

Response of mosquito population dynamics to climate change in Brazil

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Mosquito-borne diseases such as Zika, dengue and chikungunya present an enormous global health problem. The problem is particularly pronounced in Brazil where environmental conditions favour persistence of the mosquito species *Aedes aegypti*, which is a vector of these diseases. Previous studies have modelled the associations between climate and dengue cases. However, we believe that it is important to focus on the mosquito ecology, not just disease occurrence. This is because we live in a changing world where urbanisation, agricultural expansion and climate change modify mosquito habitats. The effects upon the major disease vector *Aedes aegypti* cannot be captured by focussing upon dengue cases alone.

The objective of this study is to assess the climate change influence on *Aedes aegypti* population dynamics in Brazil. We used climate model output (between 2000 – 2100) from HadGEM2-ES forced by RCP 4.5 and 8.5 scenarios, which allows us to compare and contrast the effects of future climate upon mosquito populations depending on whether we are pessimistic or optimistic about climate change. We also used available occurrence data from a comprehensive entomological survey in 2013 to create a probability map of the occurrence of *Aedes aegypti* in Brazil, which was combined with model output.

Overall, this study found that the population sizes of *Aedes aegypti* in Brazil will increase dramatically. In the northeast of Brazil, mosquitoes will remain endemic over the next 80 years due to favourable temperature conditions. The southeastern of Brazil – including Rio de Janeiro and Sao Paulo – sees the highest degree of seasonality in mosquito occurrence, with higher numbers in the summer months. Mosquitoes may also begin to invade new areas, particularly in the south of the Amazonas. Crucially, *Aedes aegypti* presence is directly related to disease incidence. Therefore increased numbers of mosquitoes across Brazil as a result of climate change will result in an increase in mosquito-borne disease.

There are many factors affecting mosquito occurrence such as urbanisation, agricultural expansion and population density in addition to climate. We have used a probability map based upon available survey data to capture this. Future studies should focus upon mechanistic explanations of mosquito occurrence considering additional environmental drivers.

