



United States
Environmental
Protection Agency

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 up to 30% are safe for adults and children. Parents may use lower concentrations on children. Do not apply DEET to infants under 2 months, and do not spray DEET underneath clothes.

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 in humans, 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

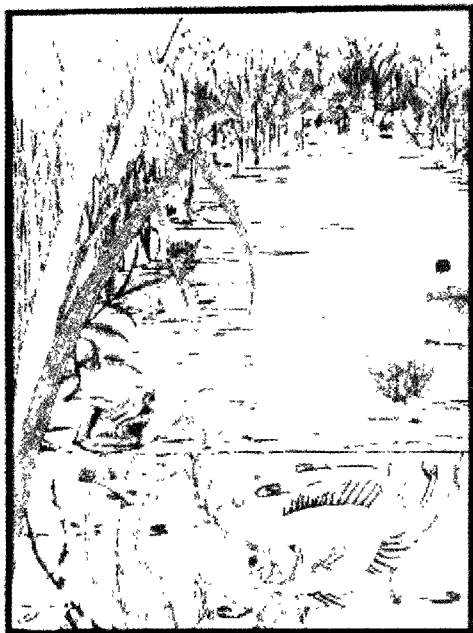
Healthy wetlands are not uncontrolled breeding grounds for mosquitoes. These unique ecosystems sustain numerous species of fish, insects, amphibians and birds that feed on mosquitoes. Moreover, the mosquito species that are primarily responsible for West Nile transmission do not prefer to reproduce in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

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 people 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 in humans, treatment is supportive; doctors help the 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 37 mosquito species in the United States have tested positive for West Nile virus. The most common carriers are the Northern House mosquito (*Culex pipiens*) and the Southern House mosquito (*Culex quinquefasciatus*). Because it readily feeds on humans, *Culex salinarius* is an important vector as well. In western states, *Culex tarsalis* plays a prominent role in transmission.

Culex mosquito
Courtesy of CDC

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

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 infections pass unnoticed. Less than 1% of infections results in severe neurological illness, such as meningitis and/or encephalitis. In 2002, West Nile caused 284 human deaths in the United States. In the same year, more than 15,000 horses were diagnosed with West Nile virus; 33% died or were euthanized. A vaccine exists for horses and is 94% effective.

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, 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. *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 may 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 help 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

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.

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.

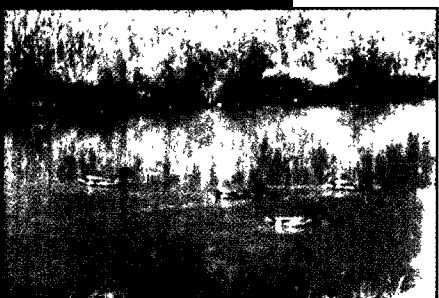
Broadleaf arrowhead

Courtesy of SWAMP, Inc.

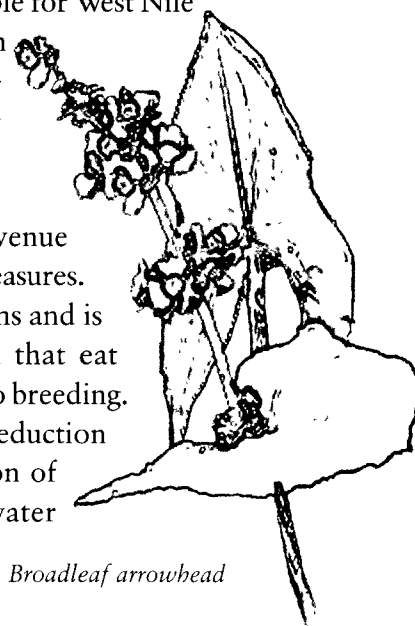


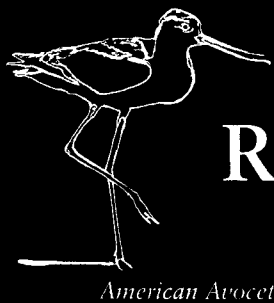
Degraded wetland.
Shallow, stagnant pools
harbor many mosquitoes.

Courtesy of SWAMP, Inc.



Restored wetland.
Carefully designed open
water habitat supports
ducks as well as fish that
eat mosquitoes.





References for

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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.

Remember that stocking wetlands and ponds with fish that eat mosquitoes may have unintended ecological consequences.

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

Try larvicides before adulticides, if possible and necessary, since larvicides more effectively control 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.nbii.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