



United States
Environmental
Protection Agency

DRAFT

Wetlands & West Nile Virus

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. The American Academy of Pediatrics states that concentrations of 30% are safe for adults and children. Parents may use lower concentrations if the mosquito threat is small. Do not apply to infants under 2 months.

The Virus

West Nile virus first appeared in the United States in 1999. Since its initial outbreak in New York City, the virus has spread to nearly every state of the Union. Female mosquitoes transmit the virus primarily among 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.

Infections can be fatal, though rarely. Because West Nile is lethal in some avian species, unusual bird deaths may signal human outbreaks.

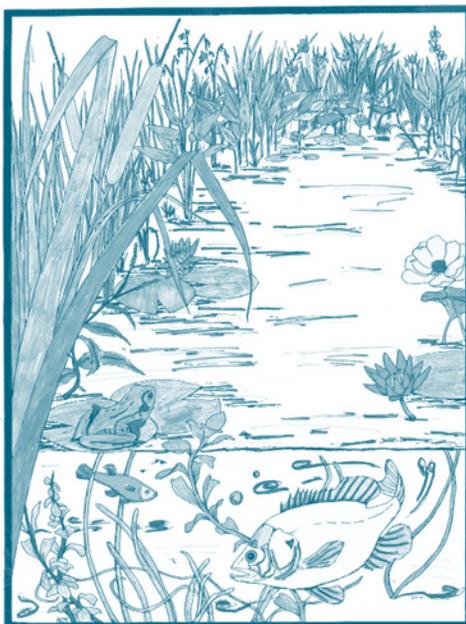


“This is a disease that we need to take seriously, [but] it is extraordinarily unlikely that the impact of West Nile would ever even get into the same radar screen as...flu and HIV-AIDS.”

— Anthony Fauci, MD, renowned AIDS researcher and director of the National Institute of Allergy and Infectious Disease.

Wetlands

Healthy wetlands are not uncontrolled breeding grounds for mosquitoes. These unique ecosystems sustain numerous species of fish, insects, amphibians and birds that feed on mosquito eggs and larvae. Moreover, the mosquito species responsible for West Nile transmission do not prefer to reproduce in healthy wetlands. They tend to breed



readily in abandoned tires, birdbaths, roof gutters and other artificial containers that lack wetland predators. They are also commonly found in highly polluted environments, such as animal waste lagoons and sewage effluent. Therefore, extra care should be taken to prevent contamination of wetlands, because polluted, degraded or converted wetlands provide more suitable habitat to mosquitoes that carry West Nile virus. When wetlands are impaired or destroyed, local communities lose more than natural mosquito predators; they lose the many other functions and values that healthy wetlands offer: water purification, floodwater retention, wildlife habitat, recreational space and educational opportunities.

**West Nile virus caused 284 deaths in 2002.
The flu kills about 36,000 each year.**

— United States Centers for Disease Control and Prevention

Healthy wetlands support mosquito predators, such as fish and amphibians.

Protect Your Home

Eliminate stagnant water in cans, buckets, used tires, pots. Change water frequently in bird baths and water bowls.

Remove leaves and other blockages from roof gutters.

Install and repair screens on doors and windows.

Be wary of electric bug zappers. Biting insects make up less than 1% of insects killed by such devices. Bug zappers also kill beneficial insects, including mosquito predators.

History

The first documented case of West Nile infection in humans occurred in Uganda in 1937. Originally endemic to Africa, western Asia and the Middle East, the virus has since stretched into Australia and parts of Europe. In 1999, West Nile crossed the Atlantic and struck New York City, causing 62 illnesses and 7 deaths. The US strain of West Nile is genetically similar to a variety found in Israel, which suggests that international travel—perhaps stowaway mosquitoes or unaware human carriers—brought the virus to the Western hemisphere.

Epidemiology

Since the initial outbreak in New York City, the Centers for Disease Control and Prevention has identified approximately 4,000 human cases in 40 states, with Illinois, Ohio, Michigan and Louisiana posting the greatest numbers. The documented cases do not account for all infections, as 80% of those infected do not experience health problems. Less than 1% of infections results in severe neurological illness, such as meningitis and/or encephalitis. In 2002, West Nile caused 284 deaths in the United States.

Medical Facts

West Nile virus belongs to the flavivirus genus, which includes yellow fever and St. Louis encephalitis. Following infection, the virus incubates 3-14 days. The vast majority of infected individuals do not exhibit any symptoms.

Symptoms

Those who develop West Nile fever have mild, flu-like symptoms that usually subside after 3 to 6 days. The relatively few patients who fall seriously ill may experience severe muscle weakness and develop meningitis and/or encephalitis. These patients tend to experience persistent symptoms for more than a year. The elderly and the immuno-suppressed are at greatest risk of suffering health complications from West Nile virus.

Diagnosis

Generally, diagnostic tests do not search for the virus in the body; instead, they locate antibodies that fight the virus. Because many flaviviruses elicit the production of similar antibodies, West Nile infection is easily confused with other flaviviral infections, such as St. Louis encephalitis. People with vaccinations for other flaviviruses (e.g., yellow fever) may also falsely test positive for West Nile.

Treatment

Because no cure exists for West Nile, treatment is supportive; doctors help a patient's immune system tackle the infection. Antibiotics are ineffective. A vaccine is expected in a few years.

Mosquito Vectors

Mosquitoes are the primary vectors of West Nile, meaning they carry the virus from host to host. Nectar is their primary food source. Only females take blood in order to develop their eggs; males do not bite. Colder months reduce mosquito activity, but the virus persists in dormant mosquitoes and eggs that survive winter.

Culex pipiens

Flight range: ¼ mile - 1 mile
Feeding times: dusk to dawn
Habitat: stagnant pools, artificial containers
Seasons: late Spring to Fall

Culex salinarius

Flight range: up to 5 miles
Feeding times: dusk to dawn
Habitat: fresh, brackish water near coast
Seasons: early spring to November
Bothersome for duck hunters in the fall

The Centers for Disease Control and Prevention reports that 36 mosquito species in the United States have tested positive for West Nile virus. The most common carriers are *Culex pipiens* in the North and closely related *Culex quinquefasciatus* in the South. Because it readily feeds on humans, *Culex salinarius* is a particularly important vector as well. In western states, *Culex tarsalis* plays a prominent role in transmission.

Are Wetlands a Threat?

The principal mosquito carriers of West Nile virus do not prefer most wetlands. *Culex pipiens* and *Culex quinquefasciatus* reach greatest numbers in large urban centers, breeding easily in artificial containers—birdbaths, 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. *Culex salinarius* prefers fresh or brackish water near coasts and is particularly fond of salt marshes that have been converted into freshwater impoundments.

Contaminated water and degraded wetlands provide ideal habitat for mosquitoes that carry West Nile virus. High nutrient loads spur microbial growth and cause harmful algal blooms, which are sources of food for mosquito larvae. Filling or draining wetlands may increase mosquito outbreaks, as puddles that lack mosquito predators form after rains or floods. Therefore, communities can help control mosquito populations by protecting wetlands and other shallow waters from pollution and degradation.

The Reality Is...

...that healthy wetlands are not unmitigated mosquito factories. Healthy wetlands provide habitat for mosquito-eating fish, amphibians, insects and birds, all of which limit mosquito populations (and none of which exist in backyard pots or buckets). Bats also help reduce mosquitoes. According to Bats Conservation International (www.batcon.org), a single bat can catch 100 insects per hour. Protecting wetlands is more important than ever, for in addition to their well-known benefits—water purification, wildlife habitat, floodwater retention—healthy wetlands have natural mosquito controls.

Wetland Restoration and Mosquito Reduction in New Hampshire

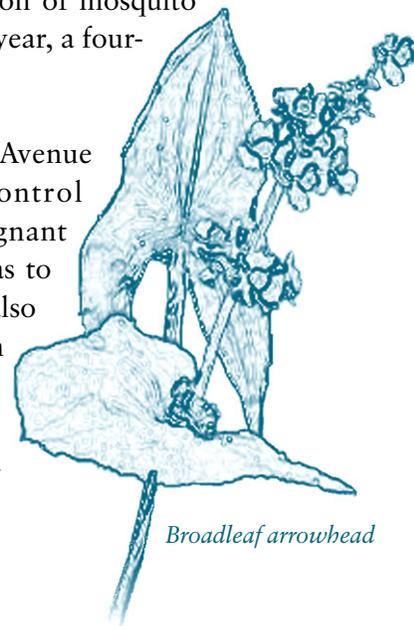
Wetland,
Pre-restoration

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 native species.

Wetland,
Post-restoration

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. From 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.



Broadleaf arrowhead



American Avocet

References for

Wetlands & West Nile Virus

Bernard, K. July-August 2001. West Nile virus infection in birds and mosquitoes, New York State, 2000. *Emerging Infectious Diseases* 7(4).

Crans, Wayne J. Products and Promotions That Have Limited Value for Mosquito Control. Rutgers, the State University of New Jersey.

Eidson M., Komar N., Sorhage F., Nelson R., Talbot T., Mostashari F., et al. 2001. Crow deaths as a sentinel surveillance system for West Nile virus in the northeastern United States, 1999. *Emerging Infectious Diseases* 7.

Fauci, A., Director of National Institute of Allergy and Infectious Diseases. September 24, 2002. Congressional testimony before Senate subcommittee on Oversight of Government Management.

Giladi M., et. al. 2001. West Nile encephalitis in Israel, 1999: the New York connection. *Emerging Infectious Diseases* 7.

Goddard L.B., et al. December 2002. Vector competence of California mosquitoes for West Nile virus. *Emerging Infectious Diseases* 8.

Mostashari F., et. al. 2001. Epidemic West Nile encephalitis, New York, 1999: results of a household-based seroepidemiological survey. *Lancet* 358:261-4.

Petersen L., Marfin A. 2002. West Nile virus: a primer for the clinician. *Ann Intern Med.* 137:173-179.

Shburn K., Hughes T., Burke A., Paul J. 1940. A neurotropic virus isolated from the blood of a native of Uganda. *Am J Med Hyg.* 20:471-92.

Protect Your Community

Report unusual bird deaths to officials at appropriate local, county or state agencies.

Protect wetlands from pollution, including runoff from farms, lawns and roads, since contaminated water attracts mosquitoes that carry West Nile.

Consider using native species, if possible, when stocking wetlands and ponds with fish that feed on mosquitoes.

Design stormwater catchments and constructed wetlands so that mosquito breeding is minimized.

Try larvicides before adulticides, if possible and necessary, since larvicides are more effective at controlling mosquitoes. Carefully follow instructions on the pesticide's label.

WEST NILE RESOURCES

on the Internet

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

Maps of West Nile Distribution in the United States
http://cindi.usgs.gov/hazard/event/west_nile/west_nile.html

State and Regional Information
<http://westnilevirus.nbio.gov/states/index.html>

Cornell University, Center for the Environment
<http://www.cfe.cornell.edu/erap/WNV/>

Health information, fact sheets, latest case counts

Locations of infections in humans, birds and other animals

State by state information on infections, surveillance and control

Updates on West Nile, sources and links for public and professionals

For more information about wetlands, visit www.epa.gov/owow/wetlands