

# More than half of human pathogenic diseases can be aggravated by climate change

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More than half of known human pathogenic diseases such as dengue, hepatitis, pneumonia, malaria, Zika and more, can be aggravated by climate change. That eye-opening and startling finding is the topic of a

research paper published on August 8 in *Nature Climate Change* by a team of researchers from the University of Hawai'i at Mānoa.

The researchers carried out a systemic search for empirical examples about the impacts of 10 climatic hazards sensitive to [greenhouse gas](#) (GHG) emissions on each known human pathogenic [disease](#). These hazards included warming, drought, heatwaves, wildfires, [extreme precipitation](#), floods, storms, [sea level rise](#), ocean biogeochemical change, and land cover change.

Combining two authoritative lists of all known infections and pathogenic diseases that have affected humanity in recorded history, researchers then reviewed over 70,000 scientific papers for empirical examples about each possible combination of a climatic hazard impacting each of the known diseases.

The research revealed that warming, precipitation, floods, drought, storm, land cover change, ocean [climate change](#), fires, heatwaves and sea level changes were all found to influence diseases triggered by viruses, bacteria, animals, fungi, protozoans, plants and chromists. Pathogenic diseases were primarily transmitted by vectors, although case examples were also found for transmission pathways involving waterborne, airborne, direct contact and foodborne. Ultimately, the research found that more than 58%, or 218 out of 375, of known human pathogenic diseases had been affected at some point by at least one climatic hazard via 1,006 unique pathways.

"Given the extensive and pervasive consequences of the COVID 19 pandemic, it was truly scary to discover the massive health vulnerability resulting as a consequence of greenhouse gas emissions," said Camilo Mora, geography professor in the College of Social Sciences (CSS) and lead author of the study. "There are just too many diseases, and pathways of transmission, for us to think that we can truly adapt to

climate change. It highlights the urgent need to reduce greenhouse gas emissions globally."

An [interactive web-page](#) showing each connection between a climatic hazard and a disease case was developed by the research team. The tool allows users to query specific hazards, pathways and disease groups, and see the available evidence.

The UH Mānoa research team included experts from CSS, Department of Earth Sciences in the School of Ocean and Earth Science and Technology (SOEST), Marine Biology Graduate Program in the School of Life Sciences, Department of Natural Resources and Environmental Management in the College of Tropical Agriculture and Human Resources (CTAHR), and Hawai'i Institute of Marine Biology in SOEST.

Key findings include:

- Climatic hazards are bringing pathogens closer to people. Numerous climatic hazards are increasing the area and duration of environmental suitability facilitating the expansion of vectors and pathogens. Warming and precipitation changes, for instance, were associated with range expansion of vectors such as mosquitoes, ticks, fleas, birds and several mammals implicated in outbreaks by viruses, bacteria, animals and protozoans, including dengue, chikungunya, plague, Lyme disease, West Nile virus, Zika, trypanosomiasis, echinococcosis and malaria.
- Climatic hazards are bringing people closer to pathogens. Climatic hazards were implicated with the forced displacement and migration of people, causing or increasing new contacts with pathogens. Storms, floods and sea level rise, for example, caused human displacements implicated in cases of leptospirosis, cryptosporidiosis, Lassa fever, giardiasis, gastroenteritis,

Legionnaires' diseases, cholera, salmonellosis, shigellosis, pneumonia, typhoid, hepatitis, respiratory disease and skin diseases.

- Climatic hazards have enhanced specific aspects of pathogens, including improved climate suitability for reproduction, acceleration of the life cycle, increasing seasons/length of likely exposure, enhancing pathogen vector interactions (e.g., by shortening incubations) and increased virulence. Warming, for instance, had positive effects on mosquito population development, survival, biting rates and [viral replication](#), increasing the transmission efficiency of West Nile virus.
- Climatic hazards have also diminished human capacity to cope with pathogens by altering body condition; adding stress from exposure to hazardous conditions; forcing people into unsafe conditions; and damaging infrastructure, forcing exposure to pathogens and/or reducing access to medical care. For example, drought was conducive to [poor sanitation](#) responsible for cases of trachoma, chlamydia, cholera, conjunctivitis, Cryptosporidium, diarrheal diseases, dysentery, Escherichia coli, Giardia, Salmonella, scabies and typhoid fever.

Researchers also found that, while the great majority of diseases were aggravated by climatic hazards, some were diminished (63 out of 286 diseases). Warming, for example, appears to have reduced the spread of viral diseases probably related to unsuitable conditions for the virus or because of a stronger immune system in warmer conditions. However, most diseases that were diminished by at least one hazard were at times aggravated by another and sometimes even the same hazard.

"We knew that climate change can affect human pathogenic diseases," said co-author Kira Webster, CSS geography Ph.D. student. "Yet, as our database grew, we became both fascinated and distressed by the overwhelming number of available case studies that already show how

vulnerable we are becoming to our ongoing growing emissions of greenhouse gases."

**More information:** Camilo Mora, Over half of known human pathogenic diseases can be aggravated by climate change, *Nature Climate Change* (2022). [DOI: 10.1038/s41558-022-01426-1](https://doi.org/10.1038/s41558-022-01426-1).  
[www.nature.com/articles/s41558-022-01426-1](https://www.nature.com/articles/s41558-022-01426-1)

Provided by University of Hawai'i at Mānoa

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