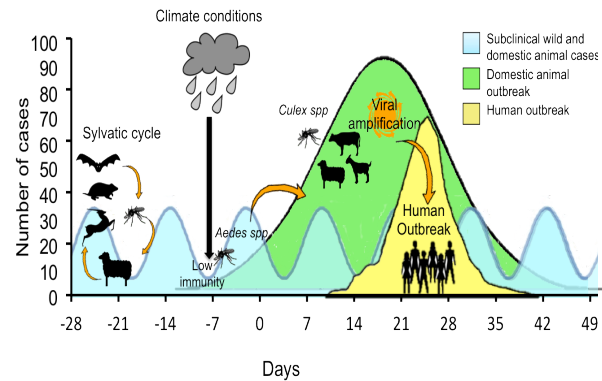


Understanding Rift Valley Fever in Republic of South Africa

Understanding Rift Valley Fever in the Republic of South Africa is an investigation into the epidemiology and ecology of the Rift Valley fever virus to better describe the amount of time between outbreaks, the reason certain areas are affected while others are not and understanding how and when vaccination would be cost-effective as there can be more than 20 years between outbreaks. Toward this

investigation, a collaboration has been formed between US and RSA institutions, thus far including: the National Institute of Communicable Diseases' Center for Emerging and Zoonotic Disease, EcoHealth Alliance, Free State Department of Economic Development, Tourism & Environmental Affairs (DETEA), University Space Research Association (USRA), NASA, South Africa National Parks (SANParks), University of Pretoria (U of P) and RSA Department of Defense. An annual meeting for relevant stakeholders, including farmers, ranchers, veterinarians and interested policy makers, will be held. All results will be disseminated to these stakeholders as well as through peer-reviewed and public literature.



RVFV devastates human and animal populations and then is dormant for long periods until the next outbreak. **The integrated approach described represents a significant step to understanding how RVFV might spread, what effect climate change may have on the virus and how vaccination strategies may affect the risk of an outbreak.** If approved, this will be the first long-term study to investigate RVFV in both domestic and wild ruminants. The vital baseline information collected can be used to better describe the activity of the virus in South Africa and the surrounding regions. Finally, these data may be used to predict possible changes in RVFV ecology associated with climate change.

The objective of this proposed project is to collect essential data for Rift Valley fever virus (RVFV) epidemiology and ecology. The project will strengthen South Africa's leadership role within the African continent for the study of RVFV and other vector-borne diseases through a mechanistic understanding of the relationship between mosquito abundance, succession, rainfall and vegetation, wild and domestic ruminant immunity to the virus at multiple scales and in multiple species and a better understanding of the patterns of human infection with RVFV in South Africa. Specific aims would include:

1. Determine how immunity against RVFV changes over time in ruminants.

Sheep flocks: Individual sheep from three flocks, one vaccinated with a modified-live vaccine, one vaccinated with an inactivated vaccine and one with non-vaccinated sheep that have never been exposed to RVFV, will be monitored. The sheep would be maintained in the same manner as domestic stock on local farms. Samples would be collected from each animal quarterly, to detect fluctuations in antibody levels. Innate immunity would also be compared with the antibody levels. Samples would be tested at CEZD-NICD for RVFV antibodies and interferon (for innate immunity).

2. Determine the herd immunity status of wild ruminants and livestock.

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During two of the proposed study years a large-scale survey of free-ranging and farmed wildlife and livestock herds will be conducted. For each meta-survey, animals from different farms would be sampled, focusing on cattle, sheep, goats, kudu, springbok and blesbok. Free-ranging wildlife samples would also be collected by SANParks from buffalo, kudu and waterbuck in Mokala National Park. Samples would be tested for RVFV antibodies at CEZD-NICD to indicate the overall state of immunity in the region.

3. Determine how mosquito abundance relates to weather in South Africa, the percentage of mosquitoes carrying RVFV and on which ruminant species these vectors are feeding.

Climate: Rainfall and vegetation conditions would be continuously monitored via satellite.

Linking satellite data with mosquito ecology: The mechanistic link between mosquito abundance and succession in South Africa would be validated with vegetation satellite data. Vegetation growth in the field would be compared to satellite data. Puddles (or dambos) of collected rainfall would also be observed to see which species of mosquitoes hatch and develop, in which order they hatch and how many of each species hatch.

RVFV in mosquitoes and which species the mosquitoes feed on: At the farms where hoofstock are sampled, adult mosquitoes would also be collected. At CEZD-NICD the mosquitoes would be sorted by species and tested for RVFV. For mosquitoes that have fed, testing for RVFV will be conducted and genetic testing would be used to determine on which species of animal the mosquito fed.

4. Determine the current seroprevalence of RVFV antibodies in people working on the study farms and detect inter-epidemic transmission in people if it is occurring.

People at high-risk of contracting RVF infection through their work or because they live with livestock would be invited to complete a questionnaire to ascertain the type and frequency of contact with ruminants and submit a blood sample (participation in both the questionnaire and blood sampling will be voluntarily and all data will be anonymous). The testing for RVFV antibodies would be conducted at NICD.

5. Support South Africa as a leader in vector-borne diseases and RVFV epidemiology.

Workshops: Two medical entomology workshops would be held for professionals from southern Africa. The workshops would provide an introduction to the taxonomy and biology of RVFV-specific vectors.

Education: A post-doctoral fellow, one PhD student and a minimum of three Masters' students (two in epidemiology and one in entomology) from South Africa (or southern Africa) would be supervised and mentored.

This proposed project will integrate scientists from diverse backgrounds to work collaboratively on a disease that has significant health and economic impacts in Africa and potentially beyond. This research would demonstrate South Africa's leadership in the field of vector-borne diseases. Finally, this project would be the first long-term project to integrate the many disciplines and disease factors (mosquitoes, climate, ruminant immunity status and human health status and risk) to better understand RVFV ecology and epidemiology.