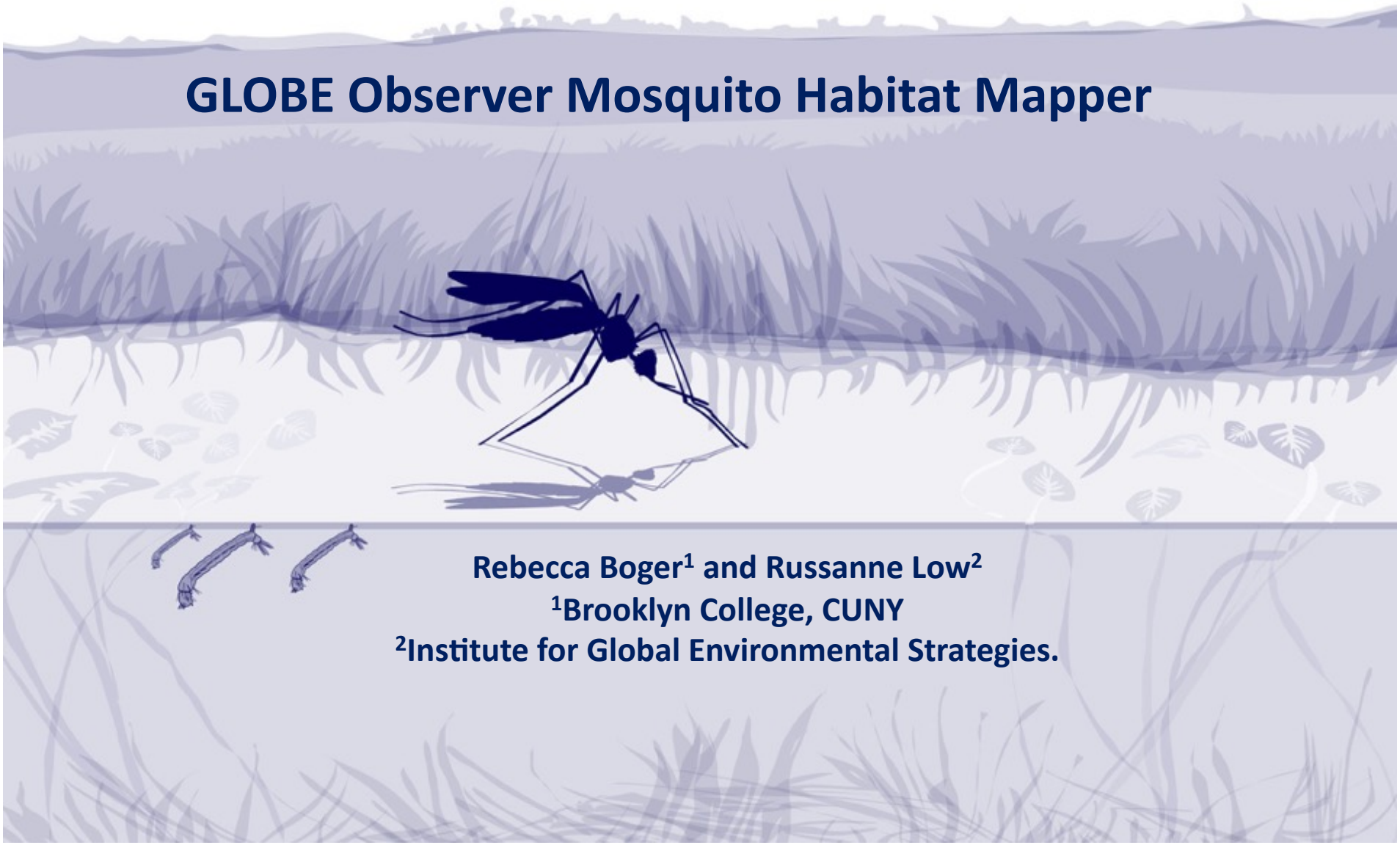
Mosquitoes on the GO!

GLOBE Observer Mosquito Habitat Mapper



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[1]Brooklyn College, CUNY

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GLOBE & GO Mosquitoes

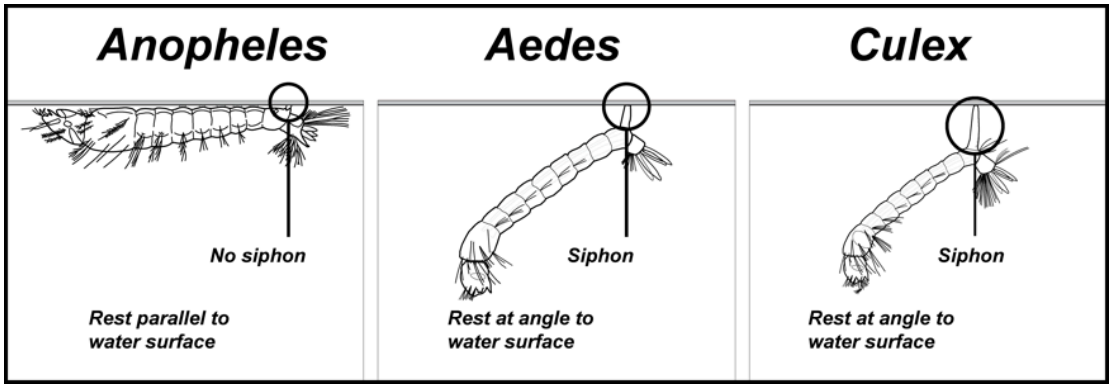
- Mosquito borne diseases
- Mosquitoes that carry these diseases
  - Life cycle
  - Habitats
- Connections with NASA; climate change
- Need for mosquito citizen science

Some facts and figures

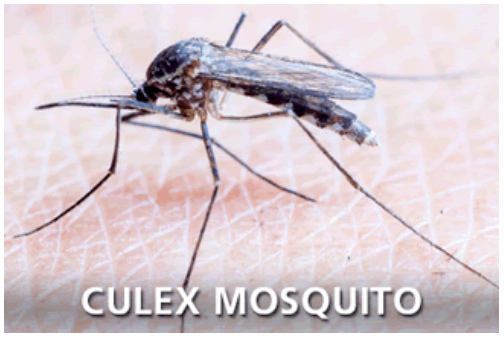
- In 2015 malaria caused 438,000 deaths, most of them children under 5 years old
- More than 2.5 billion people in over 100 countries are at risk of contracting dengue
- Worldwide incidence of dengue has risen 30-fold in the past 30 years, and more countries are reporting their first outbreaks of the disease
- More than half of the world's population live in areas where *Aedes aegypti* mosquito species is present

Mosquito genera that can transmit diseases to people

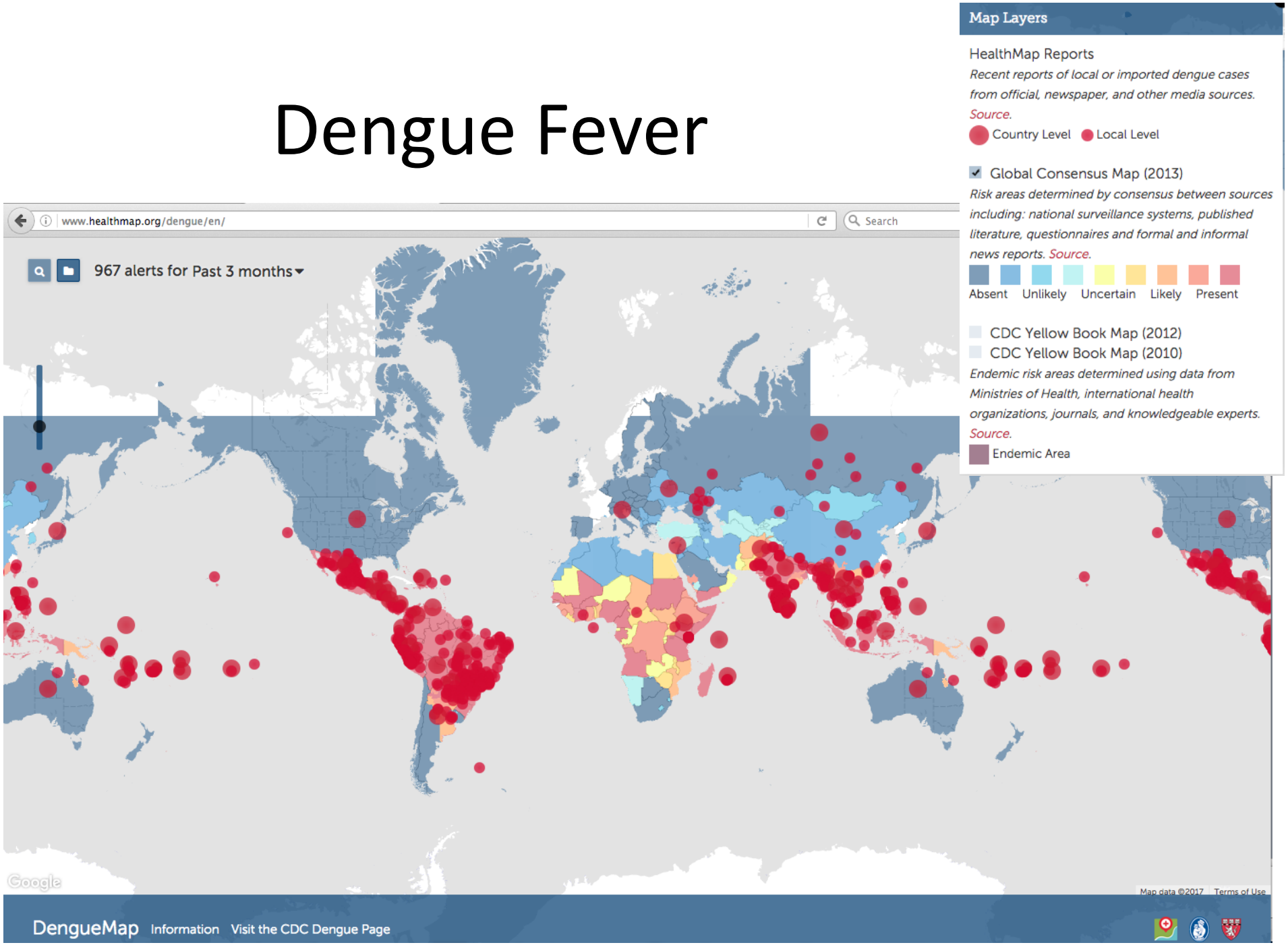
- *Aedes*
  - Chikungunya
  - Dengue fever
  - Rift Valley fever
  - Yellow fever
  - Zika
- *Anopheles*
  - Malaria
- *Culex*
  - Japanese encephalitis
  - Lymphatic filariasis
  - West Nile fever



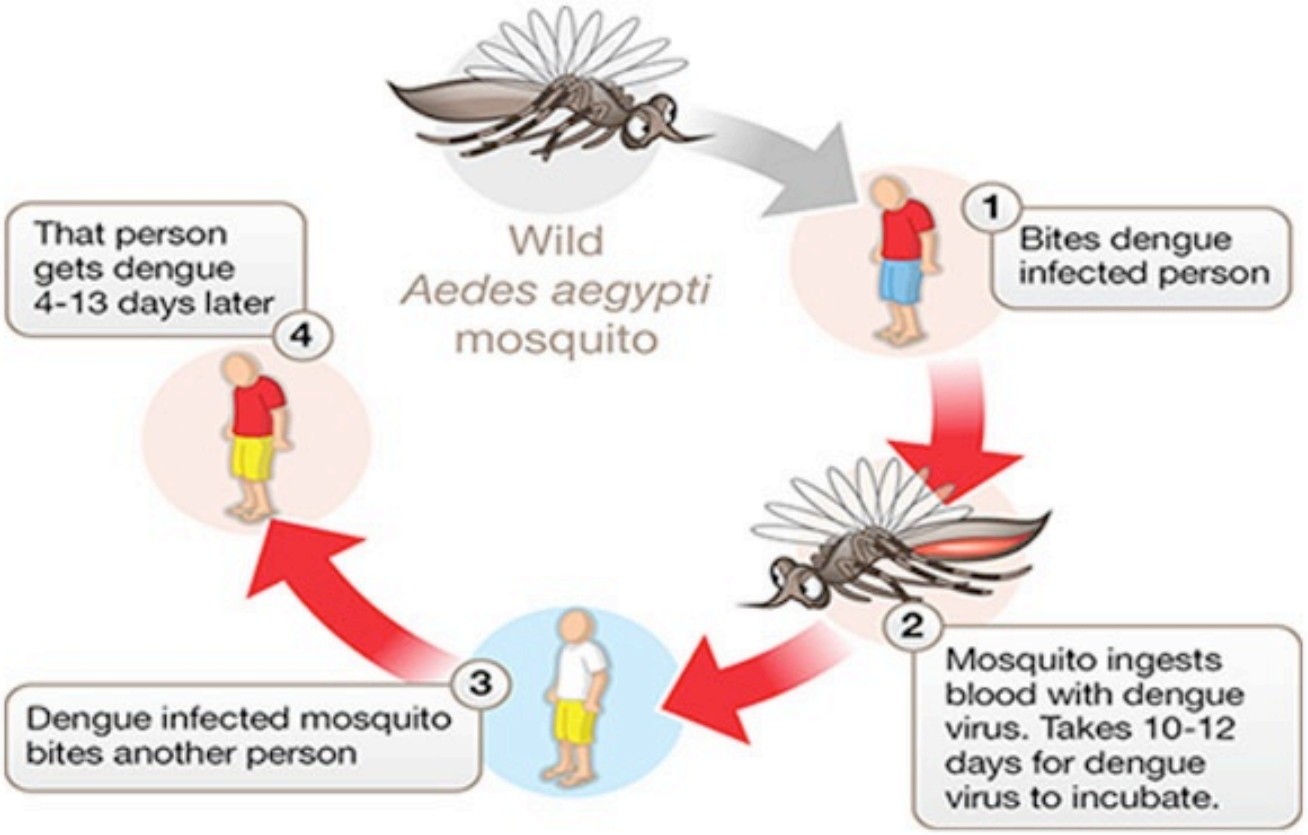
Adult *Aedes aegypti.* Image courtesy Florida Medical Entomology Laboratory.



Dengue Fever



Dengue – mosquito transmission



Females take blood meal

Dengue and other diseases are carried by *Aedes aegypti and Ae. albopictus*

Feral version: The wild type feeds on birds and small mammals and breeds in rock holes and natural depressions.

Domesticated: (this is what we have in the U.S.)

Wildly successful breeders in and around where humans live- because we make and use containers that have standing water!

Adult *Aedes aegypti.* Image courtesy of Florida Medical Entomology Laboratory

Day biter

Mosquitoes and the Zika Virus

- Human adapted- we create habitats they like!
- Bite all times of day
- Preferred breeding site: containers
- Produces 100-200 eggs
- Can persist dry for more than a year

Adult *Aedes aegypti.* Image courtesy of Florida Medical Entomology Laboratory

NOTE: Not all mosquitoes of these species carry the virus, and not all individuals who are bitten by these mosquitoes contract Zika- less than 4%.

How Zika spreads

Zika can be transmitted

- Through mosquito bites
- From a pregnant woman to her fetus
- Through sex
- Through blood transfusion (very likely but not confirmed)

Zika Virus

Language: English (US)

Cases At-A-Glance

Pregnant Women with Any Lab Evidence of Zika Virus Infection*

- US States and DC: 1,883
- US Territories: 3,916

*Source: Pregnancy Registries as of May 23, 2017

More on Outcomes

Zika Virus Disease Cases Reported to ArboNET*

- US States and DC: 5,285
- US Territories: 36,583

*Source: ArboNET as of May 31, 2017

ABOUT ZIKA

What everyone needs to know about Zika virus.

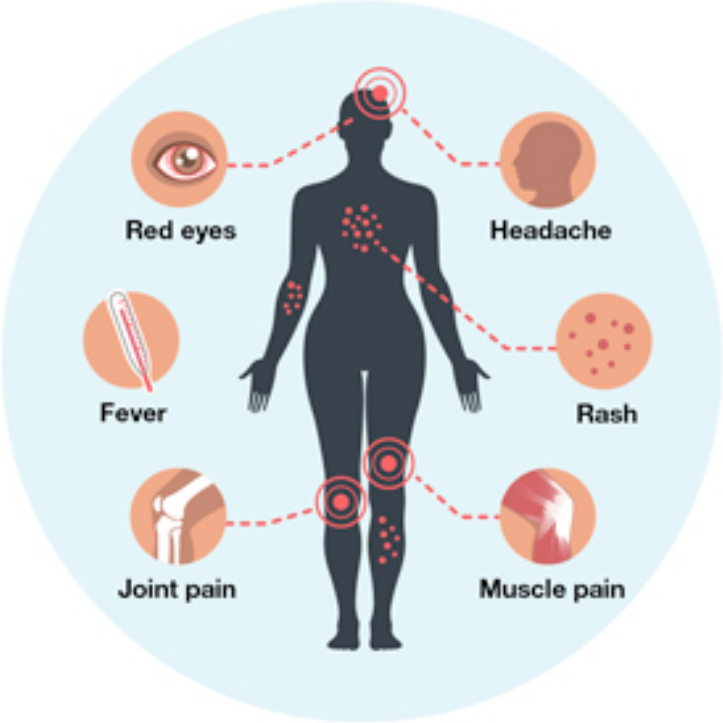
TRANSMISSION & RISKS

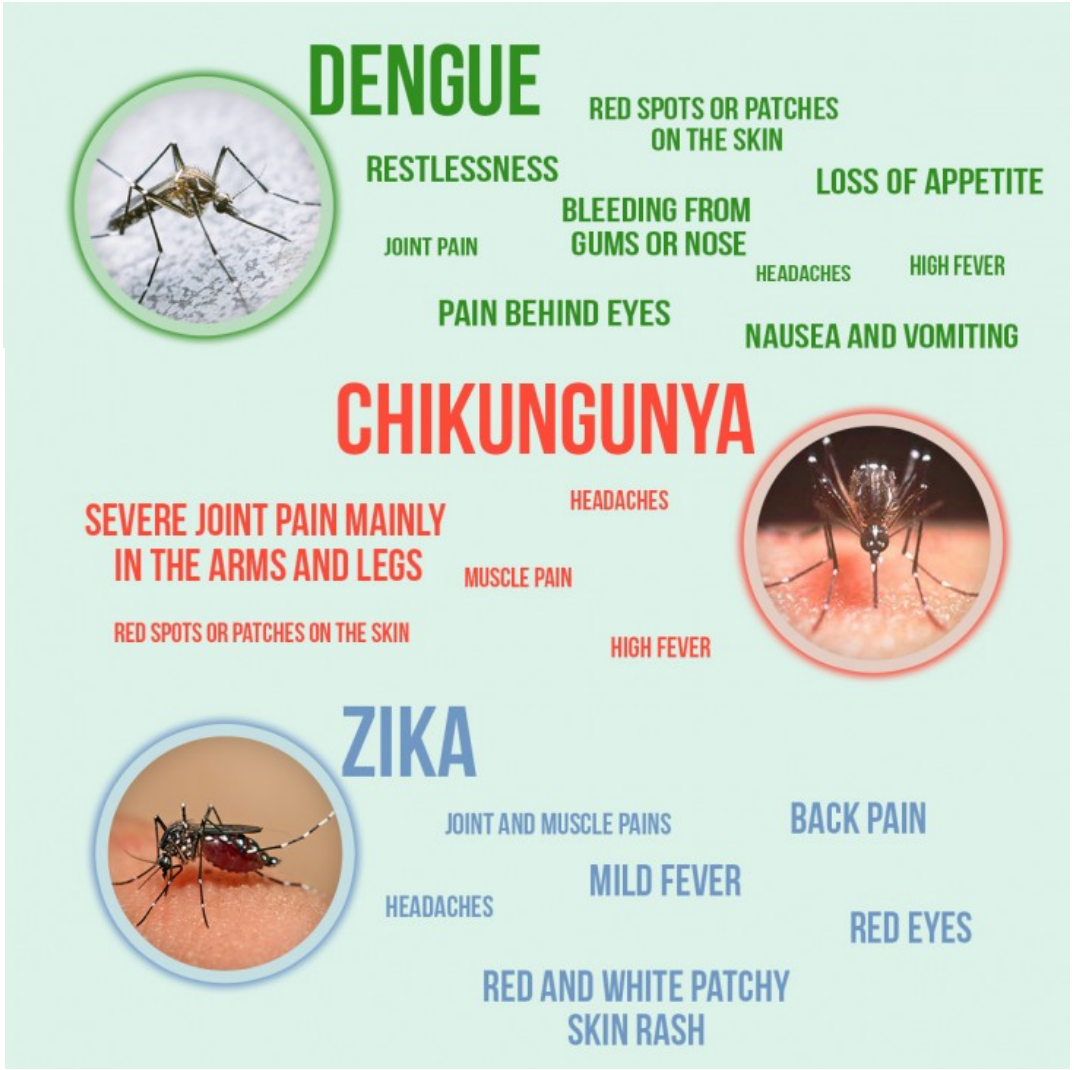
Zika is spread primarily through the bite of an infected mosquito.

SYMPTOMS, TESTING, & TREATMENT

Communication Resources

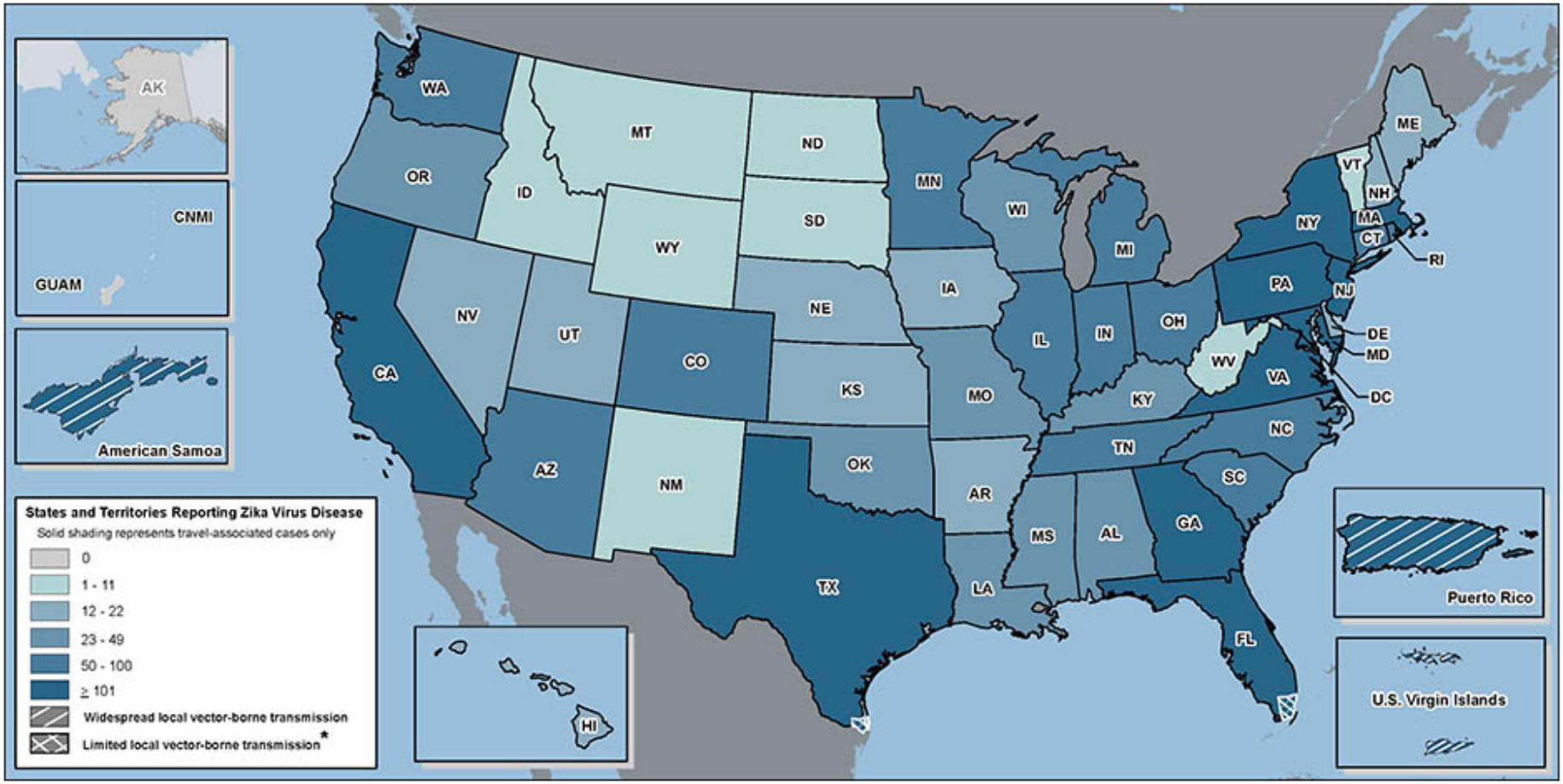
Symptoms


Red eyes
Headache
Fever
Rash
Joint pain
Muscle pain


DENGUE
RED SPOTS OR PATCHES ON THE SKIN
RESTLESSNESS
LOSS OF APPETITE
BLEEDING FROM GUMS OR NOSE
JOINT PAIN
HEADACHES
HIGH FEVER
PAIN BEHIND EYES
NAUSEA AND VOMITING
CHIKUNGUNYA
HEADACHES
SEVERE JOINT PAIN MAINLY IN THE ARMS AND LEGS
MUSCLE PAIN
RED SPOTS OR PATCHES ON THE SKIN
HIGH FEVER
ZIKA
JOINT AND MUSCLE PAINS
BACK PAIN
MILD FEVER
HEADACHES
RED EYES
RED AND WHITE PATCHY SKIN RASH

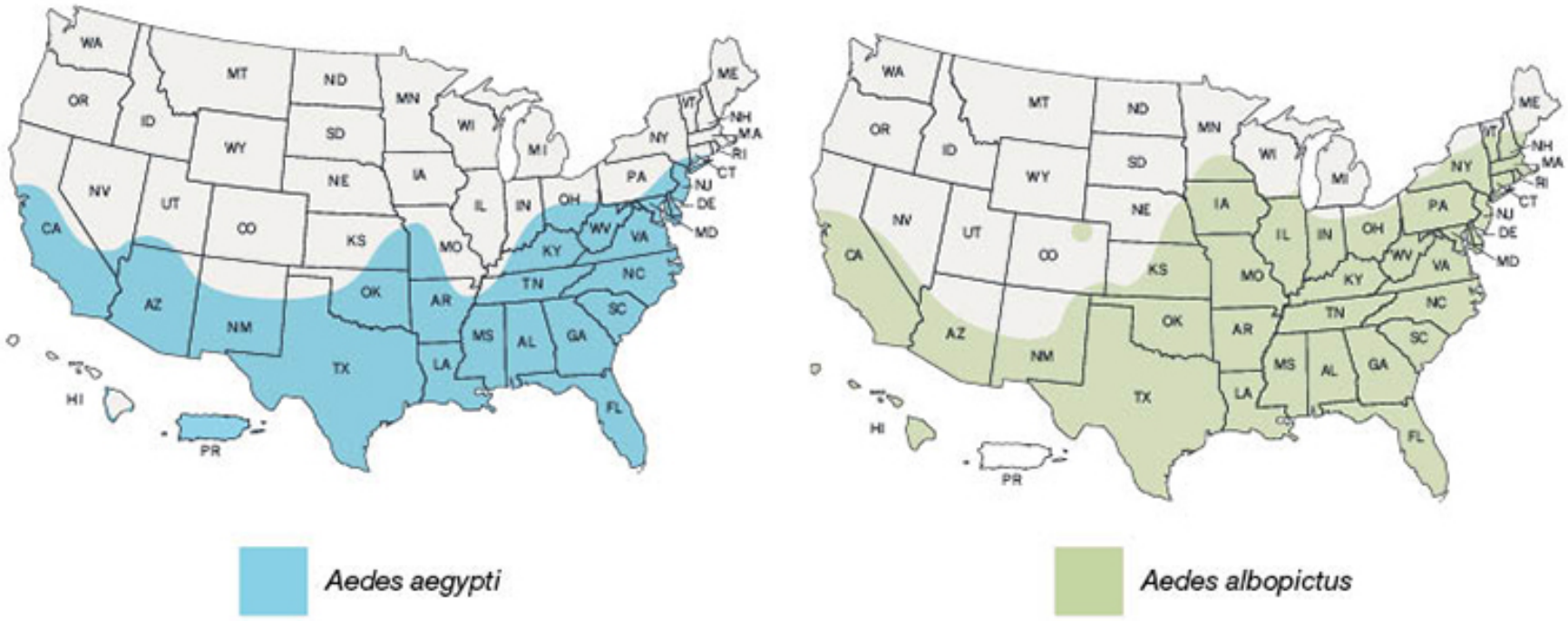
Zika Cases Reported in the United States

Laboratory-confirmed Zika virus disease cases reported to ArboNET by state or territory (as of January 25, 2017)



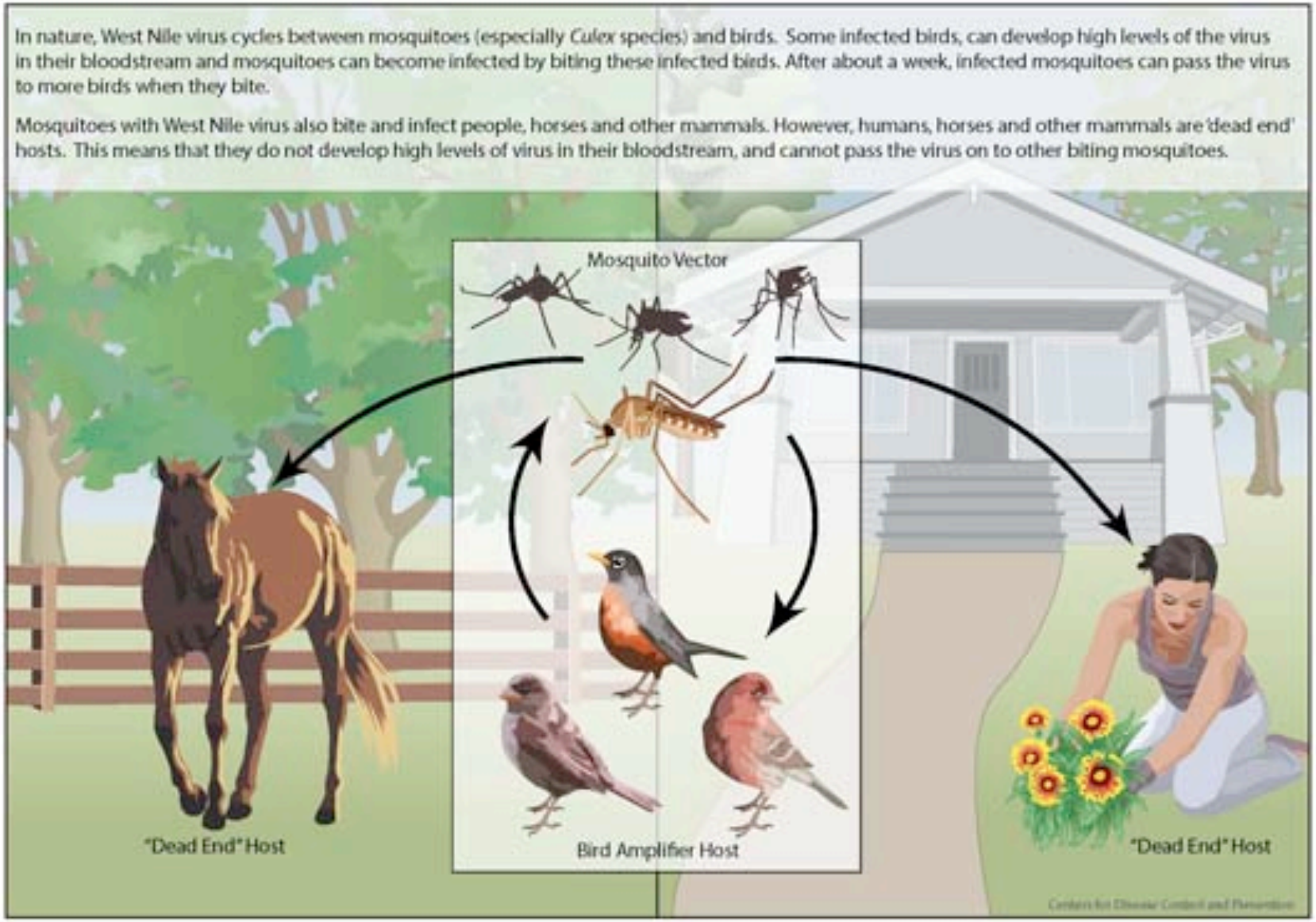
Source: https://www.cdc.gov/zika/intheus/maps-zika-us.html

Distribution of *Aedes aegypti* and *Ae. albopictus* in the United States



Above: Estimated ranges of *Aedes albopictus* and *A. aegypti* in the US, CDC. Right: https://www.optiderma.com/articles/zika-chikungunya-dengue-virus-skin-rashes/

West Nile Virus Transmission Cycle



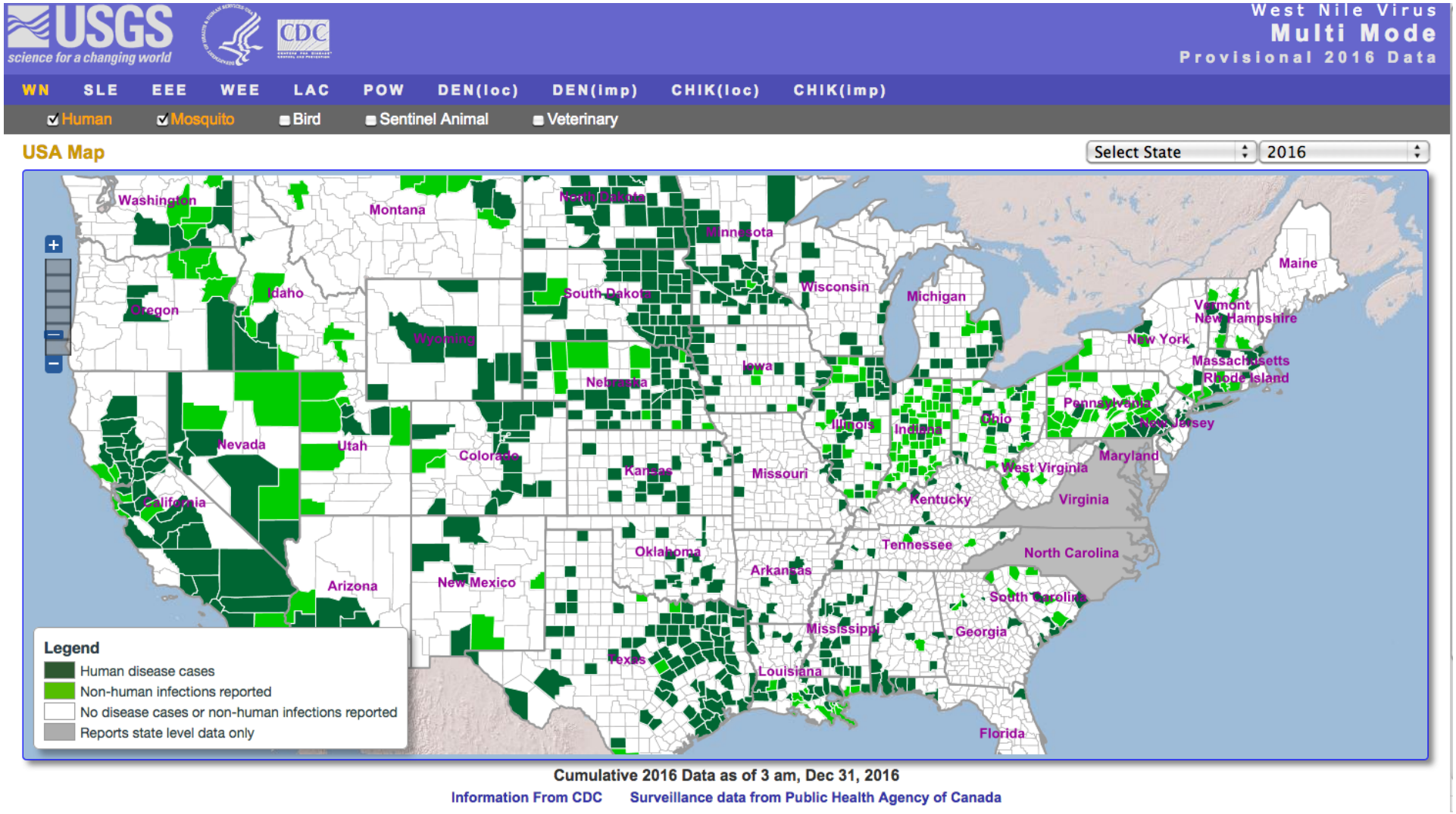
Source: https://www.cdc.gov/westnile/transmission/

WNV Transmission

- West Nile virus is most commonly transmitted to humans by mosquitoes.
- Additional routes of human infection have also been documented; these represent a very small proportion of cases:
  - Blood transfusions
  - Organ transplants
  - Exposure in a laboratory setting
  - From mother to baby during pregnancy, delivery, or breastfeeding
- West Nile virus is not transmitted:
  - From person-to-person or from animal-to-person through casual contact.
  - From handling live or dead infected birds.
  - Through consuming infected birds or animals.

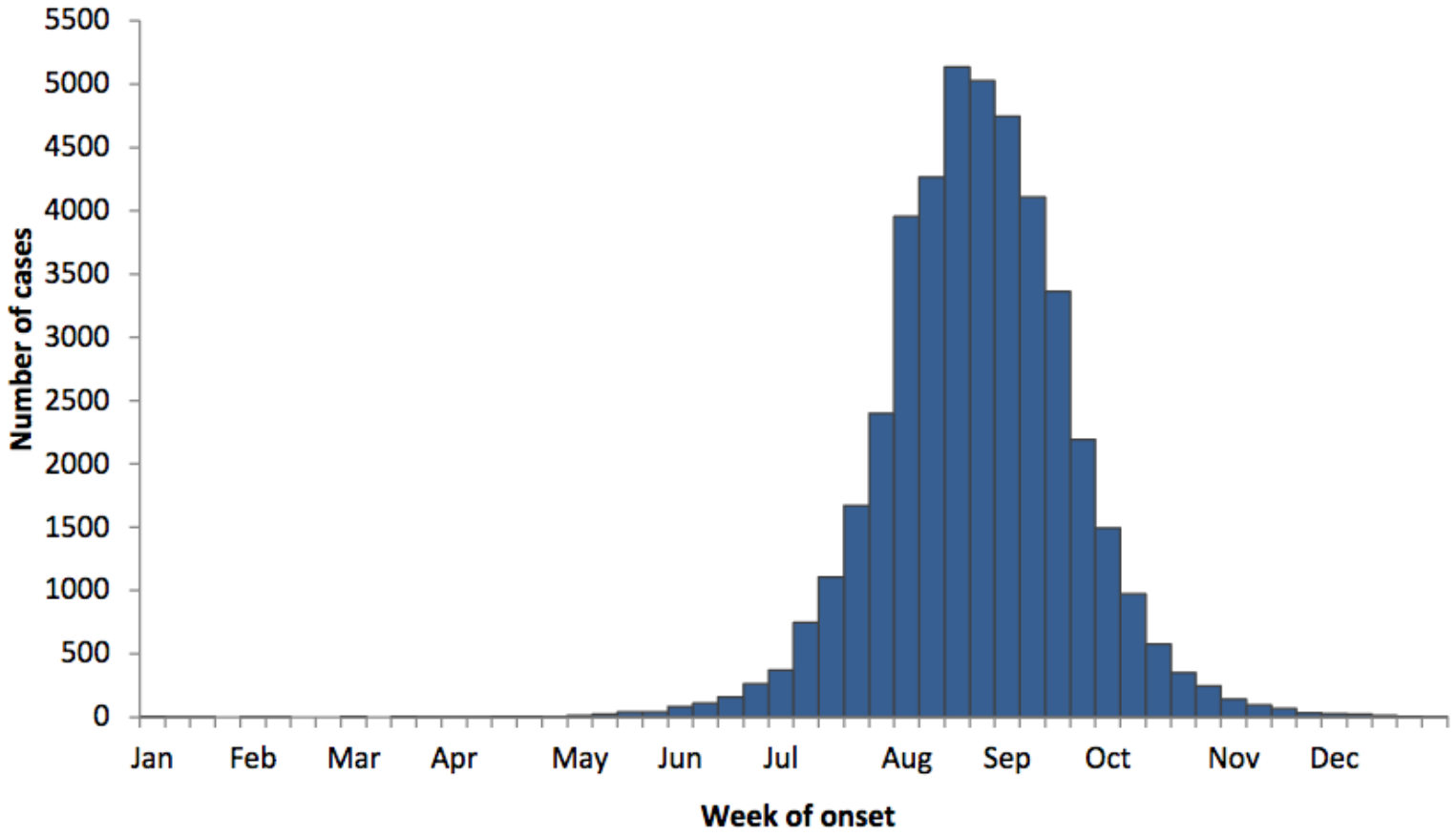
Mosquitoes - WNV

- Over 60 species have been found to carry WNV
- *Anopheles, Aedes, Culex* and other genera
- *Culex* considered the principle vectors, especially *Culex pipiens*



Source: https://diseasemaps.usgs.gov/mapviewer/

West Nile virus disease cases reported to CDC by week of illness onset, 1999-2015



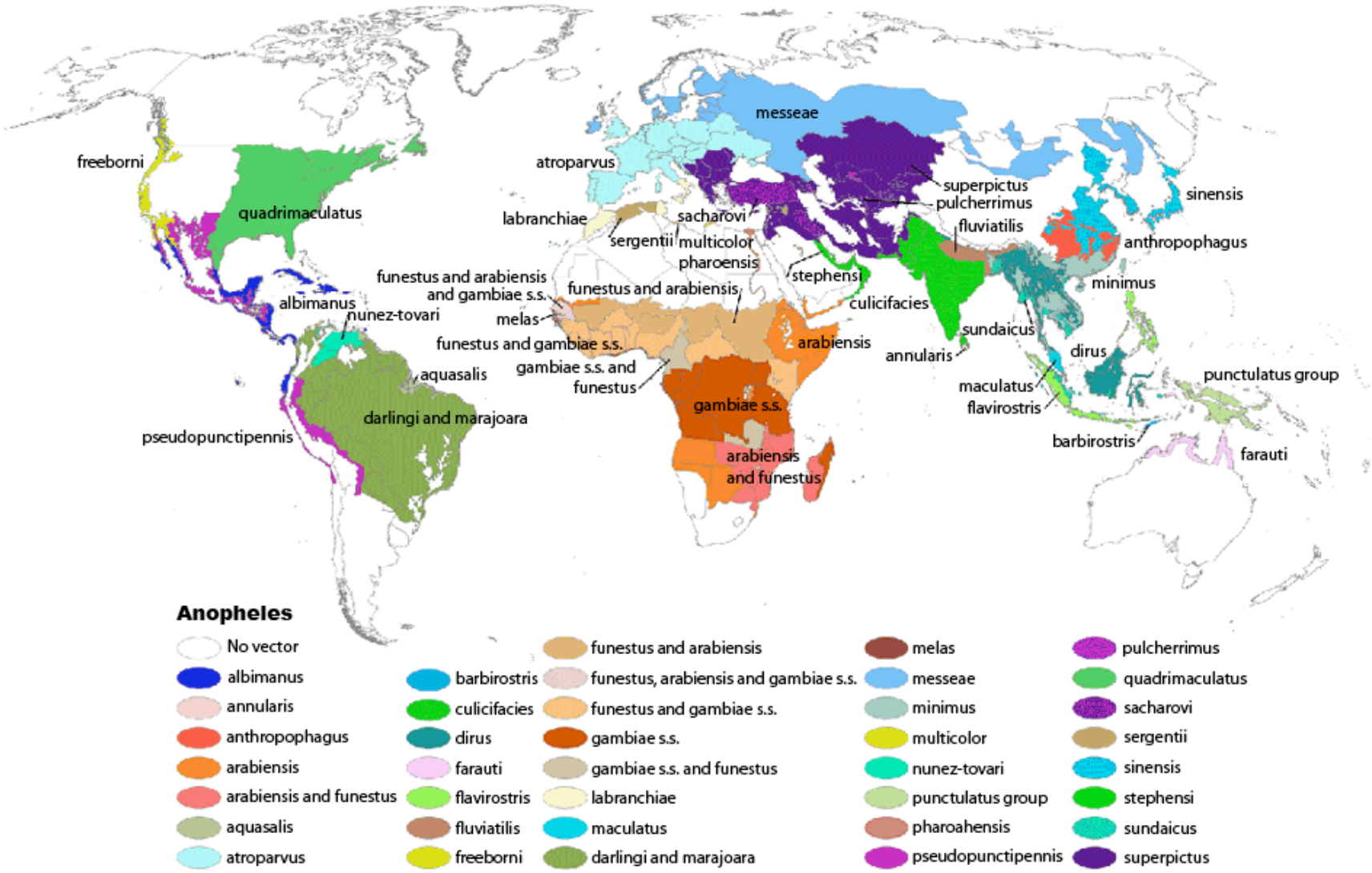
Source: ArboNET, Arboviral Diseases Branch, Centers for Disease Control and Prevention

https://www.cdc.gov/westnile/resources/pdfs/data/4-WNV-Week-Onset_for-PDF_1999-2015_07072016.pdf

Malaria

- Of about 400 Anopheles species, 30 can be malaria vectors
- Malaria is caused by Plasmodium parasites.
- There are 5 parasite species that cause malaria in humans, and 2 of these species – *P. falciparum* and *P. vivax* – pose the greatest threat.
  - *P. falciparum* is the most prevalent malaria parasite on the African continent. It is responsible for most malaria-related deaths globally.
  - *P. vivax* is the dominant malaria parasite in most countries outside of sub-Saharan Africa.

Global Distribution (Robinson Projection) of Dominant or Potentially Important Malaria Vectors

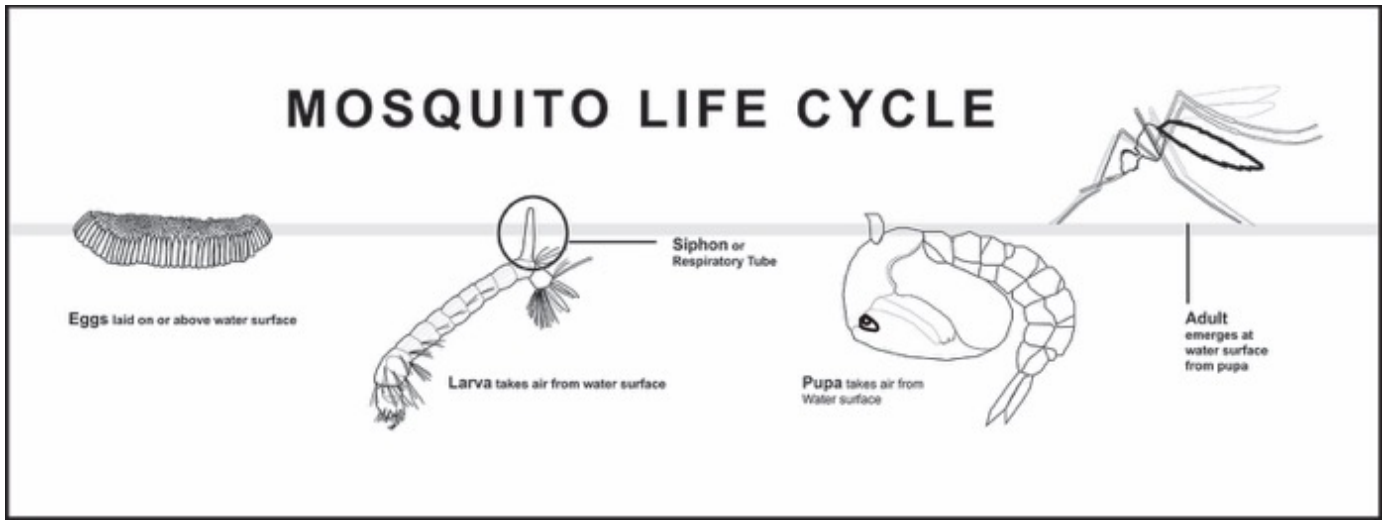


Source: https://www.cdc.gov/malaria/about/biology/mosquitoes/map.html

Life Cycle

The egg, larvae and pupae stages of the mosquito life cycle are dependent on water. The GO Mosquito App focuses on collecting and **identifying mosquito larvae in standing water.**

Note that handling of eggs and the larvae is safe: the eggs and larvae do not transmit disease. Only the bites of female mosquitoes transmit disease.



Mosquitoes, Environment and Weather

Hurricanes?

Unusually high rainfall: creates new breeding sites where none existed before.

Unusually low rainfall can change habitats can concentrate water into small pools where there was previously flowing water.

- Increase in proportion of breeding sites in containers.

Hurricanes or drought: Both provide new and unique places for mosquitoes to breed

Citizen Scientists -You -play an important role in finding breeding sites and mitigating them

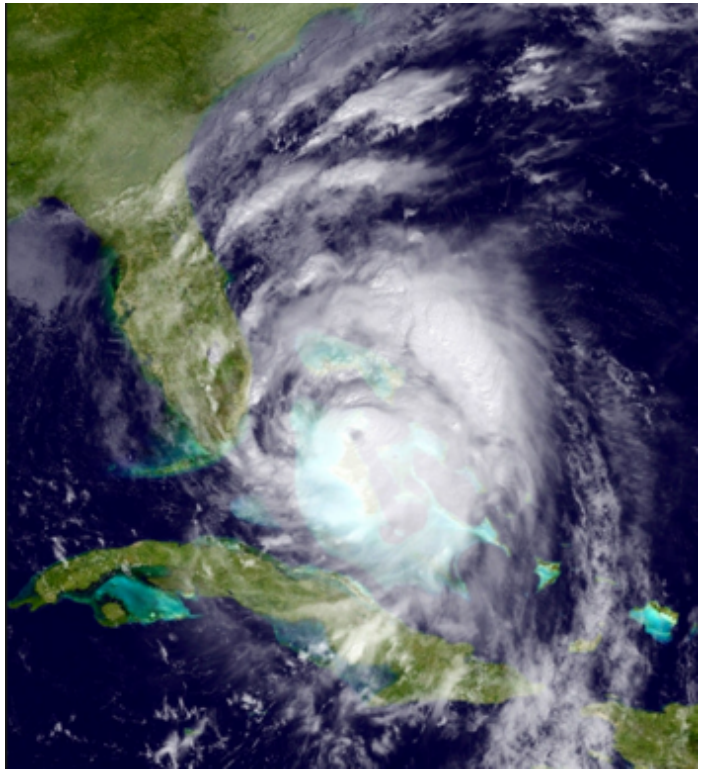


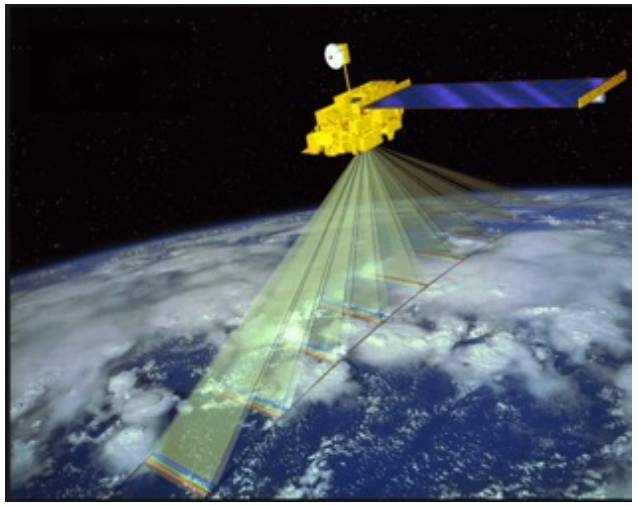
Image: CDC.

Can’t quite see mosquitoes from here!

You Can’t See Mosquitoes from Space

“I don't see mosquitoes from satellites, unfortunately, but I see the environment where mosquitoes are,” says Felix Kogan of the NOAA Satellite and Information Service in this video about his work**. “Mosquitoes like warm and moist environments and this is what I see from the operational satellites.”**

Seasonal patterns of temperature and precipitation may be altered by climate change where you live. Changes in land use is also an important factor in creating new mosquito breeding sites.



Can’t quite see mosquitoes from here. Terra from space. Image: NASA.

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On-the-ground monitoring of mosquito breeding habitats is important for NASA Science!

Why Collect Mosquito Data?

Globally, there is a major effort to use data from satellites to predict the onset, decline, and spread of vector-borne diseases. Reliable ground-based data are helpful for the development of realistic computer models based on satellite data.

In many parts of the world, sufficient "ground-truth" data are simply not available- so GLOBE observations are critically important to tracking and controlling disease.

And- these satellites can't distinguish between the sites in your community- we need the "eyes in the sky" but also the "boots on the ground"!

Teachers Guide

Hydrosphere
Alkalinity
Conductivity
Dissolved Oxygen
Freshwater Macroinvertebrates
Mosquitoes
Nitrates
Salinity (including Titration)
Water Temperature
Water Transparency
pH
Discussions & Member Documents

Mosquitoes

Teachers Guide Search

Search by grade level, protocol...

Protocol Field Guides Data Sheets

Protocol

Mosquito Larvae Protocol (pdf)

To sample, identify and count the number of mosquito larvae at the genus or species level in your study site or community.

Protocolo de la Larva del Mosquito (pdf)

Tomar muestreos, identificar y contabilizar el número de larvas de mosquito a nivel de género o especie en su sitio de estudio o comunidad.

Field Guides

Step-by-step instructions for collection data according to the protocols.

Mosquito Larvae Identification Guide (pdf)

Mosquito Larvae Sampling Field Guide (pdf)

Protocolo de Identificacion Larva del Mosquito (pdf)

AT&T
1:32 PM
GLOBE
Observer
Choose your protocol:
GLOBE
clouds
GLOBE
mosquito
habitat
mapper

The app explains how you can collect a sample to examine the larvae.