Consortium *for* Conservation Medicine *at Wildlife Trust*

WILDLIFE TRUST
Saving Nature Together

Testimony of Auston Marmaduke Kilpatrick, PhD

Before the Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs of the Committee on Government Reform U.S. House of Representatives

Hearing on Current Challenges in Combating West Nile Virus

October 6, 2004
Washington, D.C.

Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity and time to discuss these important issues. My name is Marm Kilpatrick, and I am a Senior Research Scientist with the Consortium for Conservation Medicine at Wildlife Trust. The Consortium is a unique collaboration among Harvard Medical School's Center for Health & the Global Environment, Johns Hopkins Bloomberg School of Public Health, Tufts University's School of Veterinary Medicine's Center for Conservation Medicine, the U.S. Geological Survey's National Wildlife Health Center, and Wildlife Trust. Wildlife Trust is a global organization dedicated to promoting innovative conservation science, linking ecology and health, and empowering local conservation leadership. We are a pioneer in the field of conservation medicine, which looks at the links between ecological health, wildlife health and human health, and the emergence of diseases such as AIDS, SARS and West Nile virus.

I am a disease ecologist working on West Nile virus as a part of a project funded with Federal and private foundation funds. We have been trapping and testing birds and mosquitoes for West Nile virus at nine sites throughout the Baltimore-Washington area over the past two years.

My testimony represents my opinion and experience on how best to combat the West Nile virus epidemic. Because I am a scientist and a grantee of federal research funds, I am concerned with how to facilitate increased understanding of West Nile virus transmission and how to use this information to reduce future West Nile virus epidemics.

Consortium for Conservation Medicine at Wildlife Trust, 61 Route 9W, Palisades, NY 10964 T: 845-365-8337 F: 845-365-8487
The CCM strives to understand the link between anthropogenic environmental change, the health of all species including humans, and the conservation of biodiversity.
Email: admin@conservationmedicine.org
www.conservationmedicine.org

There are four major points to my testimony:

I. The allocation of the limited resources available for control of West Nile virus could be improved by basing allocation on a quantitative assessment of the relative risk of human cases at the local, county and state levels using a framework developed by our research team.

II. Our ability to predict future West Nile virus hotspots critically depends on understanding what determines virus transmission at the local scale, which requires additional research.

III. Our understanding of West Nile virus would be greatly facilitated by increased sharing of data between scientists and health departments at the county, state and federal level.

IV. The spread of West Nile virus to Hawaii and the introduction of other mosquito borne diseases from other continents to North America is likely to occur through the accidental transport of mosquitoes on airplanes and requires urgent actions to avoid future epidemics.

I. Resource Allocation

In the past, it has been difficult to predict which areas will be the epicenters of West Nile virus outbreaks. This is because the virus has been expanding into new areas and because it is difficult to compare the relative risk of human West Nile virus cases between areas at the local, county or statewide scales. However, this year (2004) has brought West Nile virus to the West Coast and except for parts of the Northwest, it is now present in most of the U.S., and has been established for several years in some states. In the past, surveillance resources were allocated primarily to determine the presence or absence of West Nile virus in each location over time. However, research and monitoring over the past four years suggests that rather than being present in some areas and absent in others, it is present in most areas but at different intensities. As a result, a more effective approach to assessing the risk of a human epidemic would focus surveillance activities on determining the intensity of the disease in different areas over time, as is suggested by current CDC guidelines for Surveillance, Prevention, and Control.

In addition, recent research by our group has produced a risk analysis measure that enables the comparison of the risk of human West Nile virus infections between locations at any spatial scale. This makes it possible to allocate limited West Nile virus control funds to the places where the risk for a human epidemic is the greatest.

The risk measure is easy to describe and understand, which should facilitate its use by resource managers in a range of settings. It is an estimate of the number of West Nile virus-infectious bites by all the mosquitoes in a location on humans. At a point in time the risk of a human epidemic is calculated as the product of three characteristics of the mosquitoes in an area and the human population density:

= (Mosquito Density) x (% WNV infectious) x (% of diet from humans) x (human density)

Estimating the risk of human West Nile virus cases from this technique is possible using data or approximations from previously published research and information that is currently collected by mosquito surveillance efforts. As a result, it does not require additional funds to estimate. It can be used at the state level to allocate resources between counties, or at the county level to allocate effort at the local scale.

The risk measure has some limitations and is an approximation, but it represents an improvement over current resource allocation protocols based on the presence or absence and timing of West Nile virus in samples collected from surveillance activities. The shortcomings of current resource allocation efforts are threefold. First, the likelihood of finding West Nile virus infected birds, mosquitoes, horses or humans is largely dependent on the effort expended. Second, many surveillance programs curtail activities such as dead bird monitoring after finding their first few West Nile positive birds, which makes it impossible to gauge the intensity of the avian epidemic. Finally, allocating resources differentially to West Nile positive or negative locales ignores important differences in disease intensity that are captured in the risk measure discussed previously.

II. Prediction of future West Nile virus hotspots

A critical step in reducing the intensity of future West Nile virus epidemics is predicting which areas will be most affected months in advance. This will allow slower effective control measures to be carried out, including education outreach, the development of integrated mosquito control plans, etc. However, due to limited resources, effective control requires focusing on a subset of areas that are most likely to suffer from a West Nile virus outbreak. Research conducted to date suggests that many factors are likely to impact the intensity of West Nile virus epidemics, including mosquito abundances, previous exposure of the bird community, the species composition of the bird community (through differences in the propensity of infected birds to infect biting mosquitoes), and temperature (through effects on mosquito development, survival, and viral development in mosquitoes). As a result, predicting future West Nile virus hotspots requires information on the relative importance of these factors.

Unfortunately, our understanding of West Nile virus ecology is in its infancy. Additional research along several lines is greatly needed. A recent funding initiative by the CDC will improve our understanding in several areas, but additional funds are needed for basic West Nile ecology research that will lead to the prediction of future West Nile virus hotspots.

III. Data sharing

Our understanding of the spread of West Nile virus across the U.S., and the long-term persistence and variability of this disease would be greatly facilitated by increased sharing of data from the last four years of surveillance activity. Although the CDC's West Nile virus reporting database ArboNET represents a substantial step forward in efforts to coordinate disease surveillance on a national level, it suffers from two critical shortcomings. First, the data that are collected, the number of West Nile positive mosquito pools, dead birds, veterinary cases and human cases, suffer from biases associated with the effort that was expended by each area reporting West Nile positive samples. Secondly, ArboNET is missing two key pieces of information, the abundance and West Nile virus infection prevalence of mosquitoes. Mosquito surveillance is generally coordinated by county health departments, and there are often privacy or property value concerns that make department officials hesitant to share mosquito abundance or West Nile virus infection prevalence. Nonetheless, it should be possible to aggregate the data to a level that maintains the usefulness of the data for planning and resource allocation while also addressing privacy and property value concerns. Finally, creation of a database holding past, present and future data collected by ArboNET in an open-access format that facilitates use by scientists and epidemiologists would greatly increase the number of people researching this topic.

IV. Introduction of West Nile virus and other mosquito borne diseases

The transport of mosquito borne pathogens across oceans is likely to increase along with the travel and shipment of goods. Our research group has recently developed a framework that allows for a quantitative assessment of the risk of introduction of a mosquito borne virus from one area to another by different pathways. Application of this framework suggests that the most likely pathway of West Nile virus introduction into Hawaii will be infected mosquitoes being transported on airplanes. We performed a similar analysis for possible West Nile virus introduction into the Galapagos from Ecuador, which yielded the same results; infected mosquitoes on airplanes represent the highest risk. Both analyses suggested that introduction via mosquitoes on airplanes was at least ten times more likely than any other pathway. As a result, actions that can substantially reduce the number of live mosquitoes on airplanes will be most effective in decreasing the introduction of West Nile virus, and likely other mosquito borne pathogens. Research suggests that the most promising and feasible strategy to reduce the number of live mosquitoes transported on airplanes is the use of residual insecticide coatings on the inside surface of airplane cargo holds. Because over 80% of hitchhiking mosquitoes are found in cargo holds, this strategy achieves significant results while avoiding the politically difficult issue of using insecticides in airplane passenger cabins. However, implementing this strategy would require compliance by the airline and air transport industries and the availability of properly licensed residual insecticides. Neither are likely to occur in time to prevent the introduction of West Nile virus to Hawaii without intervention or facilitation by the EPA and other regulatory bodies.

In summary, I believe many of the challenges we face in combating West Nile virus epidemics can be overcome by integration of existing research and policy, increased data sharing between several levels of government and scientists, increased research to understand the basic ecology of West Nile virus, and the generation of West Nile virus hotspot maps. Finally, preventing the introduction of West Nile virus to Hawaii, and the introduction of other mosquito borne pathogens to North America, is likely to require actions to reduce the number of mosquitoes transported on aircraft.

Thank you again for the opportunity to appear before the Subcommittee. I would be happy to answer any questions you may have.

###