# Mosquito-borne Diseases and Mosquito IPM

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Mosquito-borne diseases impact the health of Americans every year. This year brings additional concerns due to relatively new and re-emerging disease issues.

**West Nile virus (WNV)** is a mosquito-borne virus found throughout the United States and the cause of West Nile Fever. It was first detected in North America in 1999 and is now the most commonly occurring mosquito-borne virus affecting humans in the United States. West Nile Fever is a preventable disease as the majority of people contract the virus through mosquito bites. *Culex* species mosquitoes are the main carriers of WNV, and these mosquitoes are common throughout Arizona.

Mosquitoes acquire the virus when they feed on birds that are infected with WNV (Fig. 1). After a few days, infected mosquitoes can then transmit WNV to other birds, or less commonly to humans and horses.

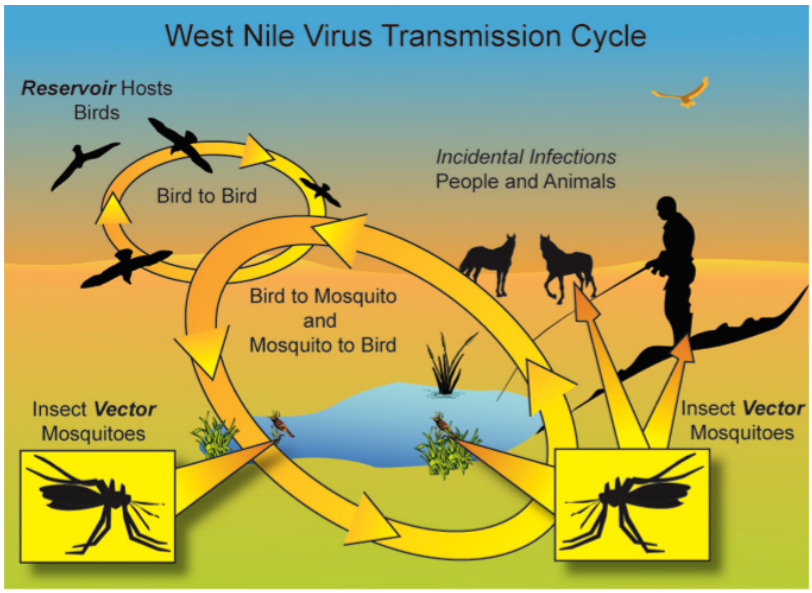


Fig. 1 West Nile virus transmission cycle. Photograph by Deborah Misch - STG Inc. From Global Climate Change Impacts in the United States 2009 Report - US Global Change Research Program.

The *Culex* mosquitoes responsible for vectoring WNV generally bite at dusk and dawn, in shady areas, or during cloudy days. People of all ages can contract WNV. About 20% of those who become infected with WNV will come down with West Nile fever; the other 80% show no or very mild symptoms. Symptoms of West Nile fever can include: fever, headache, body aches, swollen lymph glands, tiredness and rash on the trunk of the body.

Less than 1% of people who are infected will develop a serious neurologic illness such as encephalitis or meningitis (inflammation of the brain or surrounding tissues). About 10% of people developing serious neurological illnesses will die.

**St. Louis encephalitis (SLE)** is a relatively rare viral disease also transmitted by *Culex* species mosquitoes. The virus can cause illness in humans, horses, certain types of birds, and other animals.

Similarly to WNV, the SLE virus is maintained in a mosquito-bird-mosquito cycle. Mosquitoes become infected with the virus when they feed on birds that are infected with SLE (Fig. 2). After a few days, infected mosquitoes can then transmit SLE to other birds, and less often humans and horses. Wild birds are the primary vertebrate hosts. Birds that are abundant in the urban-suburban environment, such as house sparrows, finches, doves and pigeons can be virus reservoirs in the transmission cycle. Although humans and domestic mammals can acquire the SLE virus they are dead-end hosts (meaning that they cannot transmit the disease to a new host).

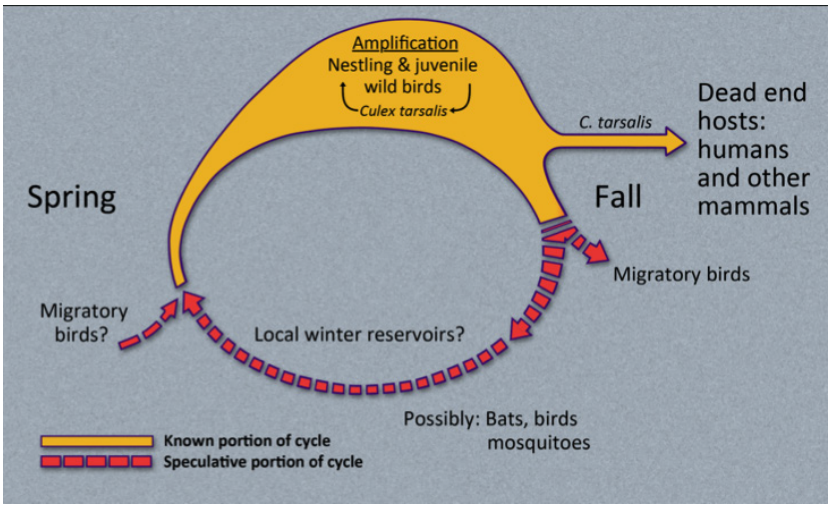


Fig. 2 Transmission cycle of St. Louis encephalitis virus in Western U.S. From CDC.

Although human disease cases are very rare in the United States, public health professionals are constantly monitoring for the virus. An increase in both detections and human cases has been reported in 2015 in some areas.

**Dengue fever** is an infectious disease caused by the dengue virus serotypes DEN-1, DEN-2, DEN-3 and DEN-4. It is essentially a human disease, transmitted between humans by *Aedes* mosquitoes. It is primarily transmitted by *Aedes aegypti* and *Aedes albopictus* mosquitoes (Fig. 3), which can also vector chikungunya virus. These mosquitoes are found throughout the tropics and subtropics, and their abundance has aided in the geographic expansion of the virus.


Fig. 3 The yellow fever mosquito *Aedes aegypti* (left) and Asian tiger mosquito *Aedes albopictus* (right).

Dengue is expanding rapidly, and there has been a 30-fold increase in incidence between 2000 and 2010. This includes increased disease incidence in endemic countries as well as encroachment into new countries and regions.

Currently, there have been confirmed locally-acquired cases of dengue identified in some of the southern states (Florida and Texas). However, many more cases are brought into the United States every year by travelers who contract the virus while abroad. Any state with *Aedes aegypti* or *A. albopictus* (Fig. 4) is at risk for local transmission of dengue virus.

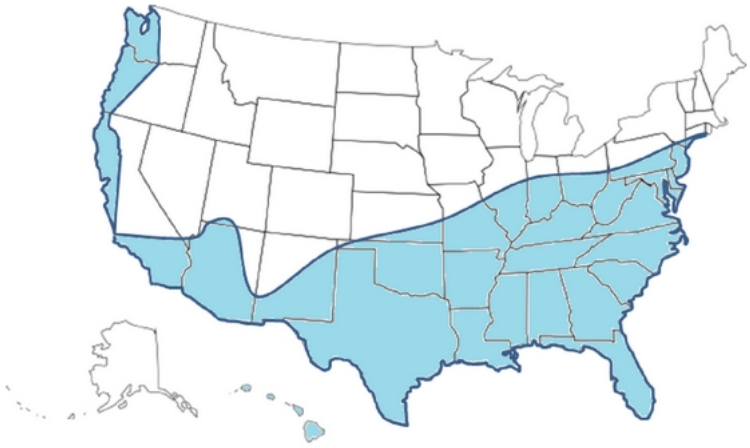

Fig. 4 Map of the U.S. showing the areas at risk of dengue and chikungunya outbreaks.

**How does locally acquired virus transmission occur?** First a person becomes infected through a bite from a vectoring mosquito while traveling outside the United States in a country with endemic (regularly found in people in an area) Dengue. Upon their return home they become sick and high levels of the virus circulate in their blood system. They are then fed on by a local *A. aegypi* or *A. albopictus* mosquito which acquires the virus from the blood meal. This mosquito can then transfer the virus to other people it feeds on. These unfortunate individuals would then be considered locally-acquired cases.

**Chikungunya fever** is another mosquito-borne disease, relatively new to the United States, and the virus is primarily transmitted by *Aedes aegypti* and *Aedes albopictus* (Fig. 3).

Since 2004 the chikungunya virus has caused large outbreaks in Africa, Asia, Indian Ocean islands, and Italy. Contrary to certain misconceptions, chikungunya does not affect chickens, and the term refers to the 'bent over' posture of severely affected people when in pain.

In December 2013 the first cases of locally-acquired chikungunya in the western hemisphere were reported among residents of St. Martin in the Caribbean. The virus quickly began to spread across the Caribbean region, and locally-acquired cases have been reported from North, Central, and South America.

Chikungunya fever is now a nationally notifiable condition. The introduction of chikungunya virus to the Caribbean and Central America increases the incidence of importation into the United States. As with dengue fever, states that have one or both of the *Aedes* vectors are at risk of subsequent local transmission of chikungunya virus. However, infected mosquitoes may also simply travel across national borders.

Although chikungunya and dengue are essentially human diseases, neither can be passed on from person to person during normal contact.

Few mosquito-borne diseases have a vaccine, so the best method of avoiding illness is to protect yourself and your home from mosquitoes. Here are some tips on **Integrated Pest Management (IPM)** methods for mosquitoes.

1. Check standing water in plant pots, bird-baths, fountains, tires, depressions in tarpaulins, and backyard trampolines. Drain the water regularly (twice a week is ideal).

2. Remove unnecessary clutter. Keep rain gutters free of leaves and other debris that prevent water from draining. Store boats, canoes and other objects so they do not collect rainwater.

3. Repair water leaks (leaky pipes, sprinkler systems, and outside faucets). Correct drainage problems in yards and playing fields. Report drainage problems in ditches, etc. Fill holes or depressions in trees with sand.


4. Empty water containers for pets and check livestock watering troughs and tanks, or add *Gambusia* (mosquito eating fish).

5. Larvacides such as the bacteria based products containing *Bacillus thuringiensis israelensis* (Bti) or *Bacillus sphaericus* (Bs) are specifically targeted against the larval life stage, while harmless to humans, pets and the environment. Mosquito larvacides can be used to kill mosquito "wrigglers" in a non-consumptive water source.

6. Report mosquito "hot-spots" to vector control specialists in your region. Call in, or log an environmental complaint on-line.

Additionally, when outdoors, consider the following safety tips:

1. Wear light colored clothing with loose fitting long-sleeves, long pants and socks. Use protective clothing when exposure to mosquitoes cannot be avoided.

2. If possible, avoid outdoor activity before dawn and after dusk when mosquitoes are most active and avoid being bitten by mosquitoes at any time.

3. Properly apply insect repellant even if you are outside for just a short period of time, and share your insect repellant with those around you. For additional help selecting which repellant is right for you, go to the EPA search page: http://cfpub.epa.gov/oppref/insect/#searchform

Consider the following tips for relieving the itch of mosquito bites: The first step is to clean the bite area with soap and water. Topical corticosteroids can reduce the itching and discomfort. Topical diphenhydramine and caine-containing derivatives should be used with caution because of concerns about inducing allergic contact sensitivity. Oral antihistamines can be effective in reducing the symptoms of mosquito bites, but may cause drowsiness. Use of a cold compress can be helpful, but do not apply ice directly to the skin.

**With education and awareness, we can limit the health threat posed by these pests.**

This information is based on the Center for Disease Control and the Arizona Department of Health Services http://www.azdhs.gov/preparedness/epidemiology-disease-control/mosquito-borne/index.php.

If you would like to learn more about mosquitoes and their management, please view:
http://cals.arizona.edu/apmc/public-health-IPM#mosquitoes
http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1221-2013.pdf

Know more about "Prevent Mosquito Bites", view: http://www.cdc.gov/features/stopmosquitoes/

Article featuring mosquitoes and West Nile Virus:
http://cals.arizona.edu/apmc/westernschoolIPM.html#schoolspestpress

Mosquito general information:
http://www.maricopa.gov/EnvSvc/VectorControl/Mosquitos/MosqInfo.aspx

West Nile Virus in Maricopa County: http://www.maricopa.gov/wnv

Know more about other pests and management, please view School and Home IPM Newsletter:
http://cals.arizona.edu/apmc/public-health-IPM#newsletter
http://cals.arizona.edu/apmc/westernschoolIPM.html#newsletter

For more information about School IPM in Arizona, visit:
http://cals.arizona.edu/apmc/westernschoolIPM.html

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