

ONE HEALTH ATLAS

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The One Health approach to manage Rift Valley fever transmission

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Rift Valley fever virus (RVFV) is a zoonotic arthropod-borne virus that infects ruminants and humans throughout Africa, the South-West Indian Ocean islands, and the Arabian Peninsula. RVFV is spread by many mosquitoes, including the genera *Culex* and *Aedes* (Figure 1). Transovarian RVFV transmission has only been shown in *Aedes mcintoshi* in East Africa and may occur in other *Aedes* species. Inter-epizootic mechanisms are still poorly known. In dry mud, infected diapause eggs may survive inter-epizootic periods. Flooded eggs hatch as infected imagoes, starting the transmission cycle (Figure 1.A). Other mosquito genera spread the virus through ruminants, accelerating the cycle (Figure 1.B). Transhumance or trade of ruminants can transfer the virus to virus-free environments. Humans are mostly infected by bovine tissues or fluids after slaughter (Figure 1.C).

Climatic and environmental factors are known to drive RVFV outbreaks and boost mosquito emergence and multiplication. In East Africa, RVFV outbreaks are linked to heavy rainfalls closely related to the warm phase of the El Niño Southern Oscillation in the south-western Indian Ocean.

Although the amplification cycle between ruminants and mosquitoes must happen before human cases will occur, RVFV outbreaks first tend to be noticed when human cases appear. This underscores the need to reinforce

One Health surveillance in risky areas, where mosquito abundance and animal and human syndromes are monitored along with environmental changes (Figure 2).

As an example of the One Health approach, an integrated analysis of environmental, cattle and human serological data was performed in Madagascar following the 2008–2009 epidemics in order to identify the at-risk area for Rift Valley fever (RVF) outbreaks in the country. Using a statistical approach, the relationship between both human and cattle RVFV serological status and several climate and landscape factors (a proxy for RVF vector abundance) and bovine density was studied at the commune level. The results suggest that the humid environment of the western, north-western and eastern coastal areas are suitable for RVFV transmission in both cattle and humans. A risk map was drawn up showing the most likely areas for RVFV transmission in Madagascar (Figure 3). This map predicted the areas affected by the 2021 RVF epidemic in Madagascar. When combined with anthropological studies to assess the social acceptability of measures taken, this study should help better target RVF prevention, surveillance and control efforts in Madagascar.

We believe that the burden of RVF can be reduced by adopting a One Health approach in broad collaboration between multidisciplinary research and health sectors.

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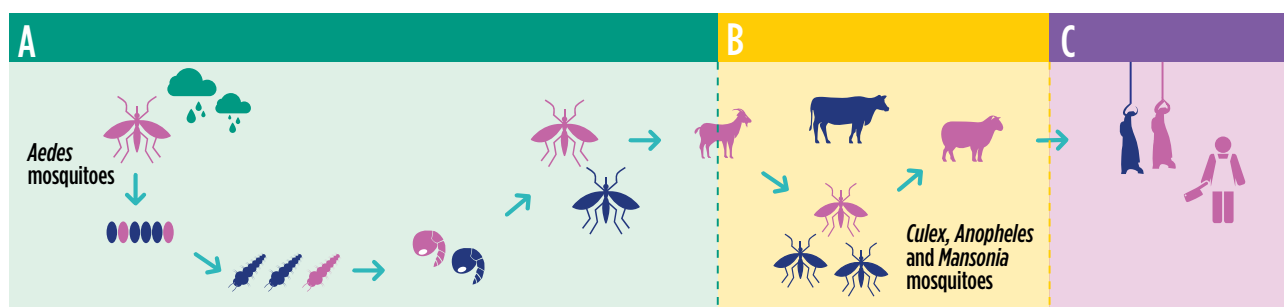


Figure 1. Schematic representation of the transmission cycle.

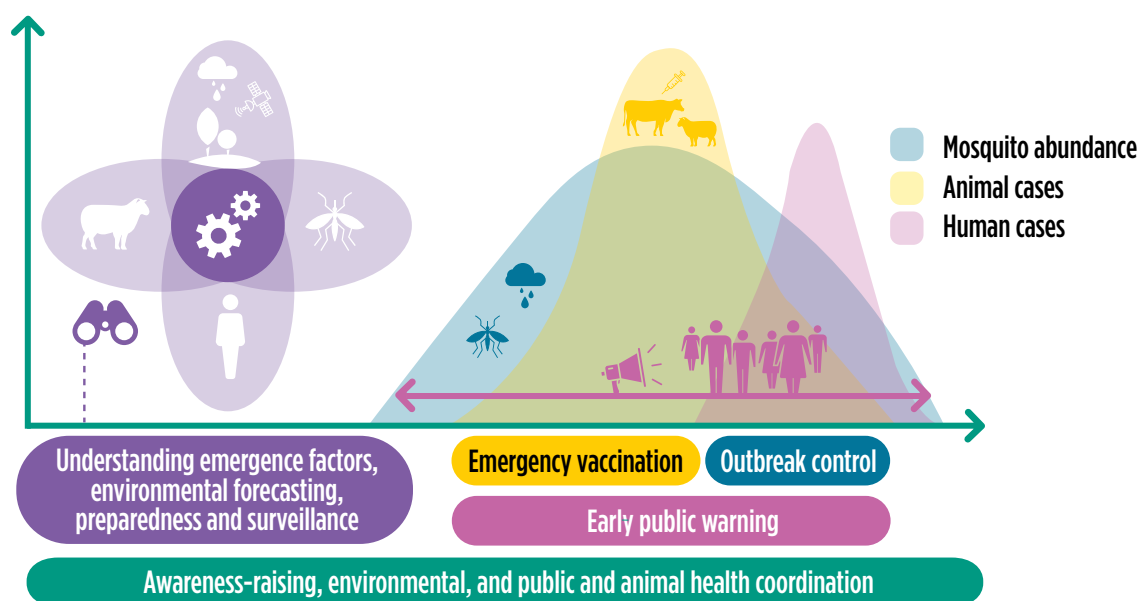


Figure 2. One Health approach to understand, forecast, prevent, ensure early detection of and control Rift Valley fever. Adapted from Lancelot *et al.* 2019; Bird and Nichols 2012.

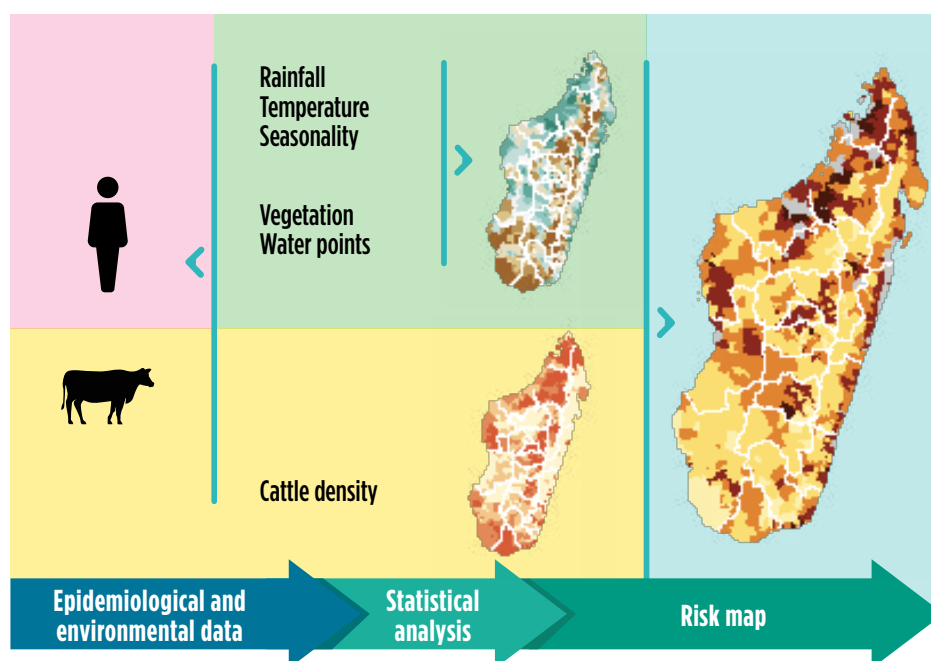


Figure 3. General framework for mapping Rift Valley fever virus transmission risk areas in Madagascar based on environmental indicators and cattle density.