

Science for Environment Policy

Biodiversity may help to prevent malaria outbreaks

Biodiversity could play a key role in preventing future outbreaks of malaria in tropical forests, according to a new study. Results indicate that a greater number of mosquito species could increase competition for mosquitoes that spread malarial parasites, whilst more vertebrate species could increase the likelihood that malarial parasites end up in 'dead-end hosts' that are unable to transmit the disease any further.

According to the World Health Organization, there is an urgent need for better understanding of the ecology and biology of vectors that spread [disease](#), such as mosquitoes and ticks. Five species of parasites can cause malaria, and the species *Plasmodium vivax*, spread by mosquitoes through their bites, is associated with 80 to 300 million cases of malaria worldwide. Better knowledge of its biology and interaction with ecosystems could improve strategies for mosquito control and reduce the number of infective bites.

A well-known way to measure the transmission of malaria and evaluate the impacts of control programmes is to calculate the 'basic reproduction number'. This is the number of cases of malaria expected to arise from a single case in a susceptible population.

Using this measure, the study investigated the effects of two possible changes in [biodiversity](#) on malarial outbreaks in south-eastern Brazil. It focused on a region known as the Serra do Mar, in the Atlantic Forest, which is home to *P. vivax* and a rich community of animals that play a role in the spread of malaria. Although malarial epidemics are uncommon in the Atlantic Forest, there can be occasional and local clusters of malarial cases and the Serra do Mar area has many tourists who could introduce the malarial parasite.

Using real data on factors that influence the spread of disease, such as the biting rate of mosquitoes and the transmission rate of malarial parasite from mosquito to human, the study modelled the effects of varying the number of species of mosquito that cannot carry the malarial parasite ('non-vector' species), and varying the number of vertebrate species that cannot host malarial parasites.

The results indicated that a decrease of approximately 80% in non-vector mosquito species and a 70% decrease in non-host vertebrates would cause the basic reproduction number to rise. This would allow malarial invasion to occur in the village populated by the indigenous Guarani Mbya tribe. In the Marujá village a reduction of just 50% in non-vector mosquito species would allow malarial invasion.

The researchers suggest that these results can be explained by the 'dilution effect', whereby a diverse community of species dilutes the effects of disease transmission. In this case, fewer species of non-vector mosquitoes would reduce competition for food and space, which would allow malarial mosquitoes to thrive. The decrease in non-host vertebrates would mean that humans are more likely to end up hosting the parasite.

The results suggest that biodiversity can contribute to disease control and that ecosystems in tropical [forests](#) could be managed to enhance the competitive and dead-end effects. Past policies of removing native vegetation to eliminate the habitat of malarial vectors have weaknesses because they may also reduce the non-vector community that protects against malarial transmission. As such, forest conservation and malaria control need not be incompatible.



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www.plosntds.org/article/info%3Adoi%2F10.1371%2Fjournal.pntd.0002139

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