

Applications of ecological niche modelling for mapping the risk of Rift Valley fever in Kenya

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Introduction

- ✘ Rift Valley fever (RVF) is an acute febrile arthropod-borne zoonotic disease
- ✘ **Aetiology:** RVFV, family *Bunyaviridae* , genus *Phlebovirus*.
- ✘ **RVF History in Kenya**
 - ✓ 1912: first report of RVF-like disease in sheep
 - ✓ 1931: virus isolation and confirmation (Daurbney *et al.*, 1931)
 - ✓ 2006/2007: last outbreak in Kenya

Disease Ecology

- ✓ *El Niño/Southern Oscillation* (ENSO) –causing flooding
 - ✓ soil types- solonetz, solanchaks, planosols
 - ✓ Elevation-less than 1100m asl
 - ✓ Natural Difference Vegetation Index (NDVI)- 0.1 units more than 3 months
 - ✓ Vector- *Aedes* ,*Culicine* and others
- (Linthicum *et al.*, 1999; Anyamba *et al.*, 2009; Hightower *et al.*, 2012; Bett *et al.*, 2013)

Ecological niche model

- **studies done on RVF mapping**
- ✓ Disease occurrence maps
- ✓ statistical models which uses presence and absence data such as logistic regression method.
- ✓ This study used Ecological Niche Modeling:
 - Uses presence data
 - Shows potential areas where RVF can occur

Methodology

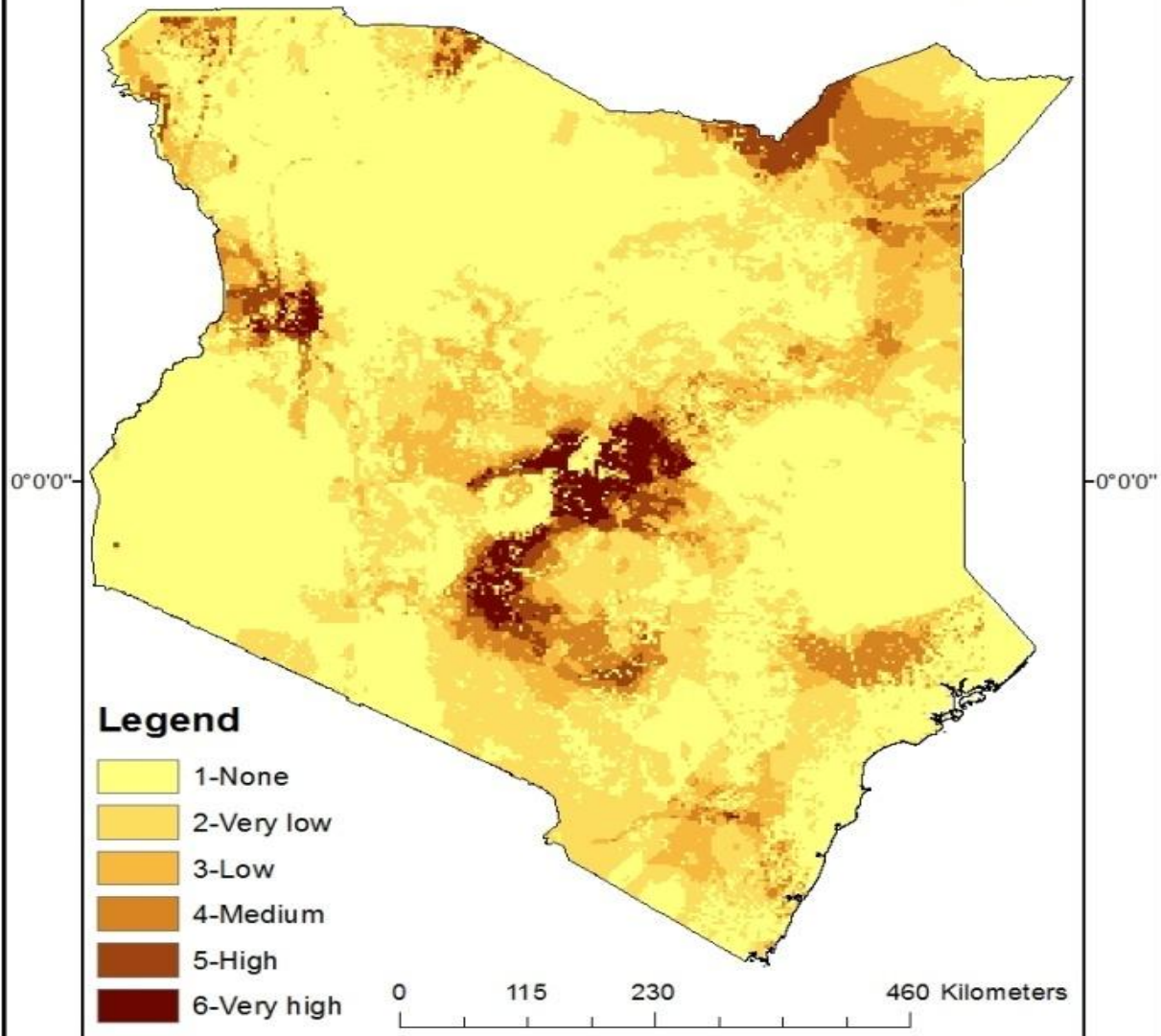
- Data on RVF outbreaks – Case – laboratory confirmed outbreak of RVF from Vet. Department was visited and geo-referenced
- GIS datasets:
 - Land use and land cover maps
 - Precipitation
 - NDVI
 - Temperature
 - Elevation
 - Soil types

Methodology cont'

- By use of Genetic Algorithm for Rule set Production (GARP); an open modeller software creates ecological niche models for species
- GARP uses a set of point localities where the species is known to occur and a set of geographic layers representing the environmental parameters that might limit the species' capabilities to survive
- Uses rules of selection, evaluation, testing and incorporation or rejection in modeling

- Sample points were collected in the field that define the niche of the species using environmental variables.
- GARP algorithm was used to map the actual and potential distribution of Rift Valley fever distribution in Kenya
- The map below shows the distribution of RVF in Kenya from regions with high risk occurrence to regions with none.
- Area Under Cover (AUC) of 0.82,). A Partial receiver operating characteristic (ROC) analysis prediction with a value of 1.77.

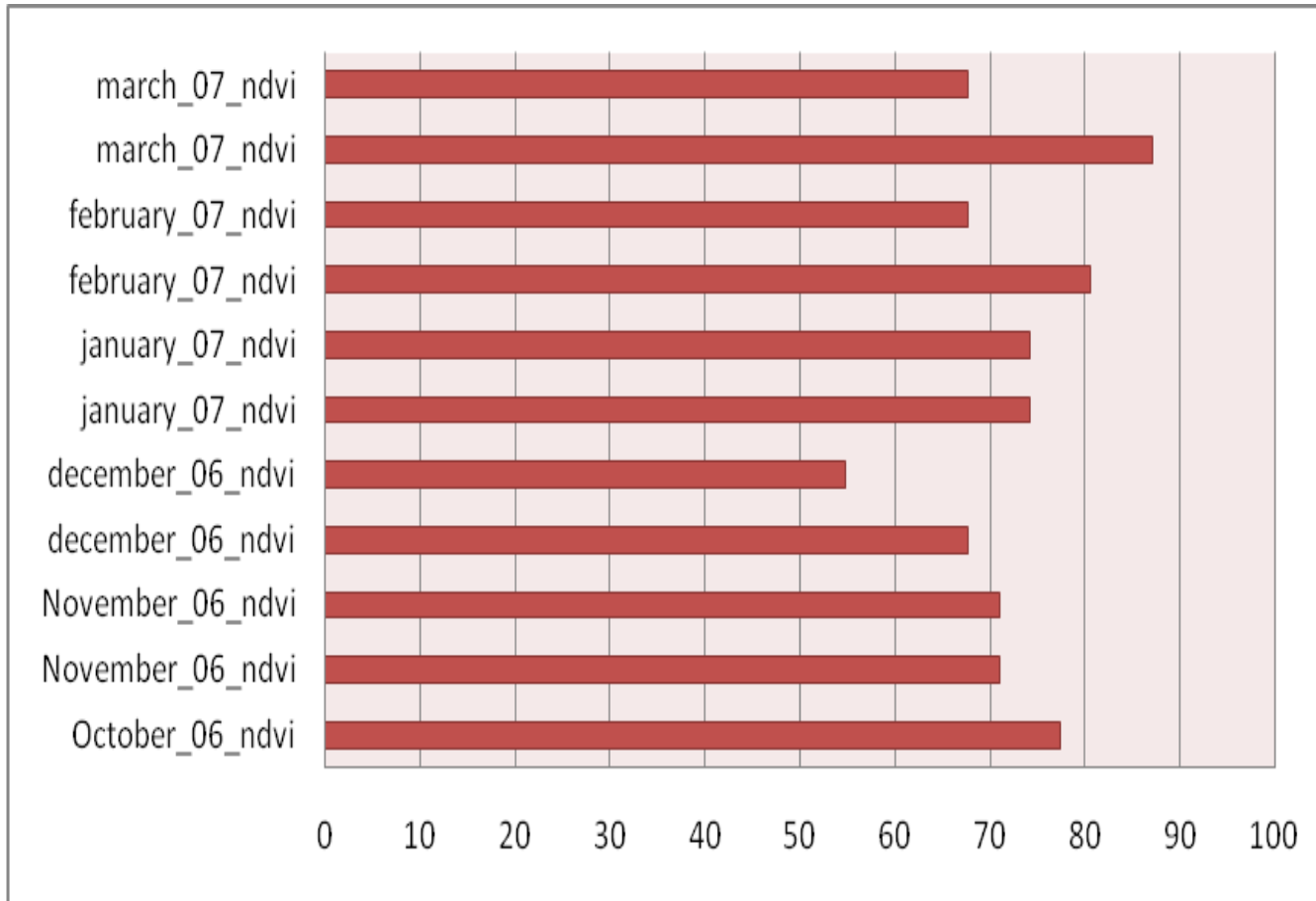
Rift Valley Fever distribution in Kenya



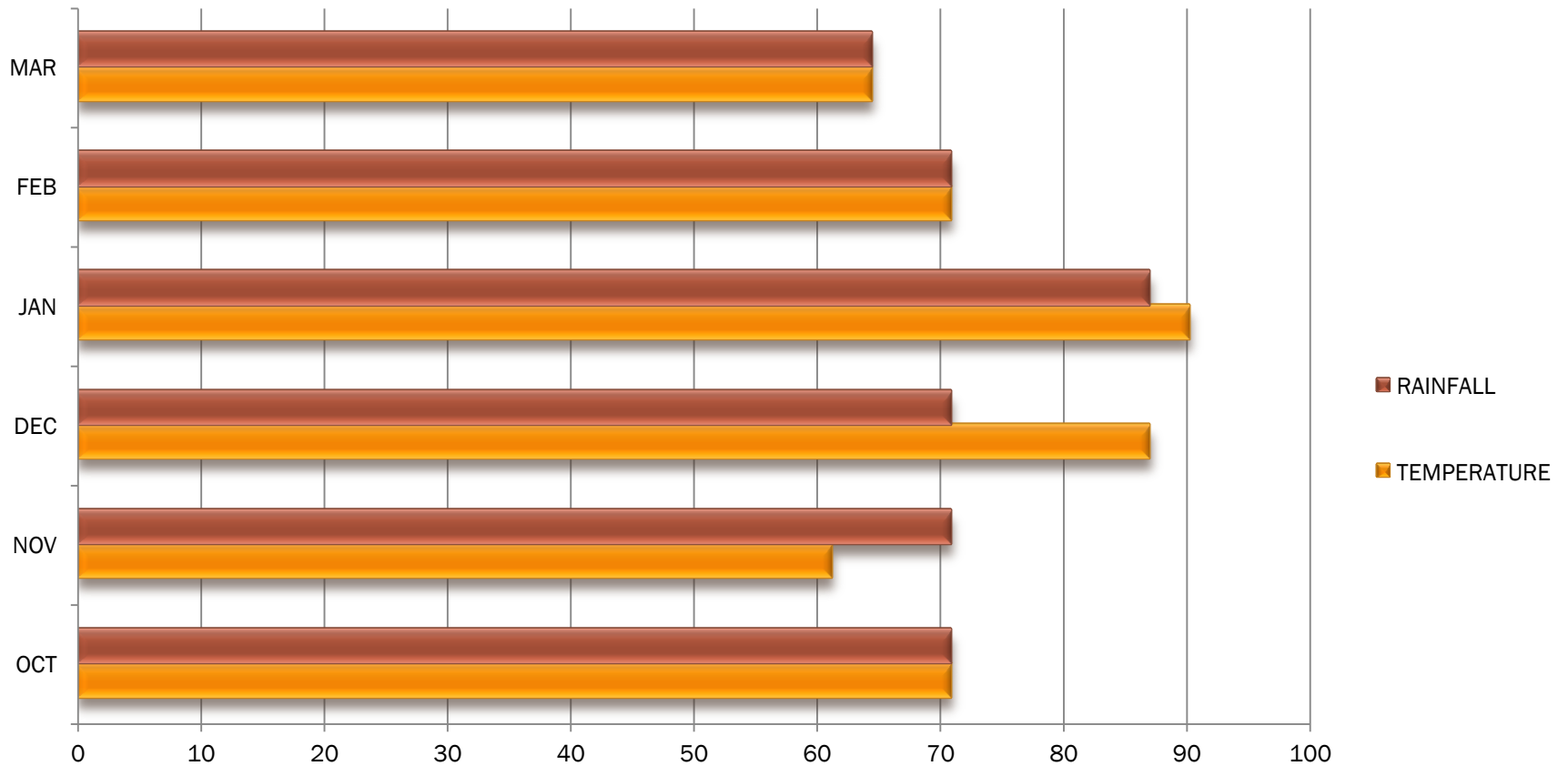
Discussion

- Results from jackknife analysis showed which variables had the highest influence on the models and the important variable .
- Vegetation index for March 2007 had the highest influence on the model while the least influence was on December, 2006.
- Temperature and rainfall data had relatively equal influence on the model for all the months.

jackknife analysis for the NDVI variables



jackknife analysis for rainfall and temperature variables



This will help the Government of Kenya to know which areas to focus their attention and put plans in place when the outbreak occurs again.

THANK YOU