

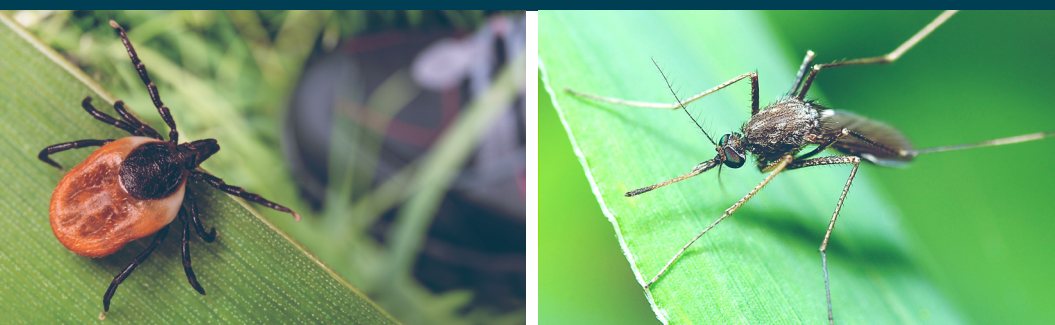


OUR RISK FOR INFECTIOUS DISEASES

Is Increasing Because of Climate Change

As the nation's public health leader, the Centers for Disease Control and Prevention (CDC) is actively engaged in a national effort to protect the public's health from the harmful effects of climate change. Scientists from CDC's National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) are at the forefront of many of these efforts. This report highlights some of that work and also looks ahead to the important work yet to come.

Lyme disease, West Nile virus disease, and Valley fever. These are just some of the infectious diseases that are on the rise and spreading to new areas of the United States. Milder winters, warmer summers, and fewer days of frost make it easier for these and other infectious diseases to expand into new geographic areas and infect more people. To understand climate change's impact, it's important to look at some of the common ways these diseases spread—through mosquito and tick bites, contact with animals, fungi, and water.



MOSQUITO AND TICK BITES

Mild winters, early springs, and warmer temperatures are giving mosquitoes and ticks more time to reproduce, spread diseases, and expand their habitats throughout the United States. Between 2004 and 2018, the number of reported illnesses from mosquito, tick, and flea bites more than doubled, with more than 760,000 cases reported in the United States. Nine new germs spread by mosquitoes and ticks were discovered or introduced into the United States during this period. The geographic ranges where ticks spread Lyme disease, anaplasmosis, ehrlichiosis, and spotted fever rickettsiosis have expanded, and experts predict that tickborne diseases will continue to increase and perhaps worsen. Longer, warmer summers have also given mosquitoes more time to reproduce and spread diseases. In 2012, a mild winter, early spring, and hot summer set the stage for an outbreak of West Nile virus disease in the United States, resulting in more than 5,600 illnesses and 286 deaths.

As the climate changes, the risk also increases for infectious diseases such as:

- ▶ Anaplasmosis
- ▶ Anthrax
- ▶ Antibiotic-resistant bacteria
- ▶ *Cryptosporidiosis*
- ▶ Dengue
- ▶ Ehrlichiosis
- ▶ Fungal diseases
- ▶ *Giardiasis*
- ▶ Hantavirus
- ▶ Harmful algal bloom-associated illness
- ▶ Lyme disease
- ▶ Plague
- ▶ Rabies
- ▶ Spotted fever rickettsiosis
- ▶ Valley fever
- ▶ *Vibrio infections*
- ▶ West Nile virus infections

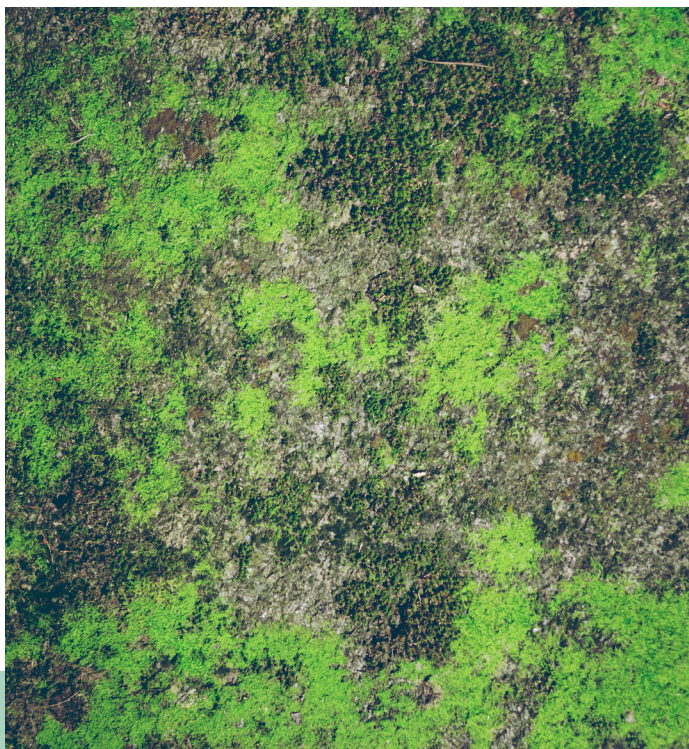
CONTACT WITH ANIMALS

Climate change has forced some animal species into new habitats as their natural habitats disappear, and it has expanded the habitats of other animals. This movement of animals into new areas increases opportunities for contact between humans and animals and the potential spread of zoonotic diseases, as these examples show:

- Wildlife carrying the rabies virus are expanding to new geographic areas of the country.
- Arctic temperatures are rising more than twice as rapidly as the rest of the world. Warming temperatures in Alaska have led to increases in vole populations, which can spread diseases like Alaskapox to humans.
- As global temperatures rise, deadly diseases that are a threat in other countries – like Ebola, Lassa, Rift Valley fever, and monkeypox – will increase along with the risk of them being imported into the United States.

FUNGAL DISEASES

Rising temperatures have allowed certain disease-causing fungi to spread into new areas that previously were too cold for them to survive. For example, Valley fever – caused by a fungus that lives in the soil in hot and dry areas – has already spread into the Pacific Northwest. This fungus can cause severe infections and death and is often misdiagnosed and treated inappropriately. As the difference between environmental temperatures and human body temperatures narrows, new fungal diseases may emerge as fungi become more adapted to surviving in humans. Climate change also increases the risk for natural disasters and flooding, which can increase the risk for mold to grow in people's homes. Certain molds can cause deadly infections of the lungs and brain.



WATER

Scientists predict that climate change will have devastating effects on freshwater and marine environments. For example, we could see more frequent and more severe instances of harmful algal blooms, which are the rapid growth of algae or cyanobacteria in lakes, rivers, oceans, and bays. Warming temperatures in Lake Erie have contributed to extensive toxic blooms that last into the early winter months. Harmful algal blooms can look like foam, scum, paint, or mats on the surface of water and can be different colors. They endanger our health when we eat contaminated shellfish. They also can harm pets, livestock, wildlife, and the environment. While no human deaths caused by cyanobacteria have been reported in the United States, some of these toxins can make dogs and other animals sick and possibly even cause death within hours to days. Dog deaths have been reported after dogs swam in or drank fresh water containing cyanobacterial toxins.

Additionally, scientific evidence shows that traces of antibiotics are present and can sometimes remain in the environment (waterways and soils) for a long time. Scientists need to do more research to better understand the connection between the environment, existing and emerging antibiotic resistance and its spread, and the impact on human health.



WHAT CAN WE DO?

NCEZID has the expertise and tools to respond to this growing connection between climate change and infectious diseases.



- The **Division of Vector-Borne Diseases** is a national and international leader in researching, preventing, and controlling the deadly germs spread by mosquitoes, ticks, fleas, and other vectors. It partners with state, local, and territorial health departments to detect, track, and reduce illnesses and deaths from vector-borne diseases.
- The **Arctic Investigations Program** within NCEZID's **Division of Preparedness and Emerging Infections** collaborates closely with Alaska Native communities and tribal organizations, and with the health ministries of other circumpolar nations. It also conducts climate-related health surveillance and research.
- Globally, climate changes affect the migration routes of humans and animals—and any infectious pathogens they may be carrying. NCEZID's **Division of Global Migration and Quarantine** works with partners around the world to identify these migration routes and help the affected countries strengthen their ability to quickly respond when outbreaks occur.
- CDC's **One Health Office** helps U.S. and international partners strengthen coordination, collaboration, and communication between the human, animal, and environmental health sectors. Their goal is to help partner countries achieve optimal health outcomes, which includes addressing the effects of climate change. A One Health approach focuses on how climate changes are affecting human health, biodiversity, animal habitats and food sources, and environmental conditions such as deforestations and warming ocean temperatures.
- Human activity can contaminate the environment with antibiotics, antifungals, and the organisms resistant to them, which can accelerate the development and spread of resistance. CDC's **Division of Healthcare Quality and Promotion and CDC's Antibiotic Resistance Solutions Initiative** emphasize a One Health approach in research to better understand resistance in the environment; the connections between resistance across health care, the community, and environment; and its impact on human health.
- Changes in the environment and microorganisms are affecting the occurrence and complexity of foodborne, waterborne, and environmentally transmitted diseases. The **Division of Foodborne, Waterborne, and Environmental Diseases** identifies and tracks infections spread by food, water, environmental, and other routes. DFWED is also one of the few public health groups in the world devoted to preventing and controlling fungal diseases. Experts work with state and local health departments and academic partners to address the spread of severe fungal diseases in the United States, and the growing threat of emerging fungal diseases domestically and globally.
- The **Division of High-Consequence Pathogens and Pathology** protects the public's health from some of the deadliest diseases on the planet, whether they are caused by highly lethal viruses, bacteria, prions, or unknown pathogens. The risk for some of these diseases is increasing because of climate changes. For example, thawing permafrost poses a risk to humans by potentially exposing them to anthrax spores, which can survive for decades in frozen ground. The division monitors and investigates deadly pathogens that may spread and proliferate with more severe weather events.
- As climate changes, new infections may emerge that threaten human health or livelihood. **The Office of Advanced Molecular Detection** helps public health innovate and use new technology to detect and respond to outbreaks.

WHAT'S NEEDED?

We have a lot of work ahead. Our main goals are to learn more about climate change's impact on our health and what we can do to protect ourselves. Looking ahead, here's what's most needed to keep these threats in check:

- We must continue to invest in disease surveillance systems so that we can track these diseases and see if they are increasing or shifting over time.
- We need to maintain a strong national public health system and workforce so that we can predict, prevent, detect, and respond to new diseases as they expand to new areas of the United States.
- We need new tools to help us analyze and interpret the data we collect and predict where threats are most likely to occur.
- We must understand inequities in how climate change impacts certain populations and use data to inform tailored prevention and response strategies for communities that are disproportionately affected.
- We need to invest in research, environmental data collection, and disease/climate modeling efforts that will help us predict and prepare for future climate scenarios that will impact disease outcomes.

