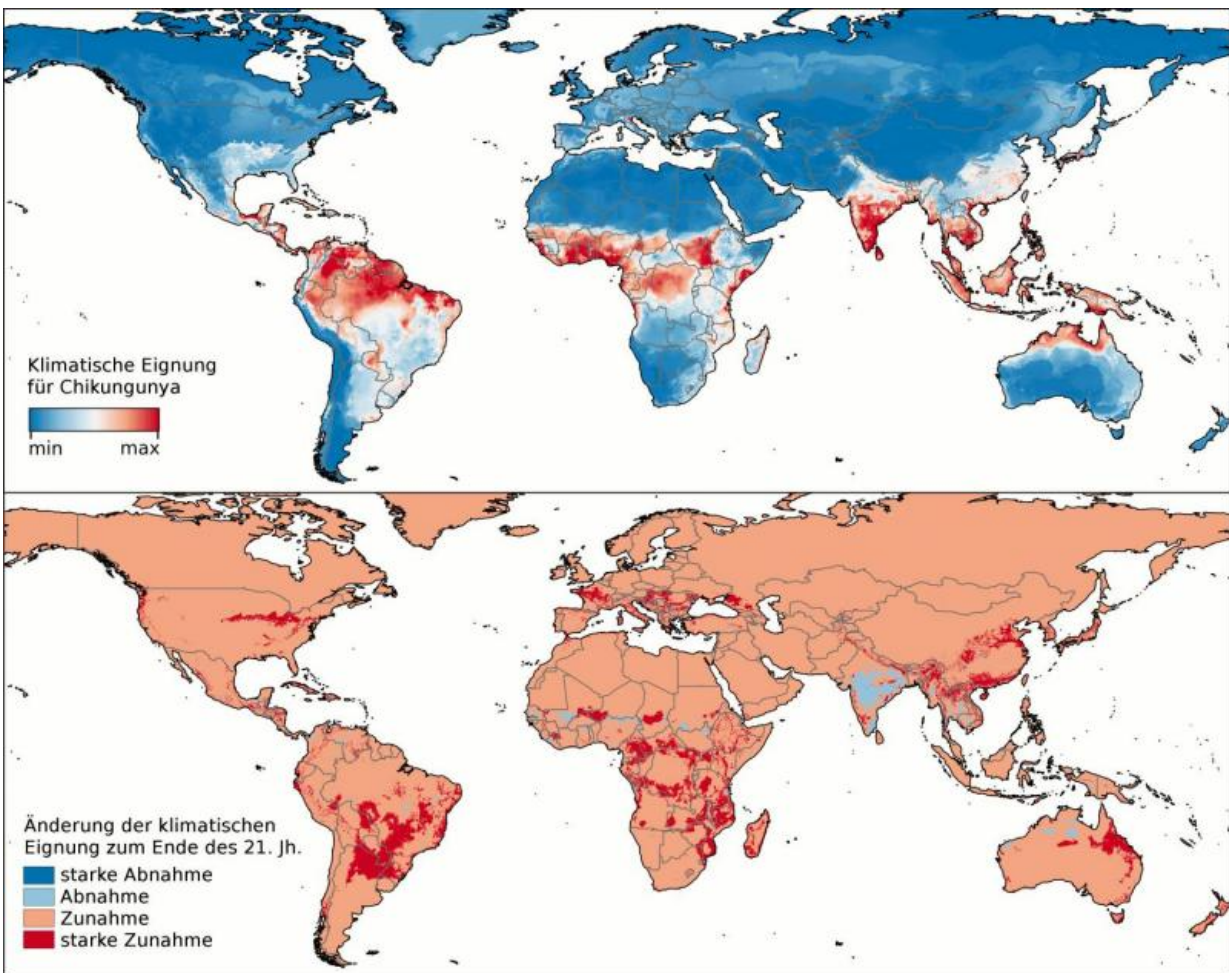


Researchers explore whether climate change could bring tropical viruses to Europe

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The map above shows the regions of the world which currently have climatic conditions that facilitate Chikungunya infection. - The lower map shows how the regions which have climatic conditions that facilitate Chikungunya infection will intensify and grow (or subside) through the end of the 21st century if climate change is left largely unchecked. Credit: Nils Tjaden.

The mosquito-borne viral disease Chikungunya is usually found in tropical areas. Researchers at the University of Bayreuth and the European Centre for Disease Prevention and Control (ECDC) in Stockholm have now discovered how climate change is facilitating the spread of the Chikungunya virus. Even if climate change only progresses moderately – as scientists are currently observing – the risk of infection will continue to increase in many regions of the world through the end of the 21st century. If climate change continues unchecked, the virus could even spread to southern Europe and the United States. The researchers have published their findings in *Scientific Reports*.

It is the Asian tiger mosquito and yellow fever mosquito that infect humans with the Chikungunya virus. The climate affects the spread of a mosquito-borne virus in two main ways. First, it plays a crucial role in the geographical distribution of the mosquitos, which can only thrive in the long term if temperature and precipitation levels are high enough. Second, the virus replicates especially quickly in the body of the mosquito if the ambient temperature is high and remains relatively constant over the course of the day. For this reason, the risk of being infected with the Chikungunya virus has – until now – been mainly limited to tropical regions of Africa, Asia, and South America.

A world map displaying the current risk areas

A team of researchers at the University of Bayreuth led by Prof. Carl Beierkuhnlein and their colleagues at ECDC in Stockholm, Dr Jan Semenza and Dr Jonathan Suk, have investigated the [climate conditions](#) that facilitate the spread of the Chikungunya virus. They looked at the factors responsible for the climate conditions in regions that have traditionally had a high rate of infection. The data they collected enabled them to generate a world map displaying those areas where the risk of

infection is particularly high. To this end, the researchers selected an approach based on machine learning that is often used in nature and wildlife conservation to develop models for the distribution of various species of plants and animals. The approach makes use of a computer programme based on the so-called "maximum entropy method", which takes care of all the necessary statistical calculations. "In close cooperation with the researchers at the European Centre for Disease Prevention and Control (ECDC) we were able to derive a sophisticated global overview of the risk of Chikungunya infection," said Nils Tjaden, a doctoral researcher in Bayreuth's biogeography team.

Increased risk of infection due to climate change

How will the current risk areas be affected by [climate change](#)? This depends on the underlying assumptions regarding the future course of [global climate change](#) on which one's calculations are based. The researchers in Bayreuth and Stockholm used two different climate change scenarios. One of the two scenarios assumes that climate change will progress moderately and that the IPCC target of 2 degrees Celsius per year will only be slightly missed. The average global temperature would increase by 2.6 degrees Celsius by the year 2100 compared to pre-industrial times. On this assumption, the calculations point to a general trend that will make the climate conditions around the world more favourable for Chikungunya infections.

By contrast, the second scenario assumes that climate change will be left unchecked to a large extent. Here the average global temperature would increase by around 4.6 degrees Celsius by the year 2100 compared to pre-industrial times. In this case, the regions at high risk of Chikungunya would grow noticeably. The virus would likely spread to countries in southern Europe as well as to the United States. "Since we have yet to develop a global strategy that would effectively slow down climate change, this scenario appears to be more likely than the other. At

temperate latitudes, the risk of Chikungunya infection may reach levels even higher than the projection given in the second scenario," Prof. Beierkuhnlein said. "People have already been infected with Chikungunya in Italy, France, and Florida; however, such cases are still too rare to play any significant role in our model. The climatic potential for new diseases in southern Europe and the US is probably being underestimated," explained Dr. Stephanie Thomas, biogeography researcher in Bayreuth. According to the team's predictions, the risk of Chikungunya is only likely to decrease slightly in two places: India and on the southern edge of the Sahara. The reason? Conditions in those places could become even too extreme for the mosquitos.

The question of how tropical infectious diseases could spread as a result of [climate](#) change in Europe and other regions of the world has been a research priority of Bayreuth's biogeography team for more than a decade. Prof. Beierkuhnlein's research group specializes in the analysis of factors that facilitate the spread of insects such as the Asian tiger mosquito, which not only carries the Chikungunya [virus](#), but also the dreaded dengue fever.

More information: Nils B. Tjaden et al. Modelling the effects of global climate change on Chikungunya transmission in the 21st century, *Scientific Reports* (2017). [DOI: 10.1038/s41598-017-03566-3](https://doi.org/10.1038/s41598-017-03566-3)

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