Utilizing The Landscan (2011)™ High Resolution Global Population Data Set Copyrighted By UT-Battelle, LLC, Operator Of Oak Ridge National Laboratory Under Contract No. DE-AC05-00OR22725 With The United States Department Of Energy. The United States Government Has Certain Rights In This Data Set. Neither Ut-Battelle, Llc Nor The United States Department Of Energy, Nor Any Of Their Employees, Makes Any Warranty, Express Or Implied, Or Assumes Any Legal Liability Or Responsibility For The Accuracy, Completeness, Or Usefulness Of The Data Set. Available At Http://Www.Ornl.Gov/Sci/Landscan/
- Gething, Peter W. et al. A new world malaria map: Plasmodium falciparum endemicity in 2010. Malaria Journal 2011, 10:378.
- Bhatt, S. et al. 2013. The Global Distribution and Burden of Dengue. Natrure, 496: 504-507.
- Maroli, M. et al. 2012. Phlebotomine Sandflies and the Spreading of Leishmaniases and other Diseases of Public Health Concern. Medical and Veterinary Entomology (2012), doi: 10.1111/j.1365-2915.2012.01034.x

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WRBU
WALTER REED BIOSYSTEMATICS UNIT
Know the vector, know the threat

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

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.

Vector Photos Provided by Judith Stoffer, Walter Reed Biosystematics Unit

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Walter Reed Army Institute of Research

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