



Medical and Veterinary Entomology Livestock & Poultry Integrated Pest Management



N. C. State University - Department of Entomology

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West Nile Virus, Mosquitoes and Waste Lagoons

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West Nile virus made national headlines late in the summer of 1999, with reports of dead birds and cases of a sometimes fatal encephalitis affecting humans and horses in the New York City area. There was much speculation about how the virus got there, how it was transmitted, when and where it would show up next, and the danger it posed to human and equine health. Many of those questions were answered almost before the outbreak was over, but the big question of when and where West Nile virus will ultimately spread in this country is still unknown. The following information about West Nile virus will help you better understand what happened in New York, the risks associated with this disease, the current West Nile virus outlook in North Carolina, and ways to protect yourself and your employees from contracting the disease.

A Brief History of West Nile Encephalitis Outbreaks In The United States: The 1999 appearance of West Nile encephalitis in New York City was fairly typical of mosquito-borne encephalitis outbreaks. It first appeared in wild bird populations. Reports of dead crows and other wild birds started in June. The first cases of encephalitis in humans occurred in early August, and by late August an outbreak of equine encephalitis was underway on Long Island. A preliminary diagnosis of the human cases indicated that the St. Louis encephalitis virus was the culprit. However, later analysis of tissues from wild crows and several exotic birds that had died at the Bronx Zoo in September revealed that West Nile virus was responsible for the bird deaths. It wasn't long before reevaluation of the human and equine cases confirmed that West Nile virus was to blame. By the time the outbreak was over in early October, clinical cases of West Nile Encephalitis were confirmed in 61 humans and 23 horses. Mortality attributed to the disease included at least seven people and eight horses. In addition, 200 wild birds submitted from New York and neighboring states were found to be infected with West Nile virus.

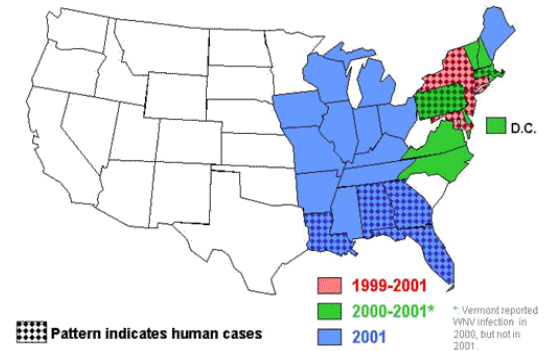
The disease once again made its appearance in New York City on July 20, 2000, and has continued to spread as predicted. By the end of 2001, West Nile virus had appeared in 27 states and Washington, DC. There were 66 human cases and 9 deaths caused by the virus in 2001, with the first cases appearing in mid July. Altogether, there were 147 human cases of the disease and 17 fatalities between 1999 and the end of 2001. The

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number of horses diagnosed with West Nile virus infections jumped to 651 verified cases in 19 states during 2001. This figure was up substantially from the 60 cases of West Nile infection reported for horses in 2000. Wild birds have fared no better. More than 7,000 birds tested positive for West Nile virus in 2001, up from 4,323 positive birds the preceding year. And by the look of things in 2002, the spread of West Nile virus hasn't slowed down. As of mid-August there were 156 clinical human cases of West Nile virus infection, and 130 clinical cases in horses. Anyone listening to the news or reading the newspaper since August knows that new human or equine cases are being reported every week from as far away as Colorado to the East Coast. Recent reports from North Carolina show an increase in the number of West Nile virus infected birds, but no reports about human or equine cases as yet. We won't know for sure how the year will end, but it's pretty clear that West Nile virus is not going away.

West Nile Virus in the United States, 1999-2001



What Is West Nile Encephalitis and How Is It Spread? An encephalitis is specifically an inflammation of the brain generally caused by viruses or bacteria. West Nile and other encephalitides are most often characterized by mild fever, head and body aches and, in some cases, a rash and swollen lymph nodes. More severe cases of West Nile Encephalitis produce flu-like symptoms (headache, high fever, neck stiffness, disorientation and stupor). In rare cases the disease may progressively worsen and result in death. There are no vaccines available at present to immunize people against this disease. However, a vaccine for horses has been provisionally approved and is available through veterinarians.

Mosquitoes are the only proven vectors of the West Nile virus. The cycle of transmission for West Nile virus is similar to that of St. Louis and Eastern Equine Encephalitis viruses. Wild birds serve as the reservoir for the virus. Mosquitoes feed on infected birds and transmit the virus to other birds after a short incubation period. Infected birds may become ill and recover or may exhibit no noticeable symptoms. Wild birds may also die of the infection however, sometimes in relatively large numbers. In the case of West Nile Encephalitis, crow mortality has been high. The virus becomes widespread in the wild bird population by midsummer when mosquitoes are abundant. The likelihood that mosquitoes will become infected and transmit the virus to dead-end hosts such as humans and horses is highest between July and late October.

Most of the mosquito species so far associated with West Nile virus in the northeast are found in North Carolina. *Culex* and *Aedes* species are the probable mosquito vectors of the virus, either by spreading it throughout a wild bird population or serving as “bridge vectors” that carry the virus from birds to humans and horses. One species, *Culex quinquefasciatus*,¹ shows a preference for breeding in waste lagoons and should be of

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particular concern to municipalities and livestock or poultry producers with liquid waste handling systems. Although *Cx. quinquefasciatus* is relatively simple to control in waste lagoons, large populations can develop from midsummer to early fall under the right set of conditions.

Does the presence of *Cx. quinquefasciatus* in large numbers greatly increase the risk of a localized outbreak of West Nile encephalitis? This question is not easy to answer. Preliminary studies of *Cx. pipiens*, the species closely related to *Cx. quinquefasciatus*, suggest they are not the most efficient vector of the West Nile virus (Turell, *et. al.*, 2000). Eighty percent of *Cx. pipiens* exposed to the virus may become infected, but only about 20% of those are able to transmit the virus to other hosts. As promising as this information seems, it is too soon to know if *Cx. quinquefasciatus* plays a major role in the transmission of West Nile virus. Different geographical populations of the two closely related *Culex* species may be more or less efficient vectors of West Nile virus. The prudent decision is to assume that the risk is great enough to be sure mosquito control BMP's are in place for waste lagoons.

How Serious Is West Nile Encephalitis? West Nile Encephalitis is not a potentially devastating disease like cholera, malaria or yellow fever. Most people and horses are not at risk if exposed to the West Nile virus. Serological testing of residents in the most heavily affected area of New York City (Queens) in 1999 showed that about 2.6% of the population might have been positive for West Nile virus. This translates to an estimated 1,256 cases of West Nile virus infection in 1999. The estimates for subsequent years are similar. The important message in these figures is that most cases of West Nile virus infection in humans are “inapparent”(no clinical symptoms) or very mild. Estimates of West Nile Encephalitis in horses are less precise, but only 0.4% of the horses in the most heavily affected area (Suffolk County, Long Island) exhibited clinical signs of infection in 1999. The mortality rate is higher for horses, however. Clinical cases of West Nile virus infection among horses resulted in mortality rates of 35%, 39% and 33% (died or euthanatized) in 1999, 2000 and 2001, respectively.

The numbers make it clear that the human and equine deaths attributed to this disease are relatively small. However, we should not take West Nile virus for granted. The confirmed reports of a few birds infected with West Nile virus in North Carolina this year doesn't seem like much of a problem, but we can reasonably assume that it means the virus is established in the state. Even if this is not the case, it is certain that West Nile virus will become established in North Carolina in another year or two. **Awareness and appropriate precautions will go a long way towards minimizing the impact of this disease.**

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^{1/}*Culex quinquefasciatus* is one of two species (the other being *Culex pipiens*) that are closely related. These two species readily interbreed with one another throughout North Carolina and Virginia and are commonly grouped together as the *Culex pipiens* complex.

Further Reading:

Turell, M. J., M. L. O'Guinn, D. J. Dohm, and J. W. Jones. 2001. Vector competence of North American mosquitoes (Diptera: Culicidae) for West Nile virus. *Journal of Medical Entomology*, vol. 38, no. 2; p. 130-134.

More information about West Nile encephalitis and mosquito control is available on the web.

A *Summary of West Nile Virus in the United States* and other information is available from USDA/APHIS at:

<http://www.aphis.usda.gov/oa/wnv/>

A wealth of information about West Nile Encephalitis is also available from Centers for Disease Control and Prevention at:

<http://www.cdc.gov/ncidod/dybid/westnile/index.htm>

The North Carolina Public Health Pest Management Group web page provides state information about West Nile encephalitis and other vector borne diseases affecting public health at:

<http://ncwnv.com>

Information about personal protection and other mosquito related topics around the home are available from N. C. State University, Department of Entomology at:

<http://www.ces.ncsu.edu/Insects/Urban/mosq-info.htm>

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