



# Mosquitoes as Vectors of Human Disease: *Aedes*, *Anopheles* and *Culex*



# What do you know about mosquitoes?

- Where do they breed?
- Why are some mosquitoes dangerous to humans?
- How can you protect yourself and your community?

# Mosquitoes are responsible for more human deaths than any other kind of animal.

Every year, more than a billion people worldwide (roughly one in every seven people) become ill and half a million die as a result of mosquito bites.

This presentation will introduce you to some of the most serious mosquito vectors of human disease. They fall into one of three genera:

*Anopheles*

*Aedes*

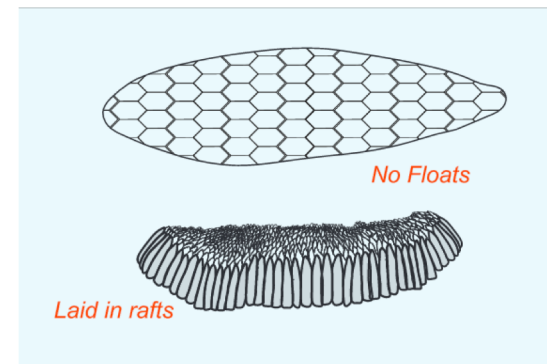
*Culex*

## Genus *Anopheles*

- *Anopheles* mosquito larvae are found in a wide variety of habitats. Many species of *Anopheles* prefer open-water pools with little vegetation, but others have adapted to different habitats.
- *Anopheles* species lay individual eggs, supported by floats, on the water surface or on moist soil immediately adjacent to fluctuating water bodies.



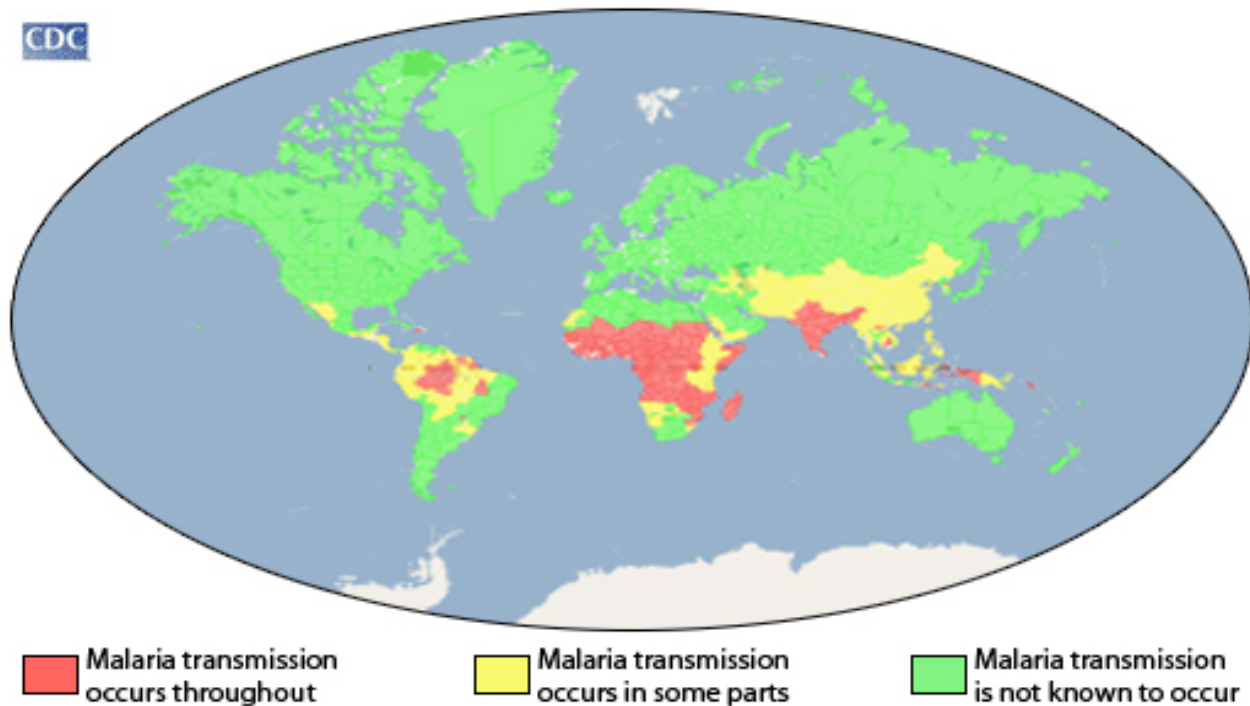
*Anopheles gambiae*  
Credit: James Gathany  
Source: CDC



## *Anopheles* as a human disease vector

- Malaria is a disease caused by parasites that are transmitted to humans by the *Anopheles* mosquito. Malaria causes more deaths per year than any other mosquito-transmitted disease.
- The female *Anopheles* requires a blood meal to produce her eggs.
- When female mosquitoes bite an infected person the parasite is transmitted to the mosquito. The parasite enters the mosquito gut and eventually moves to her salivary glands. The mosquito injects the parasite along with her saliva at a subsequent feeding.
- Not all *Anopheles* mosquitoes transmit malaria.
- You can find out which species are important vectors for disease transmission in your region.

# Malaria (*Anopheles* mosquito)



**Number of cases per year:** 214 million.

**Prevention:** Anti-malaria medication, netting and screens, bug repellent, long clothing, and eliminating breeding sites.

## *Anopheles* in Central and South America

### Common species include:

*Anopheles darlingi*

*Anopheles marajoara*

*Anopheles albimanus*

*Anopheles pseudopunctipennis*

*Anopheles aquasalis*

*Anopheles albitarsis*

*Anopheles braziliensis*

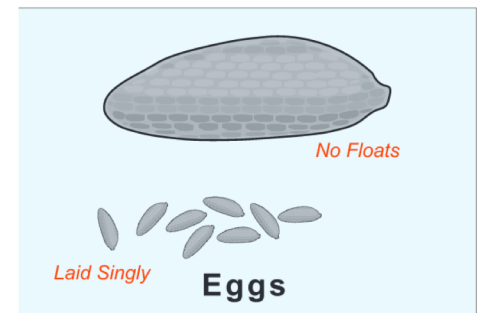


*To determine if the Anopheles mosquito you identify using the GLOBE Observer Mosquito Habitat Mapper is a potential disease vector, consult a local mosquito key.*

## Genus *Aedes*

*Aedes aegypti* and *Aedes albopictus* are container breeding mosquitoes. They lay eggs in artificial containers that contain water. The females lay the eggs just above the water level. When the water level rises, it moistens the eggs, and they then begin to develop. *Aedes aegypti* strongly prefer artificial containers. *Aedes albopictus* will use both artificial and natural containers.

Other *Aedes* mosquitoes breed in floodplains after rain events, in irrigation ditches, in woodland pools, brackish swamps and salt marshes.





## *Aedes* as a human disease vector

*Aedes aegypti* and *Aedes albopictus* are species that potentially transmit pathogens to humans that can cause the following diseases:

- Yellow fever
- Dengue fever
- Zika virus
- Chikungunya
- Lymphatic filariasis

# Yellow fever

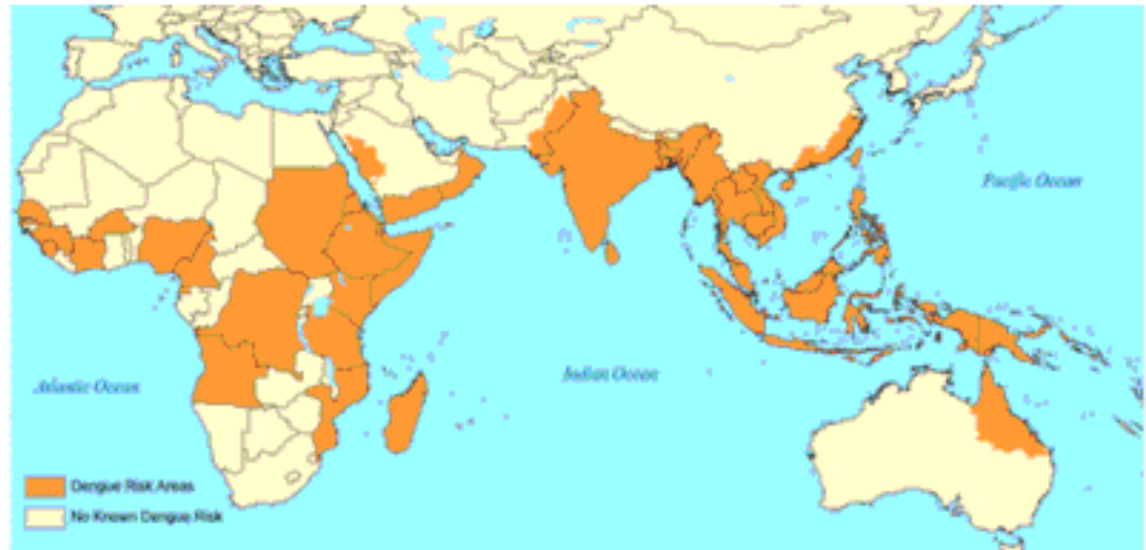
*(Aedes aegypti/ Aedes albopictus mosquito)*

- **Symptoms:** fever, headache (mild) to organ failure (severe)
- **Prevention:** Vaccination, repellants, long clothing, , netting and screens, eliminating breeding sites.



# Dengue

*(Aedes aegypti/ Aedes albopictus mosquito)*

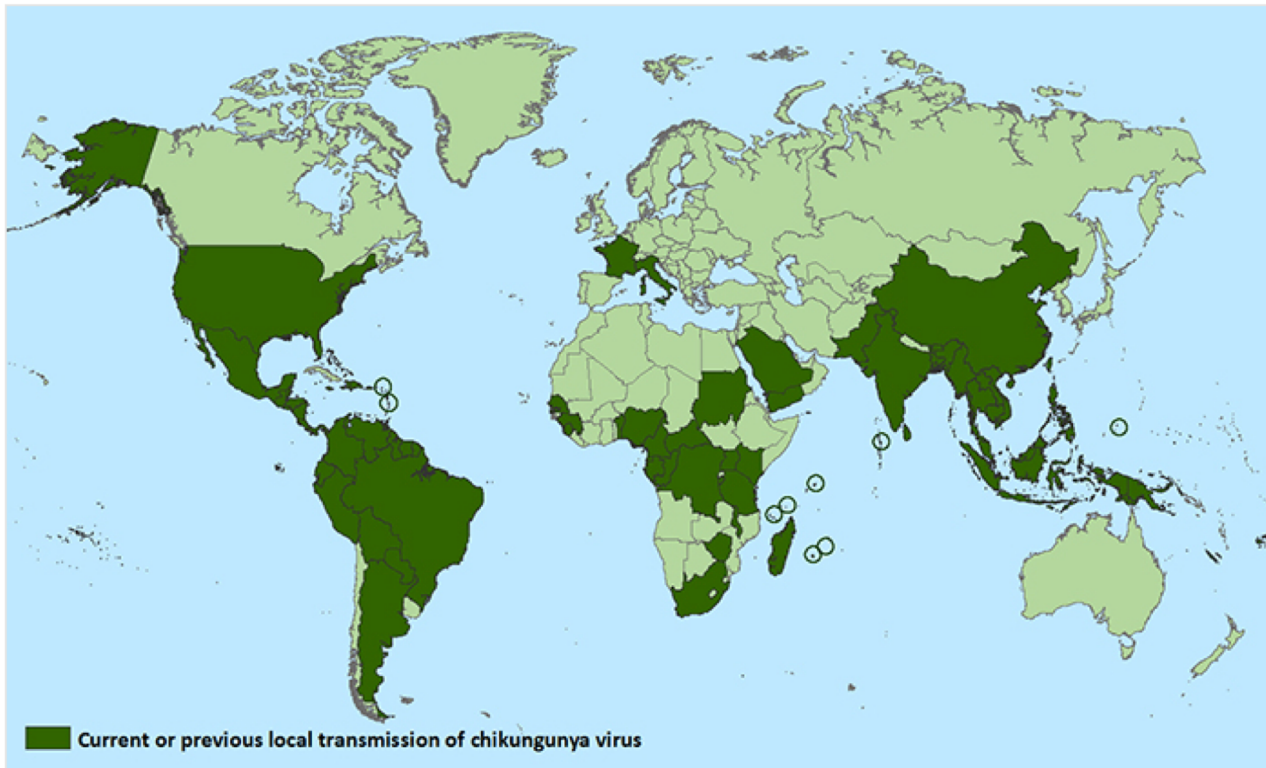


- 40% of the world's populations lives in areas where there is a risk of dengue transmission.
- **Number of cases per year:** ~400 million (CDC).
- **Symptoms:** fever, headache, joint pain, rash... can be fatal
- **Prevention:** Repellants, long clothing, netting and screens, eliminating breeding sites. (No vaccine)

# Chikungunya

*(Aedes aegypti/ Aedes albopictus mosquito)*

Countries and territories where chikungunya cases have been reported\* (*as of April 22, 2016*)



- **Symptoms:** fever and rash – similar to dengue and Zika.
- **Prevention:** Repellant, long clothing, netting and screens, eliminating breeding sites.

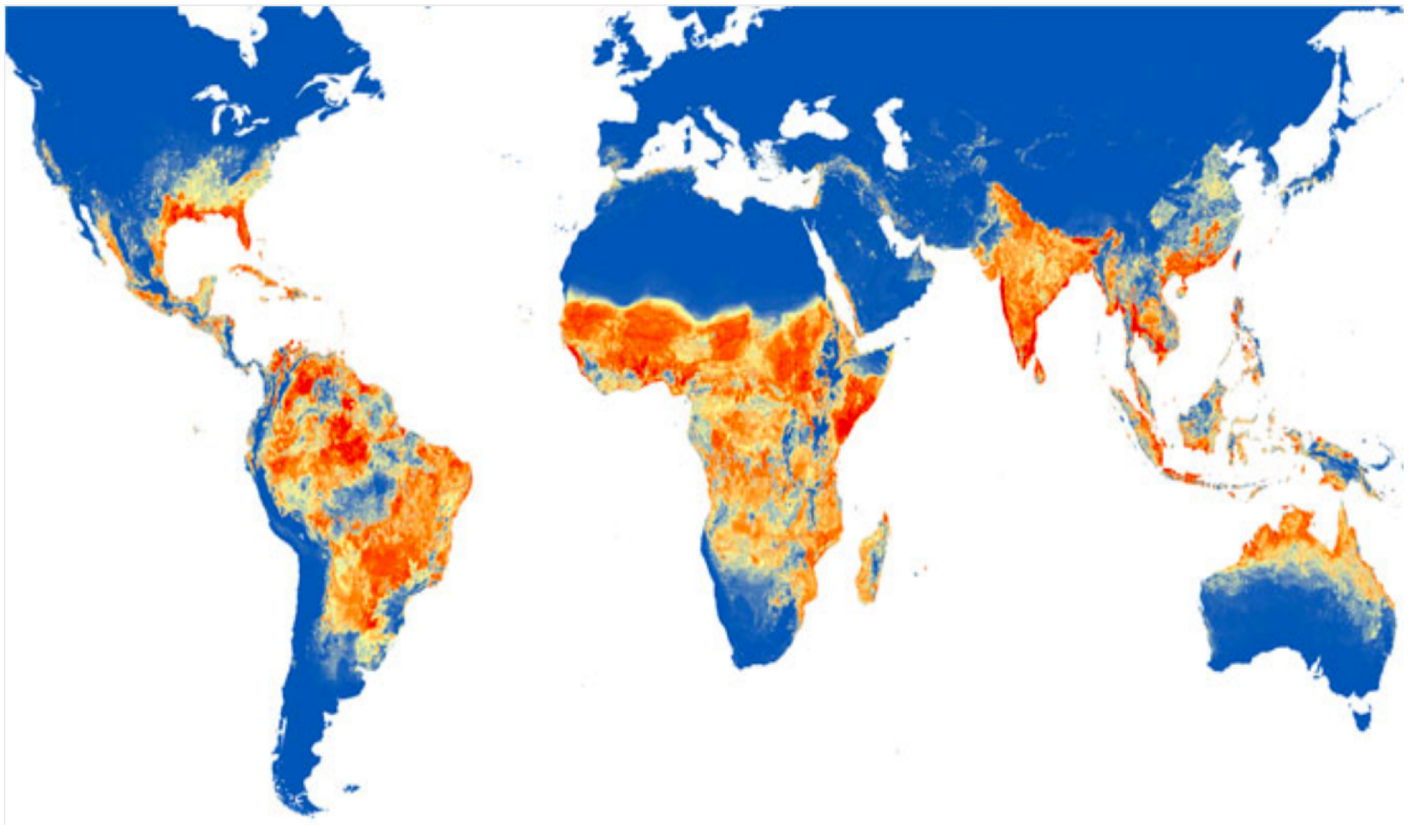
\*Does not include countries or territories where only imported cases have been documented. This map is updated weekly if there are new countries or territories that report local chikungunya virus transmission.

# Zika

*(Aedes aegypti/ Aedes albopictus mosquito)*

**Symptoms:**  
fever, rash,  
headache,  
joint/muscle  
pain.

**Prevention:**  
Repellant, long  
clothing, netting  
and screens,  
eliminating  
breeding sites.



Global map of the predicted distribution of *Ae. aegypti*. The map depicts the probability of occurrence (from 0 blue to 1 red).

# Zika

*(Aedes aegypti/ Aedes albopictus mosquito)*

## Connections to Climate Change

- In 2013, Zika arrived in South America for the first time. People there had no prior exposure or immunity to the virus.
- Two years later, El Niño brought wetter, warmer weather- and with it, more mosquitoes (and more Zika). (Mosquitoes thrive when the conditions are warm and there is access to standing water.)
- Zika is a disease of great concern because of the risk of birth defects when mothers are infected.

Podcast here: <https://www.yaleclimateconnections.org/2017/06/zikas-link-to-climate-change/>

## Genus *Culex*

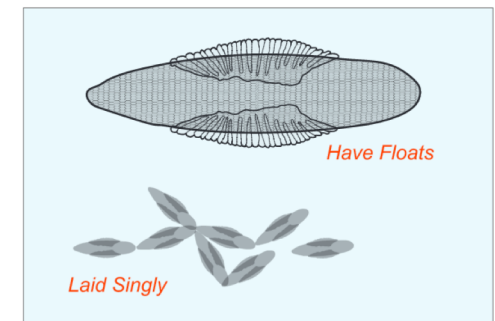
- *Culex* mosquitoes breed in
  - stagnant water: places such as rainwater barrels, drainage systems, septic tanks, and containers (tires, buckets and rain barrels).
  - open habitats: surface water habitats that become stagnant and enriched with organic matter (swamps, marshes, bogs, rice fields, pastures).
- They prefer to lay eggs in rainwater barrels, storm drains, septic tanks.
- Eggs are laid in rafts that float on the water surface



*Culex quinquefasciatus*

Credit: Jim Gathany

Source: CDC



## *Culex* as a human disease vector

Some species of the genus *Culex* carry viruses or other pathogens. A number of viruses are transmitted by the mosquito to animals and livestock. There are also some viruses that can be transmitted to humans.

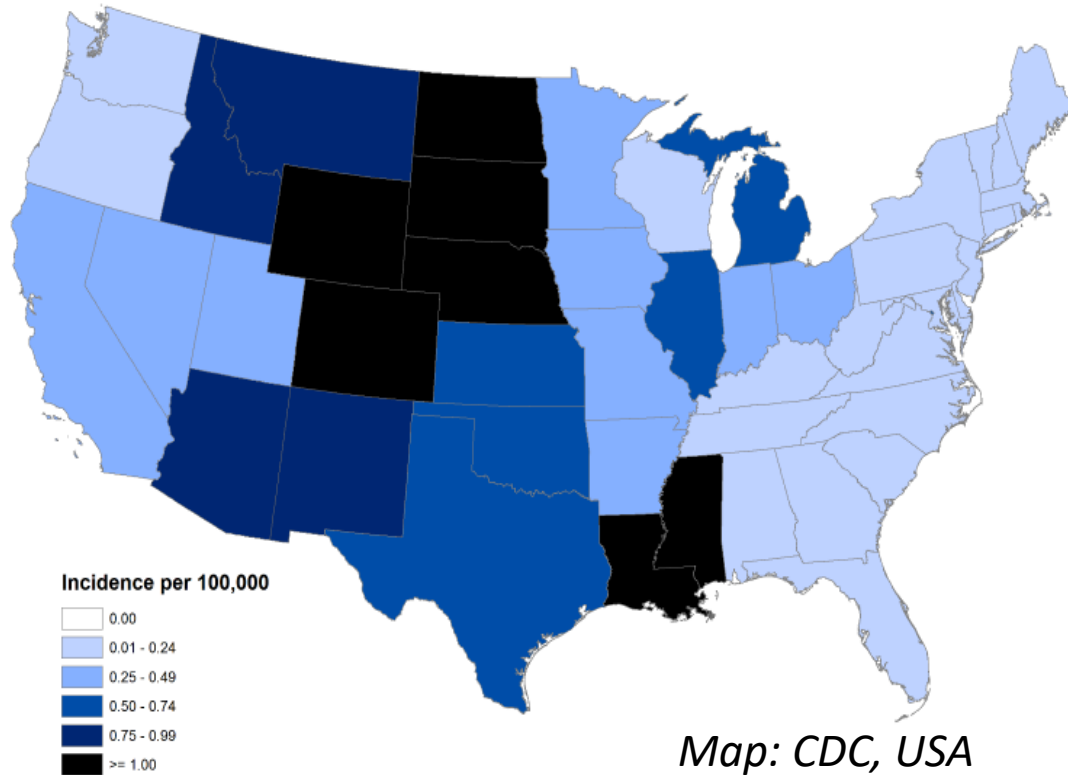
Diseases include a number of encephalitis viruses that are found around the world, as well as West Nile virus.

Some species of *Culex* can also transmit filarial worms- a type of nematode. Adult female mosquitoes acquire the worm larvae. The larvae mature and migrate to the proboscis of the mosquito; they enter the bite puncture or the intact skin of a person bitten by the mosquito. Filariasis causes swelling in the lymph glands in humans.



# West Nile virus (*Culex mosquito*)

Average annual incidence of West Nile virus neuroinvasive disease reported to CDC by state, 1999-2015



- **Symptoms:** none in most people; 1 in 5 get fever, headache; <1% get encephalitis/meningitis.
- **Prevention:** Repellant, long clothing, netting and screens, eliminating breeding sites.



# GLOBE Observer Mosquito Habitat Mapper

Use the GLOBE Observer Mosquito Habitat Mapper to determine if you have found a potentially dangerous mosquito, or one of the approximately 3,500 other non-disease carrying species.

Remember that mosquitoes play important roles in our ecosystems as pollinators and as food for frogs, fish and other animals.



*You will not be able to determine if a mosquito is carrying a disease, only if it is a type of mosquito that can potentially carry disease.*

*Your data can be used by public health partners to determine if disease is being transmitted by the mosquitoes in your community.*

*Knowing where the mosquitoes are located is important for public health authorities, who take action to reduce the risk of disease in your community.*

*Eliminating breeding sites by dumping water from containers and picking up trash will help reduce the population of mosquitoes in your community.*

**Reduce the risk of mosquito borne disease in yourself and your community!**

- Eliminate places where mosquitoes breed.
- Wear mosquito repellent.





# Acknowledgements

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This presentation was prepared by the Institute for Global Environmental Strategies (IGES) and does not necessarily reflect the views of the NASA or USAID. For more information, contact the MCCC PI, Dr. Russanne Low, IGES at:

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