United States Environmental Protection Agency

Wetlands & West Nile Virus

West Nile Virus (WNV) first appeared in the United States in 1999. Since its inital outbreak in New York City, the virus has spread across the country from East to West. Female mosquitoes transmit the virus primarily by infecting birds. Occasionally, mosquitoes transfer the virus from birds to humans, most of whom experience no symptoms. One out of five infected people develop West Nile fever, characterized by mild, flu-like symptoms. Infection can sometimes, although rarely, be fatal for humans. Since West Nile is lethal in some bird species, unusual bird deaths may signal human outbreaks.

Protect Yourself

Wear long sleeves and pants, especially when near stagnant or polluted water.

Be mindful of mosquito activity, which peaks at dusk and dawn in summer months.

Consider using mosquito repellants, if necessary, that contain DEET.

Broadleaf arrowhead

Are Wetlands a Threat?

Healthy wetlands are not uncontrolled breeding grounds for mosquitoes. Healthy wetlands sustain numerous species of mosquito-eating fish, amphibians, insects and birds, all of which help limit mosquito populations.

The principal mosquito carrier of West Nile virus on the East coast, *Culex pipiens*, does not prefer to reproduce in most wetlands. These species reach greatest numbers in large urban centers, breeding easily in artificial containers—birdbaths, discarded tires, buckets—and in human-created environments, such as clogged gutters, animal waste lagoons and sewage effluent. Adapted to polluted habitats, these *Culex* species generally avoid swamps and salt marshes altogether.

Damaged or degraded wetlands can provide ideal habitat for some mosquito species that carry West Nile. Excess nutrients in contaminated waters can spur microbial growth and cause harmful algal blooms, which feed mosquito larvae. Filling or draining wetlands may also increase mosquito outbreaks, as an altered landscape with stagnant pools of water may no longer contain mosquito predators.

Sometimes, even healthy wetlands may harbor large numbers of mosquito species that carry WNV. Unlike *Culex pipiens*, *Culex tarsalis*, the major WNV vector in western states, prefers to breed in clean water. Therefore, it may be necessary to use appropriate mosquito control measures to prevent WNV disease transmission.

Disease Transmission

Mosquitoes are the primary vectors of West Nile, meaning they carry the virus from host to host. While nectar is their primary food source, females take blood in order to develop their eggs. Mosquito activity is reduced in colder months, but the virus may still persist in dormant mosquitoes and eggs that survive winter.

The Centers for Disease Control and Prevention (CDC) reports that 43 mosquito species in the United States have tested positive for West Nile virus. The most common carriers are the House mosquito (*Culex pipiens*) on the East coast and *Culex tarsalis* in the West. Because it readily feeds on humans, *Culex salinarius* is also an important vector.

Since mosquitoes primarily infect birds, unusual bird deaths may signal a WNV outbreak and should be reported to appropriate local, county or state agencies. Based on analysis of 2001 and 2002 data, the CDC reports that counties that report WNV-infected dead birds early in the transmission season are more likely to report subequent WNV disease cases in humans.

***Culex pipiens* (House mosquito)**
Culex pipiens is the primary West Nile vector in the eastern United States. It can be found in urban and suburban settings, has a flight range of 1/4 to 1 mile and prefers to breed in standing water, especially in water polluted with organic matter.

Culex salinarius
Found in fresh and saltwater marshes, lakes and ponds, *Culex salinarius* also prefers artificial containers around human residences and businesses. Because it readily feeds on humans, evidence indicates that it may be responsible for transmitting West Nile to people.

***Culex tarsalis* (Western Encephalitis mosquito)**
An abundant mosquito in Western States, it breeds primarily in irrigated agricultural areas and in temporary or seasonal depressions. It is most active at dusk and feeds on humans, domesticated animal and birds. It is the primary vector for West Nile in the midwestern and western states.

Protect Your Home & Community

1 Eliminate stagnant water
Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources from around your home (e.g., tires, garden pots and bird baths).

2 Protect wetlands from pollution
Including runoff from farms, lawns and roads with buffers, since contaminated water attracts mosquitoes.

3 Check Stormwater Systems
Ensure that stormwater catchments and constructed wetlands are properly designed and maintained.

4 Install Screens
Install or repair screens on doors and windows so that mosquitoes cannot get indoors.

5 Consider Using Pesticides
If necessary, try larvicides before adulticides, since larvicides more effectively control mosquitoes. Carefully follow instructions on the pesticide's label.

Wetland Restoration
and Mosquito Reduction in New Hampshire

Prior to its restoration in 1999, the two-acre Edmond Avenue wetland was in critical condition. Residential development near Portsmouth, New Hampshire, had partially filled the wetland, and urban and stormwater runoff had contaminated the water. Increased sedimentation had reduced the extent of open water, and invasive plants choked out native species.

Degraded wetland - shallow, stagnant pools harbor many mosquitoes.

By 1996, the continued degradation of the Edmond Avenue wetland transformed the ecosystem into a major breeding site for mosquitoes, including the *Culex* species primarily responsible for West Nile transmission. During 1996-1999, the application of mosquito larvicides and sprays jumped to 4-5 times per year, a four-fold increase from the previous 15 years. Since its restoration in 1999, the Edmond Avenue wetland no longer requires mosquito control measures. The restored wetland lacks stagnant depressions and is deep enough in some areas to support fish that eat mosquitoes. Wave action also disrupts mosquito breeding. Results have been astonishing—a near 100% reduction in mosquito habitat and the virtual elimination of *Culex* species, not to mention improved water quality and bird habitat.

Restored wetland - carefully designed open water habitat supports ducks, as well as fish that eat mosquitoes.

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West Nile Resources

Centers for Disease Control and Prevention, West Nile Virus
http://www.cdc.gov/ncidod/dvbid/westnile/

Maps of West Nile Occurence in the United States
http://westnilemaps.usgs.gov

State and Regional Information
http://westnilevirus.nbii.gov/states/

Cornell University, Center for the Environment
http://environmentalrisk.cornell.edu/WNV

American Mosquito Control Association
htttp://www.mosquito.org

EPA's Wetlands Division
http://www.epa.gov/owow/wetlands

Frequently Asked Questions:

• *How many people have become infected with WNV?*

For 2003, the CDC recorded 9,858 human cases and attributed 262 deaths to WNV nationwide.

• *Will draining or filling a wetland prevent WNV?*

Draining or filling wetlands is not a necessary or appropriate way for controlling mosquitoes or WNV. Healthy, functioning wetlands typically have a balanced predator-prey relationship that provides natural mosquito control measures. Draining or filling a wetland may require a federal, state, tribal or local permit. Contact your regional Army Corps of Engineer's Office.

• *How far do mosquitoes travel?*

Many of the mosquitoes that transmit WNV have very short flight ranges. Therefore, eliminating backyard mosquito habitat, such as stagnant water or blocked roof gutters, can help control mosquito populations.