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West Nile: It's Not Just Local. It's Global

By Paul R. Epstein

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Just as the buzz about West Nile virus has begun to recede in the Northeast, infected birds are being reported in Maryland and the District, and there is news of an Israeli outbreak that has claimed at least 19 lives. Beyond the obvious lessons to be drawn from these scares, there is a link that has not been recognized: The conditions underlying outbreaks of this sometimes deadly virus can be traced to global environmental change.

This is not the kind of distant, seemingly abstract effect most people associate with the threat of global warming--melting glaciers, eroding coastlines, endangered species. It is something we can see in our own backyards.

Named for the district in Uganda where it was first identified in 1937, the West Nile virus entered the Western Hemisphere in 1999--most likely, scientists believe, via migratory birds from Europe. While the precise means of introduction is not known, we do know the conditions that "rev up" the disease's life cycle: mild winters coupled with prolonged droughts and heat waves--the long-term and extreme weather phenomena associated with climate change.

Since mosquitoes lay their eggs in water, the fact that drought can amplify transmission of diseases they carry may seem counterintuitive. But this is the case for the West Nile virus. Here is how it can happen:

West Nile virus is transmitted by mosquitoes to birds and other animals, with occasional "spillover" to humans. What makes it different from many other mosquito-borne illnesses is that its primary carrier is an urban-dwelling mosquito, Culex pipiens.

Culex typically breeds underground in the foul water standing in city drains and catch basins. During a drought, those pools are even richer in the rotting organic material that Culex needs to thrive; more rainfall would flush the drains and dilute the pools. (Another group of mosquitoes, Aedes, breeds in open ponds and puddles; some species of Aedes carry the West Nile virus, though not as efficiently as Culex.)

Drought can also lead to a decline in the number of mosquito predators, such as frogs and dragonflies. And it encourages birds to congregate around shrinking water sites--where the virus can circulate more easily.

Meanwhile, high temperatures speed up the development of viruses within the mosquito carriers (who only live about two weeks). The faster a virus develops, the greater the chance that it will reach a dangerous mature stage while the mosquito is alive and capable of biting.

All these factors enhance the possibility that infectious virus levels will build up in birds and mosquitoes living in close proximity to human beings. And in the spring and summer of 1999, all these factors were present in the Northeastern and mid-Atlantic states. The prolonged drought and intense heat (in particular the three-week heat wave that enveloped the Northeast that July) lasted until the pendulum swung

ferociously in the opposite direction, bringing torrential end-of-August rains. Culex thrived in the drought months; Aedes bred in the late summer floodwaters.

And, as is well known, a serious outbreak occurred: Seven New Yorkers died from the West Nile virus in 1999. Sixty-two people were infected and survived; many have reported chronic disabilities, such as extreme muscle weakness and fatigue.

In contrast, the unusually cool and wet weather this past spring and summer may have reduced the threat of West Nile virus for humans. Indeed, only one death has been recorded to date--that of an 82-year-old man in New Jersey. Public health measures, including targeted spraying of pesticides and the application of chemicals and bacteria that kill mosquito larvae in storm drains, were also apparently helpful.

Meanwhile, however, Israel experienced a prolonged drought and intense heat this summer--conditions that may have helped create the serious outbreak that occurred there.

Certainly there are factors other than weather and climate that contribute to outbreaks of disease. Just as forestry practices fueled the fires sparked by lightning during this past summer's prolonged western drought, local environmental problems can increase the potential for mosquito breeding in urban settings. Antiquated urban drainage systems leave more fetid pools in which mosquitoes breed, and stagnant rivers and streams do not adequately support healthy fish populations that consume mosquito larvae.

But it was extreme weather events that allowed the West Nile virus to be launched with a vengeance in this hemisphere in 1999. Now, with the virus well established on America's eastern seaboard, wide swings in weather--the projected hallmark of global climate change--threaten to encourage mosquito breeding and spawn new outbreaks in the future.

Weather extremes have played a significant role in the emergence and resurgence of dangerous diseases in the past. St. Louis encephalitis, a disease also involving Culex mosquitoes, birds and humans, made its appearance in St. Louis in 1933 during the "dust bowl." A large outbreak occurred in California in 1984 following an extended dry spell.

Hantavirus pulmonary syndrome--caused by a previously unknown virus related to one that killed U.S. and U.N. soldiers during the Korean War--appeared suddenly in the Southwestern United States in 1993. The disease is carried by rodents, and populations of the Peromyscus maniculatus mouse had been boosted tenfold by a sequence of extreme weather conditions--years of drought that helped reduce its predators, followed by heavy winter rains that encouraged the growth of the mouse's food sources. Ninety-four people were infected during the first year; 45 of them died.

Since the mid-1970s, more than 30 diseases new to medicine have emerged. Old infectious diseases are resurging, or reappearing where they had been eliminated or, like West Nile, appearing where they have never been seen before. Factors contributing to this are deepening poverty in some areas, population movements and medical and agricultural misuse of antibiotics. But the damage is compounded by local and global environmental change.

The appearance of a mosquito-borne illness in Northeastern cities underscores just how global environmental change can directly affect our lives. Diseases generated continents away can travel and spread, and no nation is immune. Public and personal health is inextricably tied to a stable climate, and to economic development and healthy ecosystems on continents far away, as well as at home.

We have embarked upon a precarious and uncertain global course. Just as we have underestimated the rate at which climate change is occurring, we have underestimated the sensitivity of biological systems to small changes in average temperatures and the accompanying weather instability. We cannot delay any longer:

Restabilizing the climate system must be a chief priority to protect our health and our well-being.

Global warming is driven by the use of fossil fuels and the emission of other heat-trapping gases into the Earth's atmosphere. This latest manifestation of global environmental change in our backyards underscores the urgency of altering the way our economies develop and the way we power that development.

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