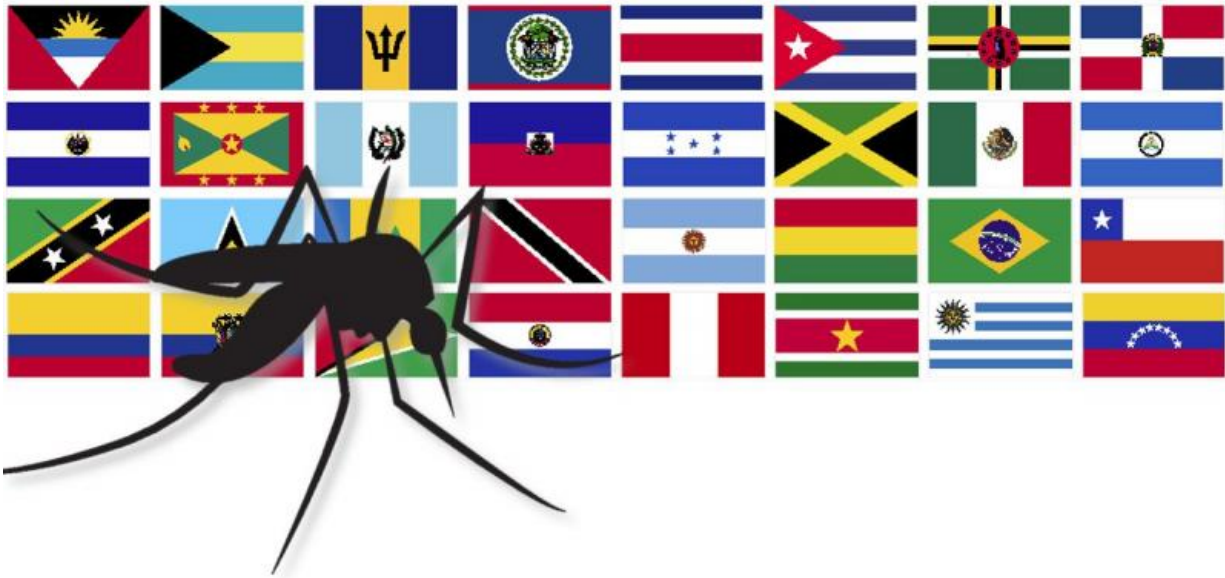


# Where next for the Zika virus?

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The southeastern US, including much of Texas through to Florida, has ideal conditions for the spread of Zika virus, according to a new study involving Oxford scientists.

A large portion of global tropical and subtropical regions have highly suitable environmental conditions and are at the greatest risk. These areas are inhabited by over 2.7 billion people.

Scientists led by the University of Oxford and the Institute for Health

Metrics and Evaluation, Seattle, have produced a fine-scale global map of Zika [virus](#) transmission. This map was produced by identifying areas of the world with similar environmental and socioeconomic characteristics as areas where the virus has been reported so far. These characteristics include simple weather variables such as precipitation and land cover, but also complex temperature-based virus incubation models. Separate analysis produced range maps for the primary mosquito vector of Zika, *Aedes aegypti*.

The research is published in the journal *eLife*.

'We have comprehensively assembled all the data for Zika occurrence in humans, displayed it as a map, and combined it with detailed predictions of where the virus could spread next,' said lead author Janey Messina from the University of Oxford's Department of Zoology.

'Our global risk map reveals priority regions where authorities could intervene to control the vector population and where surveillance of the virus should be concentrated in order to improve rapid outbreak response and clinical diagnosis.'

Recent analysis has shown that the virus was first introduced to Brazil in 2013, where it circulated undetected until it was eventually reported for the first time in 2015. Pregnant women with Zika virus are at higher risk of giving birth to infants with microcephaly, an incompletely developed brain. Today there are over 1,000 confirmed cases of Zika-associated microcephaly in the country and nearly 5,000 suspected cases. These new maps highlight that over 5 million births in the Americas alone will occur in areas that may be at risk of Zika over the next year, demonstrating an urgent need to limit the spread of the disease and protect vulnerable populations now.

An existing map provided by the US Centre for Disease Control shows

the potential range for two mosquito vectors, *Ae. aegypti* and *Ae. albopictus*. However, it does not provide any information on whether the mosquitoes could spread disease in these areas, nor does it take into account the specifics of the latest Zika case data.

To create the current maps, the researchers focused on six variables. Temperature is an important predictor of whether adult female mosquitoes can survive long enough to take a blood meal from a human and lay a batch of eggs. It also determines whether the virus can incubate for long enough in mosquitoes – this requires about ten days. The researchers included data for both *Ae. aegypti* and *Ae. albopictus*, although *Ae. aegypti* has proved to be most effective at transmitting Zika virus.

Higher rainfall is associated with higher infection risk for other mosquito-borne viruses of the same family, such as dengue. The mosquitoes lay their eggs in static water. Finally, urban areas are particularly suitable for transmitting Zika because female *Ae. aegypti* favour the blood of humans over other animals. Only the females bite and transmit disease, and they take regular blood meals from humans during the day to provide the nutrition needed to produce eggs. Urban areas also provide plenty of breeding sites, particularly artificial containers holding water.

The results show that although potential the range of *Ae. aegypti* and *Ae. albopictus* in the US is much larger, the focus for action should be the southeastern region, including most of Texas and the whole of Florida. In these and other global areas on the map assessed as 'highly suitable' for transmission of the virus, an infected person could not only import the virus but risk infecting others.

The study also confirms that travel advisories are not needed for some countries – such as Uruguay, Argentina and Chile – and that

transmission is likely to be confined to certain regions of others, such as Peru and Mexico. However, the researchers warn that it is important to be cautious at this time because we are still learning more about the virus, such as the risk from sexual transmission.

The authors highlight some surprises, for example the fact that no large outbreaks have been reported in Africa or Asia despite large portions being highly suitable for transmission. This could be due to under-reporting, misdiagnosis, or a high level of immunity in the human population, where the virus has been present for a long time. It was first discovered in Uganda in 1947.

'Our findings that a global area inhabited by over 2.7 billion people is highly suitable for transmission of Zika virus, combined with the rapid cross-continent spread we have already seen, emphasise why the World Health Organisation has declared the current outbreak as a Public Health Emergency of International Concern,' said David Pigott from Seattle's Institute for Health Metrics and Evaluation.

'With our maps and with the wealth of other information emerging from the global science and public health community, policy-makers can decide where to prioritise vector control and other preventative measures, as well as where to be most vigilant about correctly diagnosing Zika as opposed to the many other prevalence arboviruses.'

**More information:** Jane P Messina et al. Mapping global environmental suitability for Zika virus, *eLife* (2016). [DOI: 10.7554/eLife.15272](https://doi.org/10.7554/eLife.15272)

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