



## VECTOR-BORNE DISEASES

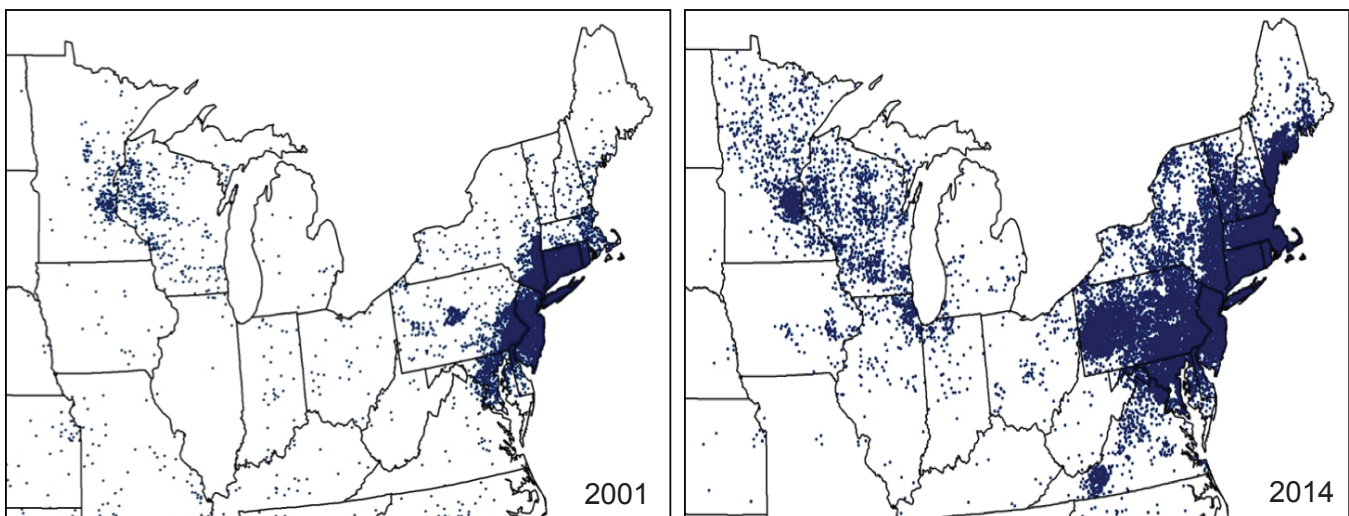
Vector-borne diseases are illnesses that are transmitted by vectors, which include mosquitoes, ticks, and fleas. These vectors can carry infective pathogens such as viruses, bacteria, and protozoa, which can be transferred from one host (carrier) to another. The seasonality, distribution, and prevalence of vector-borne diseases are influenced significantly by climate factors, primarily high and low temperature extremes and precipitation patterns.

Climate change is likely to have both short- and long-term effects on vector-borne disease transmission and infection patterns, affecting both seasonal risk and broad geographic changes in disease occurrence over decades. While climate variability and climate change both alter the transmission of vector-borne diseases, they will likely interact with many other factors, including how pathogens adapt and change, the availability of hosts, changing ecosystems and land use, demographics, human behavior, and adaptive capacity. These complex interactions make it difficult to predict the effects of climate change on vector-borne diseases.



In the eastern United States, Lyme disease is transmitted to humans primarily by blacklegged (deer) ticks.

### Changes in Lyme Disease Case Report Distribution



Maps show the reported cases of Lyme disease in 2001 and 2014 for the areas of the country where Lyme disease is most common (the Northeast and Upper Midwest). Both the distribution and the numbers of cases have increased (see Ch. 5: Vector-Borne Diseases). (Figure source: adapted from CDC 2015)<sup>6</sup>

## Changing Distributions of Vectors and Vector-Borne Diseases

**Key Finding 1:** Climate change is expected to alter the geographic and seasonal distributions of existing vectors and vector-borne diseases [*Likely, High Confidence*].

## Earlier Tick Activity and Northward Range Expansion

**Key Finding 2:** Ticks capable of carrying the bacteria that cause Lyme disease and other pathogens will show earlier seasonal activity and a generally northward expansion in response to increasing temperatures associated with climate change [*Likely, High Confidence*]. Longer seasonal activity and expanding geographic range of these ticks will increase the risk of human exposure to ticks [*Likely, Medium Confidence*].

## Changing Mosquito-Borne Disease Dynamics

**Key Finding 3:** Rising temperatures, changing precipitation patterns, and a higher frequency of some extreme weather events associated with climate change will influence the distribution, abundance, and prevalence of infection in the mosquitoes that transmit West Nile virus and other pathogens by altering habitat availability and mosquito and viral reproduction rates [*Very Likely, High Confidence*]. Alterations in the distribution, abundance, and infection rate of mosquitoes will influence human exposure to bites from infected mosquitoes, which is expected to alter risk for human disease [*Very Likely, Medium Confidence*].

## Emergence of New Vector-Borne Pathogens

**Key Finding 4:** Vector-borne pathogens are expected to emerge or reemerge due to the interactions of climate factors with many other drivers, such as changing land-use patterns [*Likely, High Confidence*]. The impacts to human disease, however, will be limited by the adaptive capacity of human populations, such as vector control practices or personal protective measures [*Likely, High Confidence*].



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Birds such as the house finch are the natural host of West Nile virus. Humans can be infected from a bite of a mosquito that has previously bitten an infected bird.

