Developing optimal vaccination strategies for Rift Valley fever in East Africa

Background
Rift Valley fever is a mosquito-borne viral zoonotic disease that affects sheep, goats, cattle and camels causing devastating losses, especially among pastoral communities that rely on livestock for their livelihoods. The disease occurs in explosive outbreaks following periods of above-normal and persistent rainfall.

People can become infected with Rift Valley fever after being bitten by an infected mosquito or through close contact with acutely infected animals or their tissues. In people, the disease manifests itself as a mild influenza-like syndrome in over 80% of cases or a severe disease with haemorrhagic fever, encephalitis or retinitis in a few cases.

Because of its episodic occurrence and predilection for remote pastoral areas, the impact of the disease is often exacerbated by delays in the deployment of prevention and control measures, frequently due to a lack of pre-allocated funds for financing emergency measures.

Livestock vaccination is regarded as the most reliable method for controlling the disease. However, an assessment of emergency vaccination programs implemented after the 2007–08 Rift Valley fever outbreak in eastern Africa and during the 2015 scare showed that vaccination levels achieved were too low to make a difference.

Current vaccination approaches have been proven to be ineffective, partly because the risk of Rift Valley fever in eastern Africa evolves rapidly and usually there is not enough time to plan and execute interventions. In addition, areas where the disease is endemic are usually inaccessible during the high-risk periods due to excessive rainfall and flooding preceding outbreaks.

Objectives
This project, therefore, aims to develop optimal Rift Valley fever vaccination strategies that combine periodic preventive vaccination and reactive vaccination in the high-risk periods to replace the current practice where only reactive vaccination is implemented after warnings of heightened disease risk have been issued. Scientists will seek to use the findings generated from the project to develop Rift Valley fever vaccination strategies which could be used by policymakers throughout the eastern Africa region.

Project activities
- Development of best-bet Rift Valley fever vaccination strategies. Desk research—including mathematical modelling—will be undertaken and stakeholder workshops organized to develop optimal Rift Valley fever vaccination strategies. The model will be used to evaluate the impact of alternative vaccination strategies under varied Rift Valley fever virus transmission patterns. It will also be formulated to account for key processes that influence herd immunity dynamics, such as livestock turn-over rates and decay rates of neutralizing antibodies. Policymakers and other relevant stakeholders will be involved in the evaluation of vaccination options.
identifying strategies that enhance opportunities for the participation and engagement of women.

- **Undertaking of field- and laboratory-based vaccination response studies.** It is often assumed that vaccination confers life-long protection to hosts, but little research has been undertaken to verify this assumption. Even if protective antibodies were to persist for a lifetime in a vaccinated host, the high turn-over rates of livestock—particularly in Rift Valley fever-endemic areas—would have a substantial impact on herd immunity. Longitudinal studies involving vaccinated cattle, sheep and goats will be implemented in Rift Valley fever-endemic sites to determine changes in protective antibody titres over time and rates of replacement of vaccinated animals in a herd. Virus neutralization assays will also be used to determine whether the potency of antibodies generated from vaccination can be maintained over a period of one year. Some of the data generated from this trial will be used to validate the transmission model used under activity one above to develop vaccination strategies.

- **Identification of factors influencing the uptake of Rift Valley fever vaccines.** Previous surveys have shown that Rift Valley fever vaccination campaigns in many areas in East Africa often attain very low levels of coverage which may not be enough to prevent an outbreak. This could be attributed to a range of factors, including institutional challenges that limit vaccine delivery and socio-cultural issues that limit uptake at community level. Extensive socio-economic studies will be conducted to identify these factors and ways of addressing them. Special attention will be paid to understanding gender roles in disease management and identifying strategies that enhance opportunities for the participation and engagement of women.

- **Refining of the Rift Valley fever decision support framework.** The lessons learned from the activities outlined above will be used to refine the existing decision support framework and contingency plans. It is anticipated, for instance, that the development of new vaccination strategies will be described in these policy documents.

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### Countries
Kenya, Tanzania and Uganda

### Partner institutions
- Department of Veterinary Services, Kenya
- Department of Veterinary Services, Tanzania
- Department of Veterinary Services, Uganda
- Ministry of Agriculture, Livestock and Fisheries, Kenya
- Ministry of Livestock and Fisheries Development, Tanzania
- Ministry of Agriculture, Animal Industry and Fisheries, Uganda
- Ministry of Health, Kenya
- Ministry of Health and Social Welfare, Tanzania
- Ministry of Health, Uganda
- University of Nairobi

### Contact
Bernard Bett (b.bett@cgiar.org)
ILRI, Kenya