

Vector Hazard Report: Ticks of the Continental United States

Notes, photos and habitat suitability models gathered from
The Armed Forces Pest Management Board, VectorMap and
The Walter Reed Biosystematics Unit



[VectorMap](#)
[Armed Forces Pest Management Board](#)

All material in this brief is provided for your information only and may not be construed as medical advice or instruction. No action or inaction should be taken based solely on the contents of this information; instead, readers should consult appropriate health professionals on any matter relating to their health and well-being.



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Background

Within the United States there are several tick-borne diseases (TBD) to consider. While most are not fatal, they can be quite debilitating and many have no known treatment or cure. Within the U.S., ticks are most active in the warmer months (April to September) and are most commonly found in forest edges with ample leaf litter, tall grass and shrubs. It is important to check yourself for ticks and tick bites after exposure to such areas. Dogs can also be infected with TBD and may also bring ticks into your home where they may feed on humans and spread disease (CDC, 2014).

This report contains a list of common TBD along with background information about the vectors and habitat suitability models displaying predicted geographic distributions.

Many tips and other information on preventing TBD are provided by the [CDC](#), [AFPMB](#) or [USAPHC](#).

Tick-Borne Diseases in the U.S.

Lyme Disease

Lyme disease is caused by the bacteria *Borrelia burgdorferi* and the primary vector is *Ixodes scapularis* or more commonly known as the blacklegged or deer tick. Along the West coast the common vector of Lyme disease are *Ixodes pacificus* or Western black-legged ticks (AFPMB, 2012). To view a map of where most cases of Lyme disease are reported to the CDC, [click here](#). [For more information see the United States Army Public Health Command FAQ sheet on Lyme disease.](#)

Anaplasmosis

Anaplasmosis, also known as, human granulocytic ehrlichiosis (HGE), is caused by the bacteria *Anaplasma phagocytophilum*. Vectors of anaplasmosis include *Ixodes scapularis* and *Ixodes pacificus* ticks. The CDC has received most reports of anaplasmosis infection from the Northern mid-West and North-East ([CDC, 2014](#)).

Babesiosis

Babesiosis is caused by protozoan parasites of the genus *Babesia* that infect and destroy red-blood cells. Although fairly uncommon, babesiosis can be fatal if left untreated. 95% of babesiosis cases reported to the CDC in 2013 were recorded in Connecticut, Massachusetts, Minnesota, New Jersey, New York, Rhode Island, and Wisconsin (CDC, 2014). The primary vector of babesiosis are *Ixodes* ticks. Most often *Ixodes scapularis* along the East coast and mid-West while *Ixodes pacificus* is more common on the West coast (AFPMB, 2012). [For more information see the United States Army Public Health Command FAQ sheet on Babesiosis.](#)

Tick-Borne Diseases in the U.S.

Ehrlichiosis

Human Ehrlichiosis is primarily caused by three species of bacteria within the genus Ehrlichia. The primary vector of this disease are *Amblyomma americanum* or lone star ticks. Cases of ehrlichiosis are most concentrated in the South-Eastern and South-Central United States (CDC, 2014). Other vectors include *Ixodes scapularis* and *Ixodes pacificus* (AFPMB, 2012). [For more information see the United States Army Public Health Command FAQ sheet on Ehrlichiosis.](#)

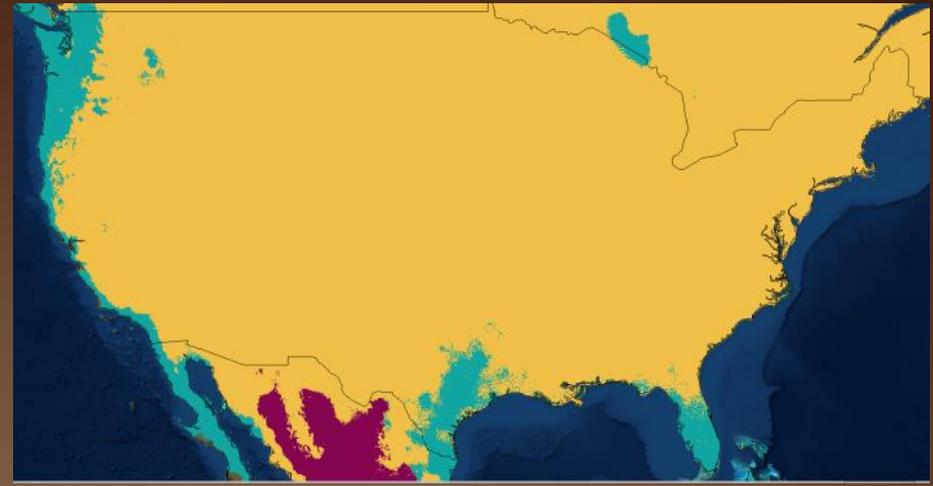
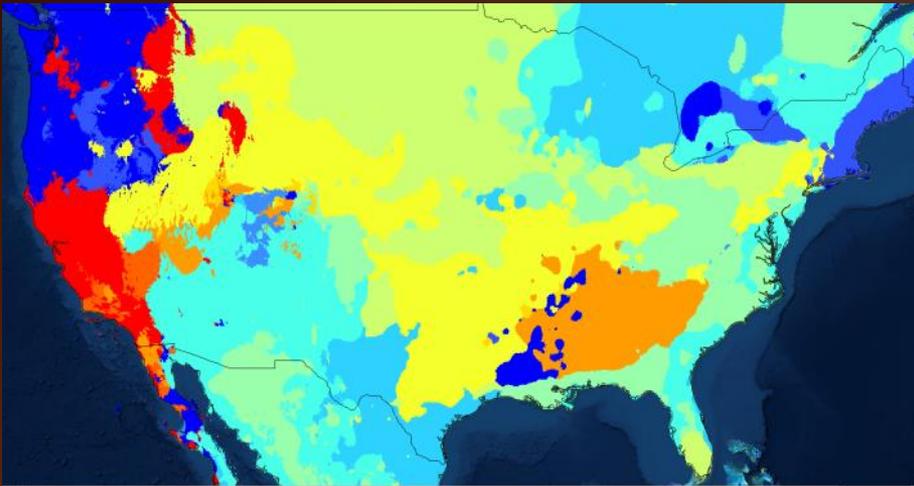
Rocky Mountain Spotted Fever (RMSF)

RMSF is caused by the bacteria *Rickettsia rickettsii* and is primarily spread through the bite of an infected *Dermacentor variabilis* (brown dog tick) and *Dermacentor andersoni* (Rocky Mountain wood tick) (CDC, 2014). [According to the CDC](#), over 60% of RMSF cases are reported from North Carolina, Oklahoma, Arkansas, Tennessee, and Missouri. [For more information see the United States Army Public Health Command FAQ sheet on RMSF.](#)

Tularemia

Also known as rabbit fever, tularemia is caused by a bacterial infection of *Francisella tularensis*. The primary vectors of Tularemia are *Amblyomma americanum*, *Dermacentor andersoni* and *Dermacentor variabilis* (brown dog tick). In addition to ticks, Tularemia is also spread through a number of other means including handling or ingesting undercooked or raw meat, drinking contaminated water and inhalation of soil dust. Mosquitoes, fleas and deer flies have also been reported vectors of the disease (AFPMB, 2012). [The CDC has reported Tularemia](#) cases in all U.S. states except Hawaii but cases are most commonly reported from the South-central and Pacific Northwest regions and parts of Massachusetts (CDC, 2014). [For more information see the United States Army Public Health Command FAQ sheet on Tularemia.](#)

Climate of U.S.



- 1. Jan
- 2. Feb
- 3. Mar
- 4. Apr
- 5. May
- 6. Jun
- 7. Jul
- 8. Aug
- 9. Sep
- 10. Oct
- 11. Nov
- 12. Dec

Month of maximum precipitation,

WorldClim
(50 year average)

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

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

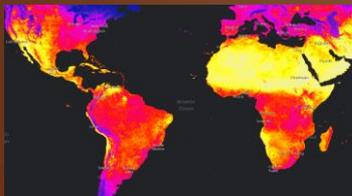
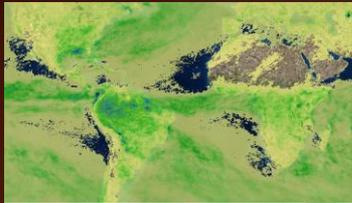
Areas receiving above average rainfall for the past month and below average rainfall for the previous 12 months. Drought breaking rain may indicate recent suitable conditions for vectors and diseases in a stressed environment or human population. Updated monthly. -WorldClim, Giovanni online data system 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

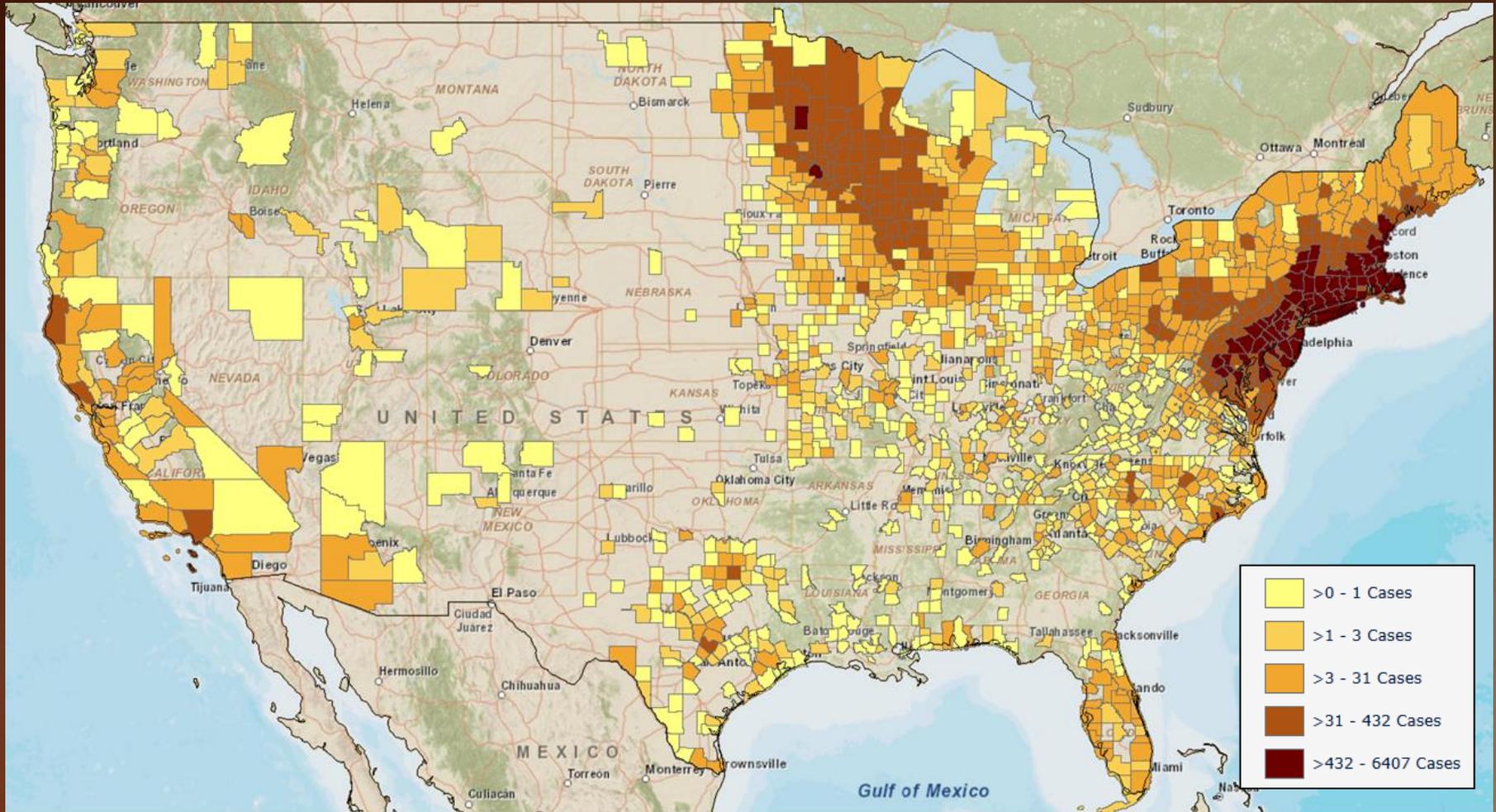
Land Surface Temperature

This map shows the temperature of the earth's lands during the daytime. Updated monthly.
-NASA Earth Observations

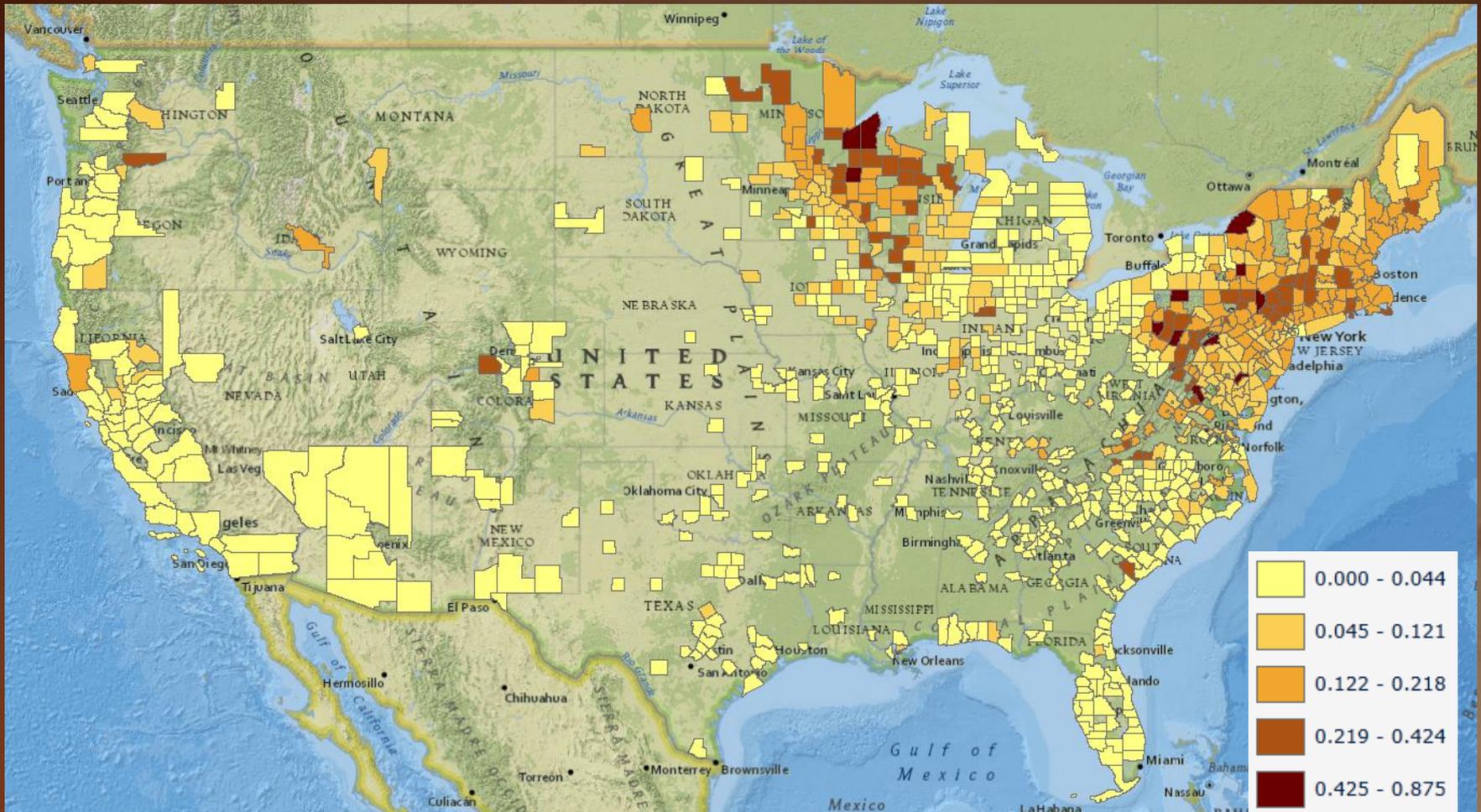


Tick-borne Disease Prevalence Maps

Lyme Disease Cases Reported to CDC by County, 2002-2006

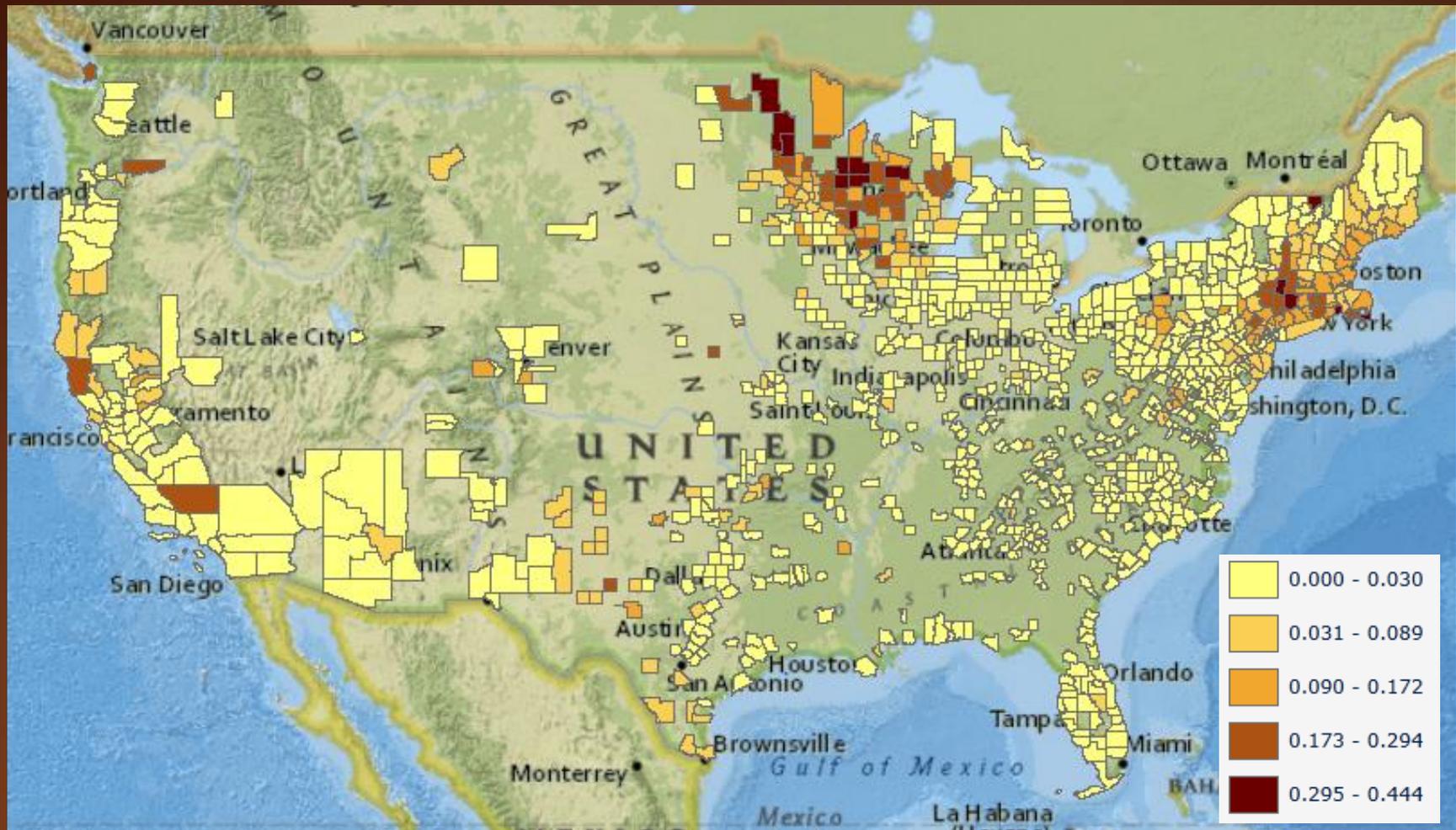


Positivity Rate: Dogs Tested for Lyme Disease -CAPC 2013

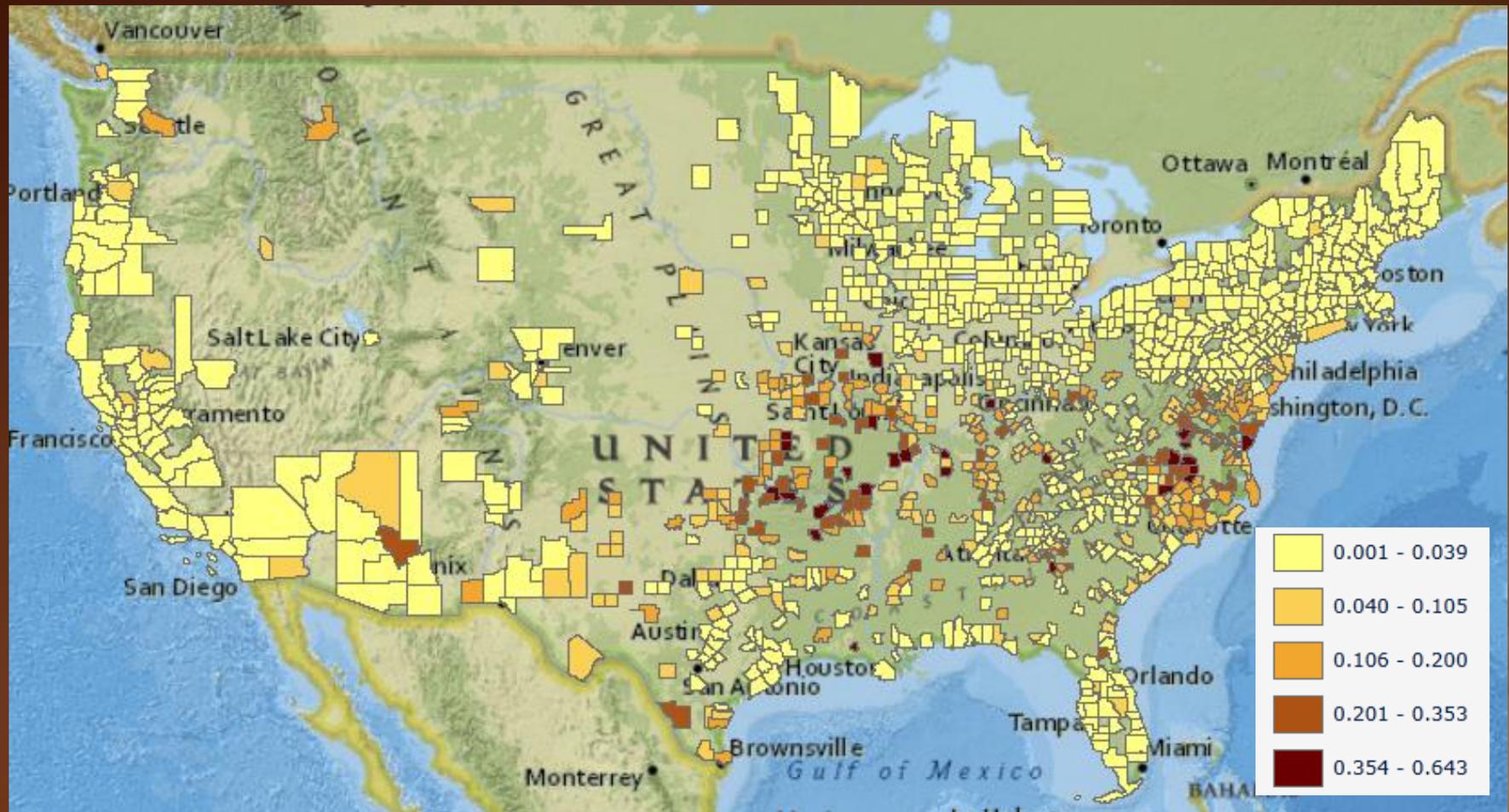


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Positivity Rate: Dogs Tested for Anaplasma -CAPC 2013

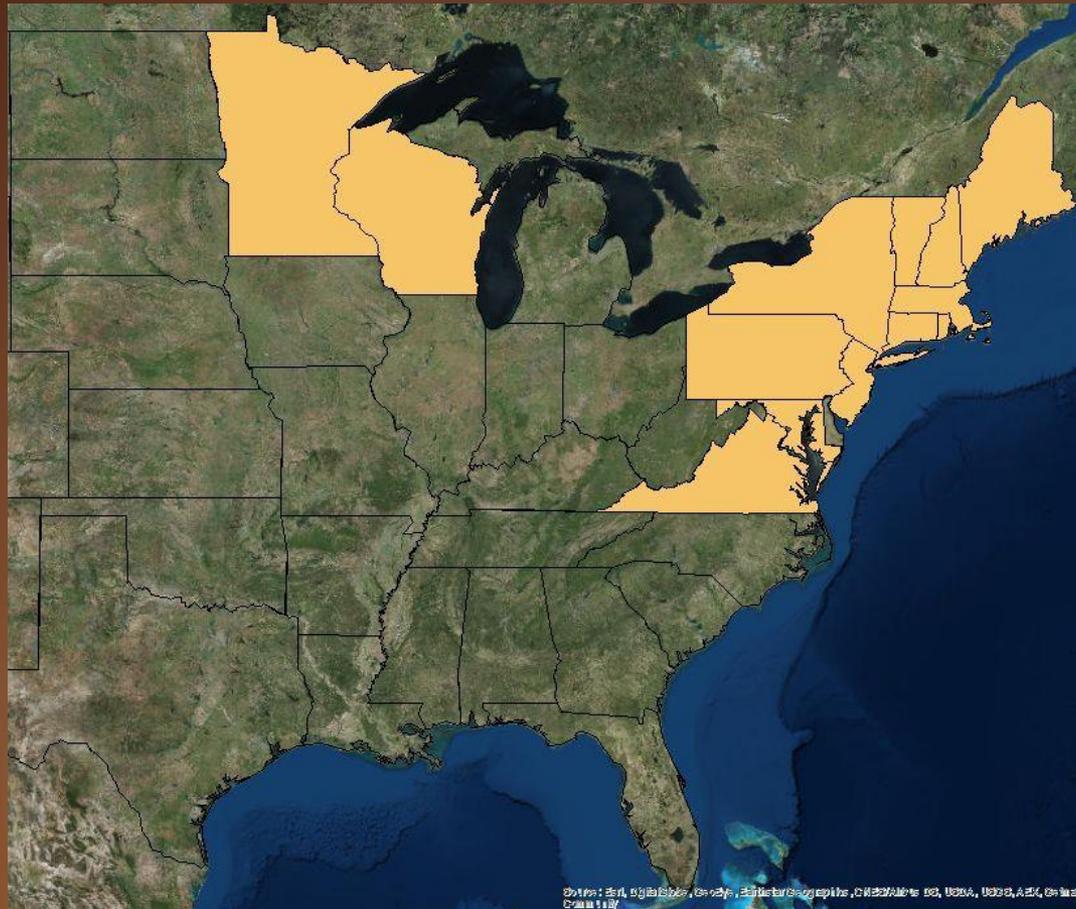


Positivity Rate: Dogs Tested for Ehrlichiosis -CAPC 2013



Top States Reporting Lyme Disease to CDC, 2013

According to the CDC, In 2013, 95% of confirmed Lyme disease cases were reported from 14 states: Connecticut, Delaware, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, Wisconsin.



States: CT, DE, ME, MD, MA, MN, NH, NJ, NY, PA, RI, VT, VA, WI
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Notes on Medically Important Ticks

Ixodes scapularis Say

(Blacklegged or Deer Tick)

Medical Importance:

Primary vector of the causative agent of Lyme borreliosis, especially in the northeastern and upper midwestern areas of the U.S.; vector of the protozoan *Babesia microti*, also in the Northeast and Upper Midwest; vector of the agent of human granulocytic anaplasmosis (HGA) and a new Ehrlichia; also vector of "deer tick virus" (closely related to POW); sometimes said to be a vector of *Bartonella henselae*, but the claim is thus far not well documented.

Hosts:

Immatures feed on lizards, small mammals, and birds; adults prefer deer but will bite people; in Mexico, additional host records from dogs, cattle, and jaguar.



Adult Female
Dorsal View



Adult Female
Ventral View

[AFPMB Tick-borne Diseases Technical Guide](#)

Amblyomma americanum (Linnaeus)

(Lone Star Tick)

Medical Importance:

Known vector of tularemia and Ehrlichia chaffensis. Suspected vector of Rocky Mountain spotted fever (RMSF), found naturally infected with Rickettsia parkeri and Ehrlichia ewingii.



Hosts:

Extremely aggressive and nonspecific in its feeding habits; all three motile life stages will feed on a wide variety of mammals, including humans and ground-feeding birds.

[AFPMB Tick-borne Diseases Technical Guide](#)



Dermacentor variabilis (Say)

(American Dog Tick)

Medical Importance:

One of the most medically important ticks in the U.S.; primary vector of RMSF in the East; also transmits tularemia and causes tick paralysis.

Hosts:

Immatures feed primarily on small mammals, particularly rodents; adults prefer the domestic dog but will readily bite humans.

[AFPMB Tick-borne Diseases Technical Guide](#)



Adult Female
Dorsal View



Adult female
Ventral View

Amblyomma maculatum Koch

(Gulf Coast Tick)

Medical Importance:

Known vector of American boutonneuse fever (infection with *R. parkeri*); nuisance effects due to painful bites.

Hosts:

Adults on large animals, including deer, cattle, sheep, and humans; larvae and nymphs on small mammals and ground-feeding birds, such as rabbits, fox, meadow larks, and bobwhite quail.

[AFPMB Tick-borne Diseases Technical Guide](#)



Adult Female
Dorsal View



Adult Male
Dorsal View

Dermacentor andersoni Stiles

(Rocky Mountain Wood Tick)

Medical Importance:

Primary vector of RMSF in the Rocky Mountain states and also known to transmit the causative agents of Colorado tick fever and tularemia; produces cases of tick paralysis in the U.S. and Canada each year.

Hosts:

Immatures prefer many species of small mammals, such as chipmunks and ground squirrels, whereas adults feed mostly on cattle, sheep, deer, humans, and other large mammals.

Ixodes pacificus Cooley and Kohls

(Western Blacklegged Tick)

Medical Importance:

Known to be a vector of Lyme borreliosis spirochetes; most, if not all, cases of Lyme borreliosis occurring in California transmitted by this tick; transmits agent of human granulocytic anaplasmosis; there are reports of Type I (IgE-mediated) hypersensitivity reactions in humans as a result of bites by this species.

Hosts:

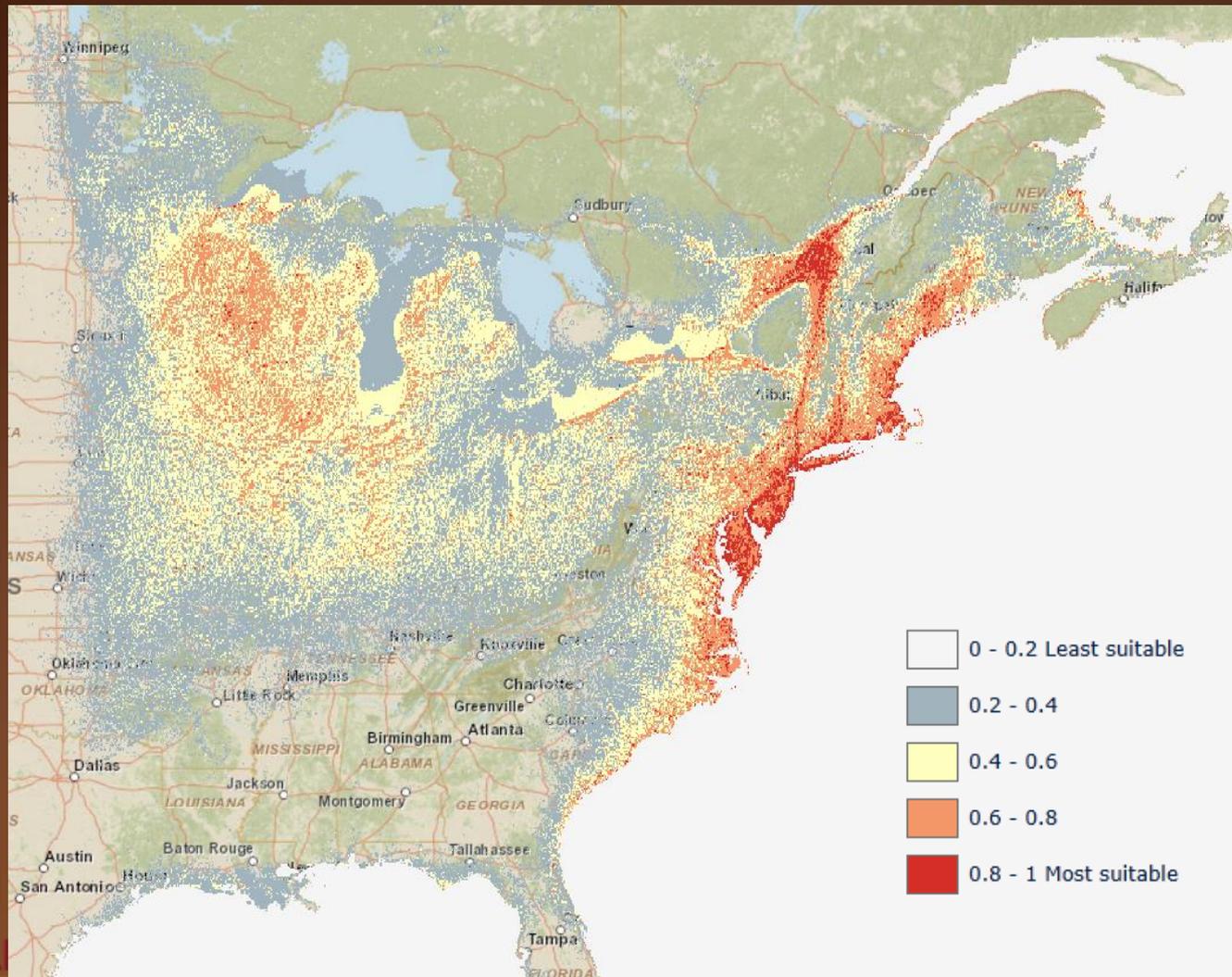
Immatures feed on numerous species of small mammals, birds, and lizards; in certain areas of California, predominance of feeding on lizards; adults feed primarily on Columbian black-tailed deer.

[AFPMB Tick-borne Diseases Technical Guide](#)

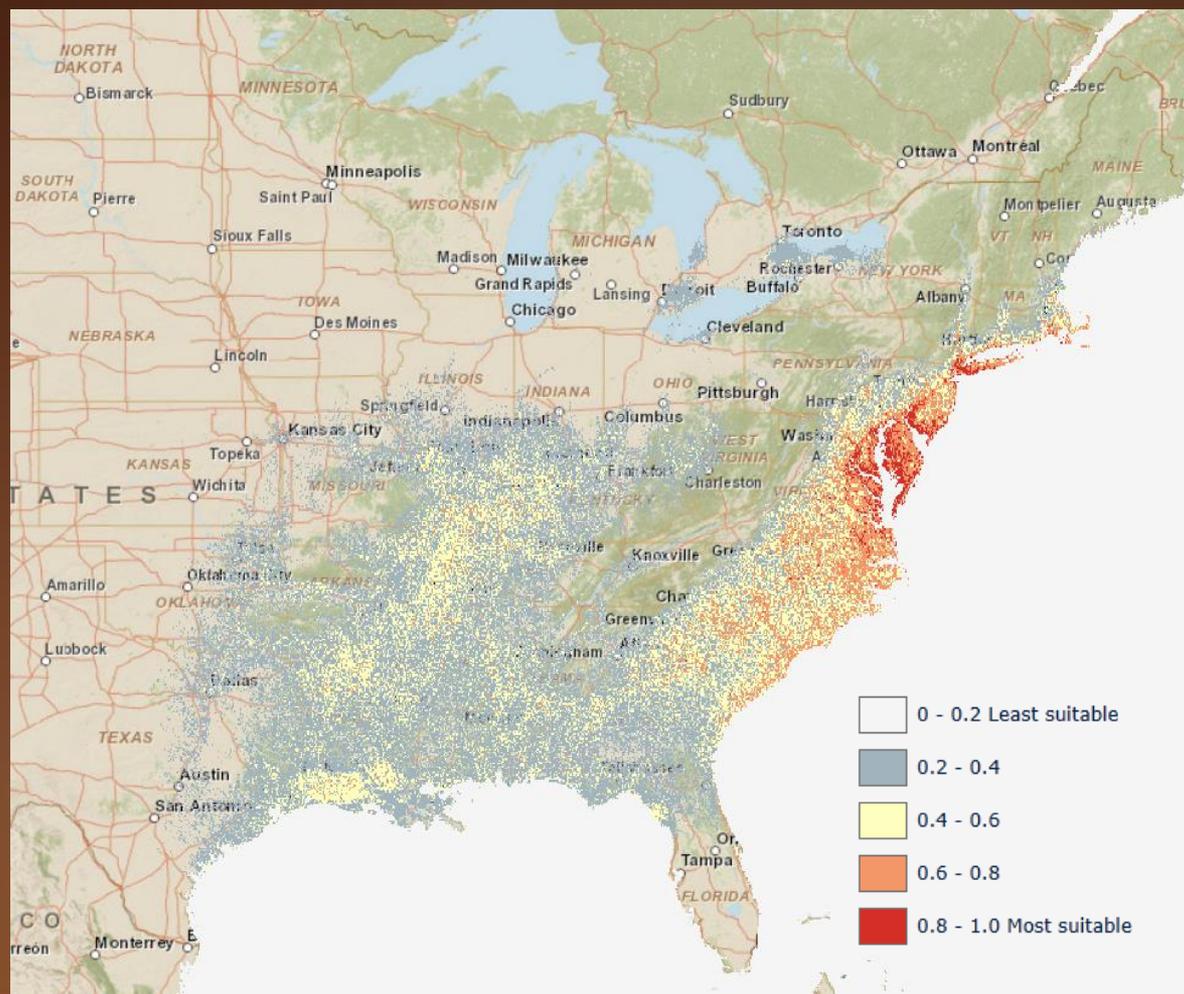
Habitat Suitability Models: Tick Vectors

Habitat Suitability Model: *Ixodes scapularis* Say

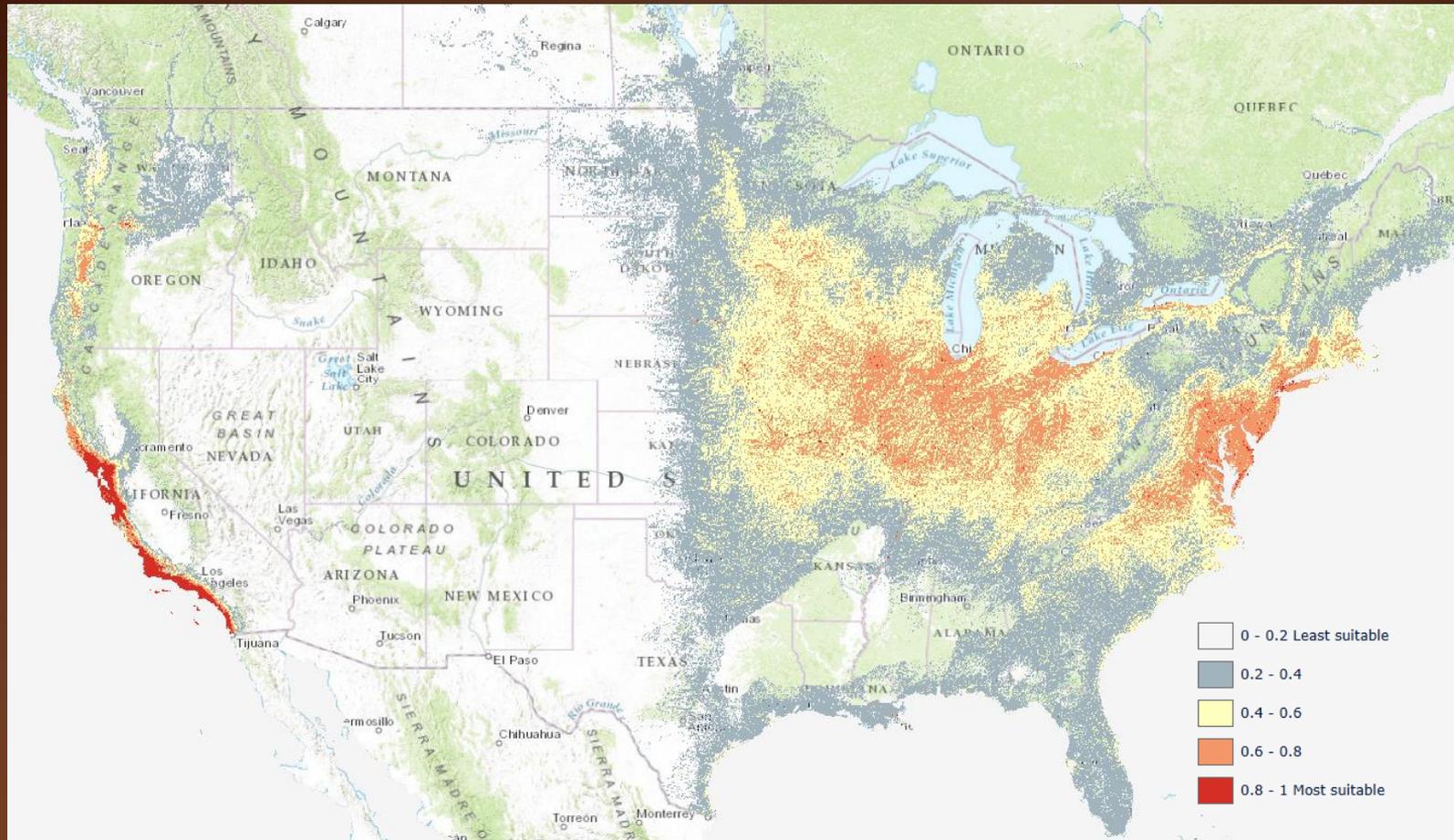
(Blacklegged or Deer Tick)



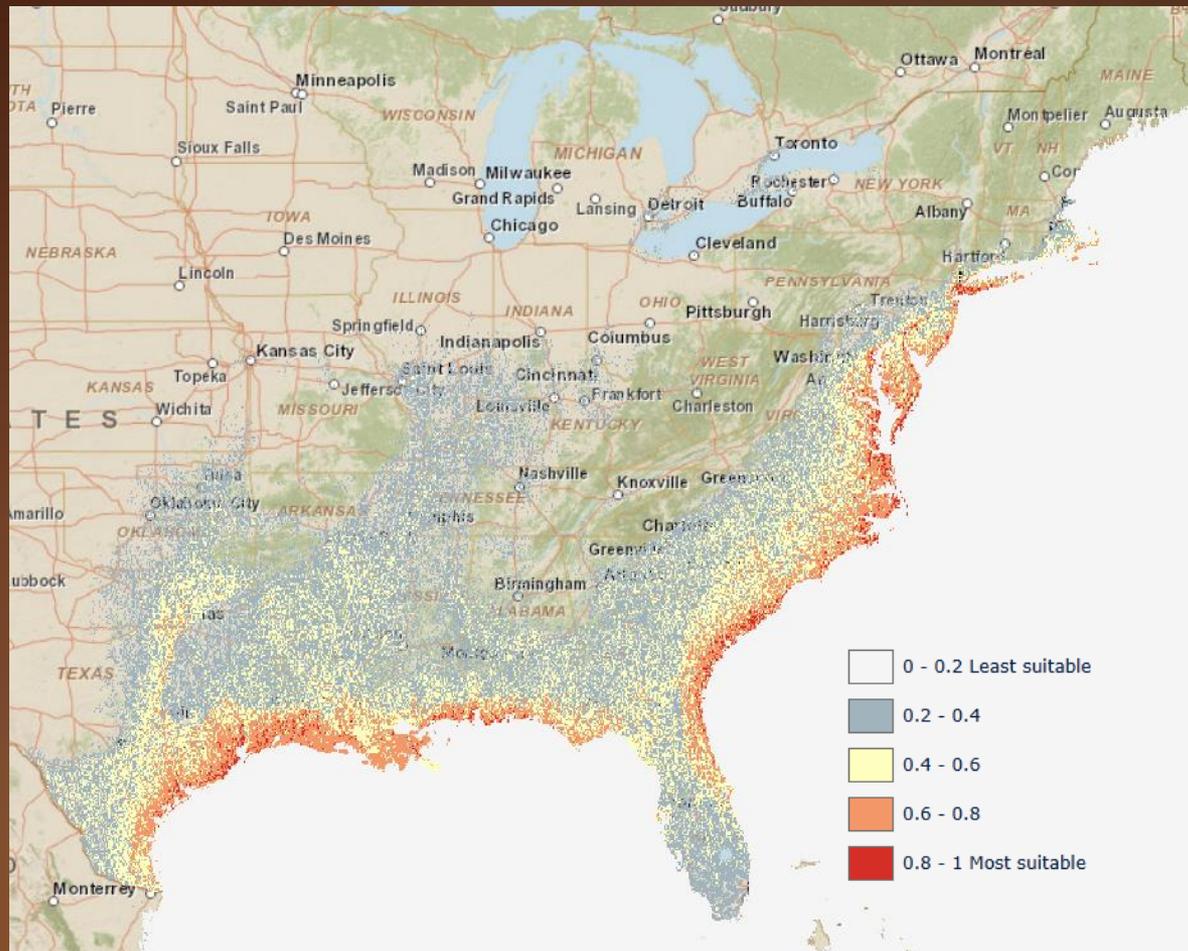
Habitat Suitability Model: *Amblyomma americanum* (Linnaeus) (Lone Star Tick)



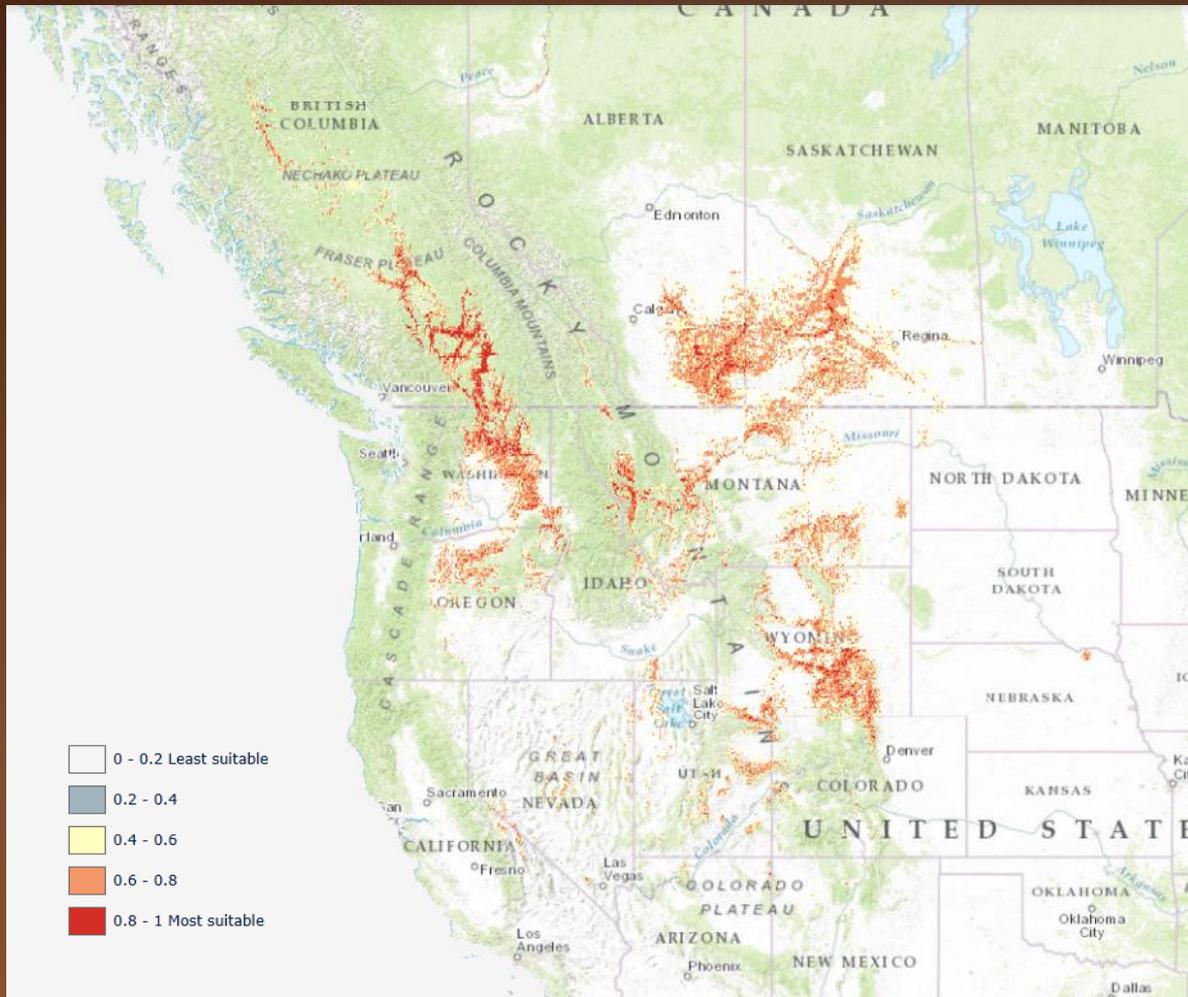
Habitat Suitability Model: *Dermacentor variabilis* (Say) (American Dog Tick)



Habitat Suitability Model: *Amblyomma maculatum* Koch (Gulf Coast Tick)



Habitat Suitability Model: *Dermacentor andersoni* Stiles (Rocky Mountain Wood Tick)

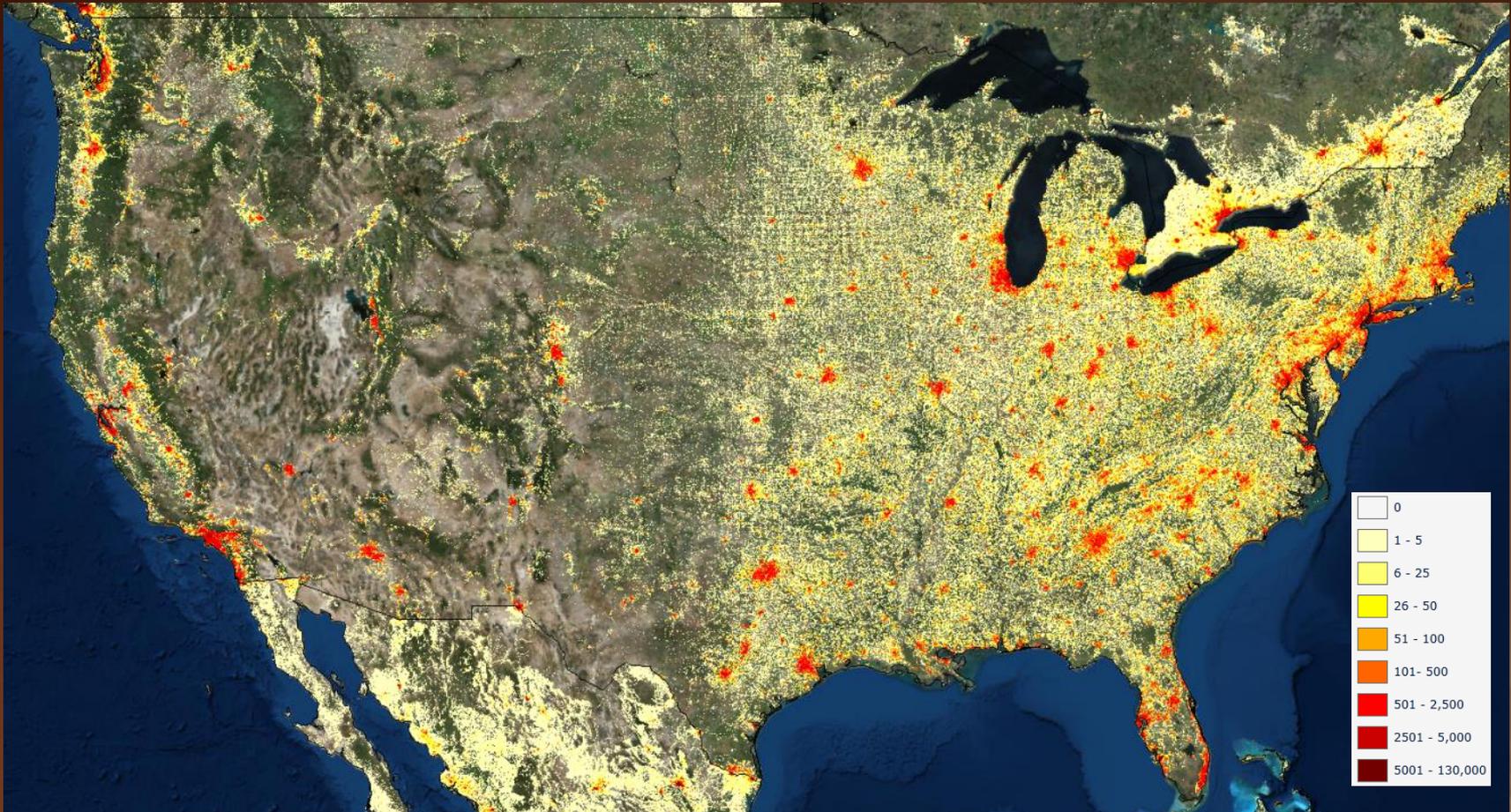


Habitat Suitability Model: *Ixodes pacificus* Cooley and Kohls (Western Blacklegged Tick)



Human Density

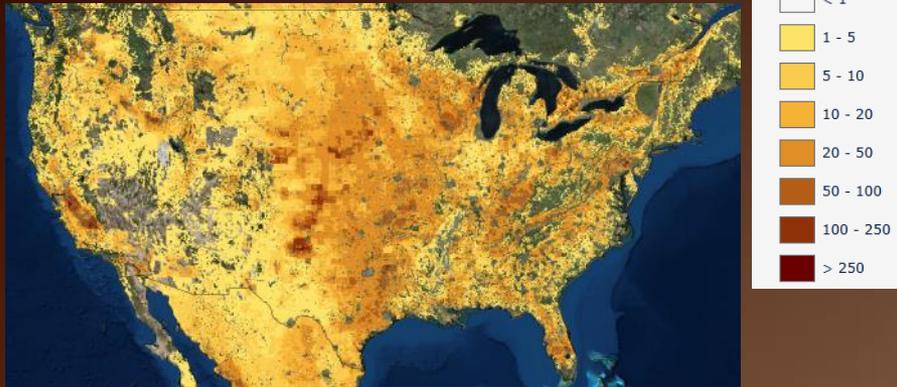
LandScan 2011



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

Host Densities, Food and Agriculture Organization of the United Nations, 2005

Cows per sq. km



Sheep per sq. km



Goats per sq. km



Poultry per sq. km



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LandScan 2011. People per 1 sq Km. LandScan (2011)TM 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/>

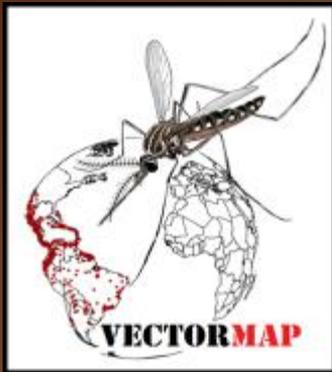
FAO (2007). The Gridded Livestock of the World. This dataset forms part of a global livestock mapping project by the Food and Agriculture Organization's Animal Production and Health Division (FAO-AGA). These data are freely available through the GLW website, through an interactive web application known as the Global Livestock Production and Health Atlas (GLiPHA), and through the FAO GeoNetwork data repository (see http://www.fao.org/AG/AGAInfo/resources/en/glw/GLW_dens.html)

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 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 Courtesy of Judith Stoffer, Walter Reed Biosystematics Unit

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