

Zika, Dengue, Yellow Fever, West Nile, and Viral Encephalitis: Invasive Mosquitoes and People on the Move Create a Perfect Storm for Disease Outbreaks

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David Bruce Conn, M.S., Ph.D.

Berry College OneHealth Ctr; Harvard Univ. Museum Comp Zoology; Scientific Advisor U.S. State Dept.

Today, on February 9th 2016, nearly 2 billion dollars has been requested from the U.S. federal government to combat the exploding Zika virus pandemic. Any humanitarian hopes this funding will be forthcoming. Yet, beyond just Zika, many of the world's most important diseases (e.g., malaria, filariasis and more) and critical emerging diseases (e.g., dengue, West Nile Virus and more) are transmitted by mosquitoes. Despite our warnings from assessing new emergence of mosquito-borne pathogens with pandemic characteristics, the public, politicians, and media have been slow or even reluctant to respond until a major outbreak is already underway. Scientific assessment of mosquito populations led to our predictions in 2010 that Chikungunya virus would soon move into the Western Hemisphere, 3

years before it finally emerged throughout the Americas. Similarly, we began warning about impending introduction of Zika virus in 2014, nearly 2 years before it arrived in the Americas. Medical surveillance is not the most important predictor or monitor for such diseases, because we only see sick people when the outbreak has already begun. On the other hand, insect vector monitoring is the best way to see danger on the horizon, before people get sick or die. If the vectors are present in epidemiologically relevant numbers, human movements are certain to introduce the pathogens to areas where they have not previously occurred. You don't leave gasoline-soaked kindling around your house just because you don't see any sparks at the moment; neither should you ignore mosquito populations just because people in your part of the world aren't yet sick with mosquito-borne diseases.

The excerpts below, from recent publications from my research lab, warn about invasive mosquitoes with vector potential for significant disease emergence. We have raised concerns about potential re-emergence of Yellow Fever as mosquito populations expand, noting that YF caused thousands of deaths across the eastern U.S. in the 1800s. We also are alerting interested parties that additional temperate-climate mosquitoes, *Aedes japonicus* and *Aedes koreicus*, currently invading much of North America and Europe, have vector potential for many serious diseases of both humans and animals. In today's world, rapid and massive movements of people, animals, and insects are creating a "perfect storm" for disease emergence with serious consequences. We should not be fearful, but we should be vigilant, smart, and determined. We certainly need to develop new diagnostics, vaccines, and drugs. But,

we can avoid most problems just by monitoring and controlling mosquitoes, before the vaccines and drugs are necessary.

Below, read some of our recently published warnings, and click on the links for more details.

“The same [*Aedes*] mosquitoes, currently within the US, are also able to transmit such viral pathogens as dengue, Chikungunya, Zika, and yellow fever, so that health officials as well as entomologists and vector biologists in both the origination and recipient countries should be alert to the possibility of such dissemination.” ([Link to: Darr and Conn 2015. Importation and transmission of parasitic and other infectious diseases associated with international adoptees and refugees immigrating into the United States of America. BioMed Research International, Article ID 763715: 1-8.](#))

“Given the obligate nature of many insect vectors, it is clear that the existence of healthy vector populations is itself a pending health threat, even if the pathogen does not occur in a given area. If competent *Anopheles* vectors of malaria, or *Aedes* vectors of dengue, Chikungunya or other viruses are present in an area, new invasion of that area by the pathogen requires only the movement of infected human or animal hosts into the area.” ([Link to: Conn 2014. Aquatic invasive species and emerging infectious disease threats: A One Health perspective. Aquatic Invasions 9: 383-390.](#))

"Although *Aedes aegypti*, the main vector of DENV [Dengue virus] feeding on human blood, do not remain alive in the winter in temperate

zones, not only can some *Aedes* species be active throughout the year in tropical and subtropical zones but they remain alive throughout the winter in the egg stage in temperate climates. This may include invasive species such as *Aedes albopictus*, which has recently colonized vast temperate areas of Europe and North America, where it threatens broader transmission of dengue and other diseases such as emerging human dirofilariosis across many new regions of Europe." ([Link to: Chomicz, Conn, et al. 2015. Newly emerging parasitic threats for human health: National and international trends. BioMed Research International, Article ID 489324: 1-4.](#))

The bottom line? Zika virus and other mosquito-borne pathogens aren't just diseases of people; they are diseases of entire ecosystems. We must manage the entire environment to eliminate or suppress the insect vectors, while maintaining the health of our water sources and our homes. This is what One Health means – a single unified strategy to protect people, animals, and the environment. The graphic below, produced with Shannon Montgomery, a student in our One Health Center, gives some strategies for protecting yourself, your children, and your neighbors -- not only from dengue, but from all the other diseases discussed here as well.