Highlight 2: Supporting Government Decisions and Planning on Rift Valley Fever Interventions

According to the World Health Organization, vector-borne diseases are responsible for one million human deaths per year. Moreover, they are a significant contributor to global poverty. Rift Valley fever (RVF) is a viral disease of cattle, sheep, goats, and camels that occurs after periods of abnormally high rainfall and flooding. It can spread to livestock producers and other livestock value chain actors, such as slaughterhouse workers, via contact with infected animals or animal products. Outbreaks have socio-economic impacts due to increased livestock morbidity, mortality, and trade embargos.

Better surveillance of RVF can help preserve herds and safeguard trade, for example between the Horn of Africa and the Middle East. Livestock trade across the Red Sea has always existed but has grown rapidly with increasing wealth in the Gulf states and seasonal demands related to the pilgrimage to Mecca. This trade has been disrupted several times in recent decades by bans implemented because of RVF outbreaks. The 2006–2007 outbreak in Kenya, for example, caused losses of US$32 million at the national level.

Yet RVF remains elusive, with intermittent outbreaks that are difficult to predict. Because it is mosquito-borne, climatic factors such as temperature and rainfall can have a significant impact on how the virus spreads. Understanding these dynamics, and where and when outbreaks may occur, is critical for targeting interventions.

Researchers from the International Livestock Research Institute (ILRI) and colleagues developed a model that brings together these environmental factors, the ecology of mosquitoes, and the epidemiology of the RVF virus. This approach distilled the problem to its essence: the surface area available for mosquitoes to reproduce, the temperatures at which they develop and survive, and the incubation of the virus. Using the model, researchers were able to capture how the seasonal patterns of water bodies and temperature influence transmission dynamics of the virus, as well as to better understand at what point environmental drivers lead to RVF becoming endemic in a given area. They were also able to identify what circumstances would lead to the re-emergence of the virus after its absence in an area for an extended period of time. Moreover, the research helped reveal under which conditions RVF epidemic patterns would resemble chaotic behavior, rendering disease predictions more difficult.

The research, published in the Proceedings of the National Academy of Sciences in June 2018, showed the environmental limits of RVF and guided refinement of RVF decision-support tools, including risk management, for governments to use in planning interventions. Maps have been used in Kenya to develop contingency plans and to target surveillance and response activities, and new work has begun in Uganda with good prospects for future research, including examining the impacts of livestock density, multiple hosts and vectors, and vegetation and natural predators.

Researchers also noted that, as climate change impacts become more pronounced, several factors that will impact RVF must be kept in mind. First, changes in temperature and rainfall patterns will necessitate revisiting the model to provide updated and accurate analyses. Second, as climate patterns change, livestock movement will likely follow, requiring ongoing study of resulting changes in RVF epidemiology. Third, climate change may limit the reliability of rainfed agriculture, necessitating the use of irrigated agriculture, which in itself can promote endemic transmission of the RVF virus.

This work was implemented under the project ‘Dynamic Drivers of Disease in Africa: Ecosystems, livestock/wildlife, health and wellbeing’ that received funding from the Ecosystem Services for Poverty Alleviation Program (ESPA). The ESPA program was funded by the UK Department for International Development (DFID).