Quantifying Weather and Climate Impacts on Health in Developing Countries (QWeCI)

A Seventh Framework Programme Collaborative Project (SICA)

13 partners from 9 countries

www.liv.ac.uk/QWeCI

Grant agreement 243964

Presented at the 4th Annual East African Community Health and Scientific Conference, Kigali, Rwanda, 27-29 March 2013

Mapping the distribution of potential Rift Valley fever hotspots in East Africa

Bernard Bett

Jusper Kiplimo, An Notenbaert, Steve Kemp

International Livestock Research Institute.

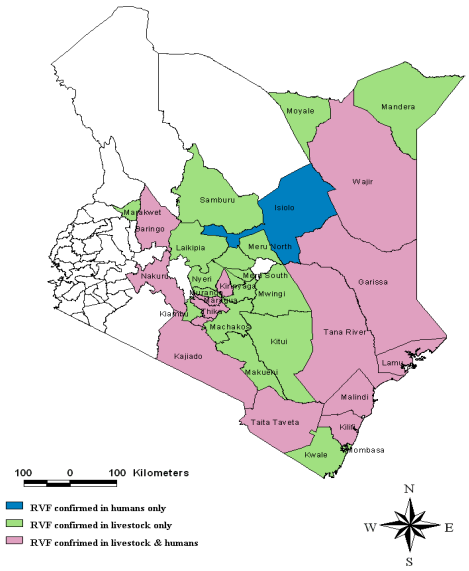
b.bett@cgiar.org

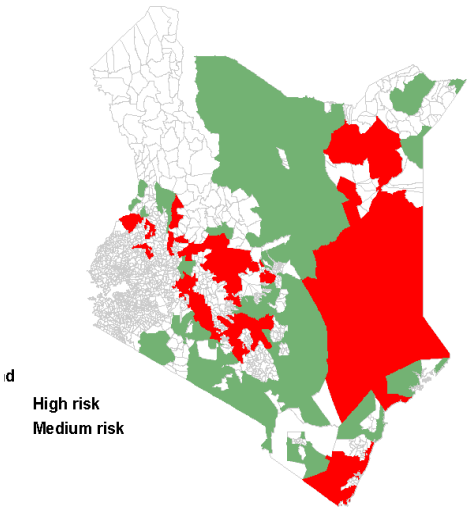
SEVENTH FRAMEWORK PROGRAMME

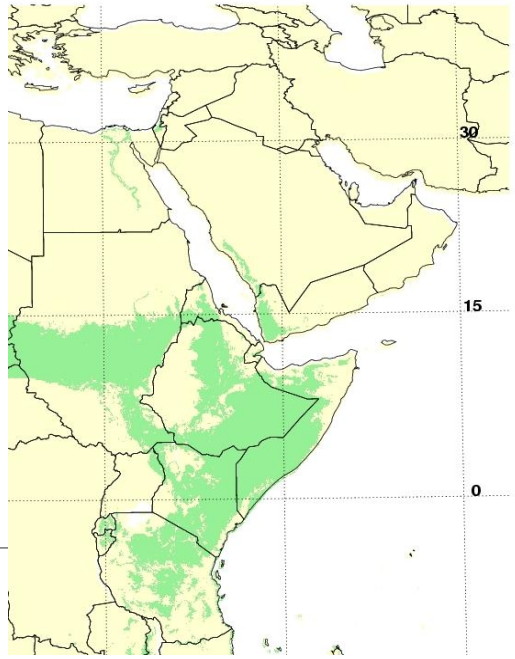
- RVF – mosquito-borne viral (RNA) zoonosis
  - Sheep, goats, cattle and camels – premature abortion and perinatal mortality
  - Man – mild flue-like syndrome (80% of the cases) or haemorrhagic fever (20% of the cases)
- Outbreaks associated with:
  - Extreme increase in precipitation, sustained for at least 3 months
  - NDVI
  - Irrigation (Sudan, Egypt, Mauritania, Senegal)
    - Climate change likely to increase the incidence of the disease
      - Increased temperature
      - Increased frequency of droughts/wet periods
- Economic impacts
  - Trade embargoes (Middle East)
  - Internal markets

- Analyse historical data to determine risk factors
- Refine the existing RVF risk maps

Existing risk maps







Department of Veterinary Services

Centers for Disease Control

NASA (NDVI anomaly >0.025)

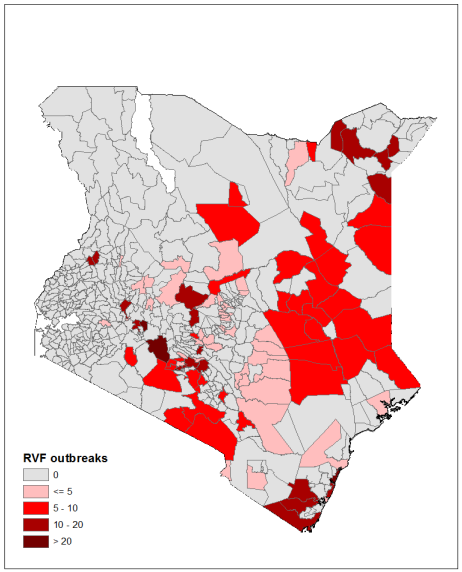
- Fit regression models to data from Kenya
- Validate the models using data from Tanzania
- Use validated model to predict the likely hotspots throughout East Africa

Data sets

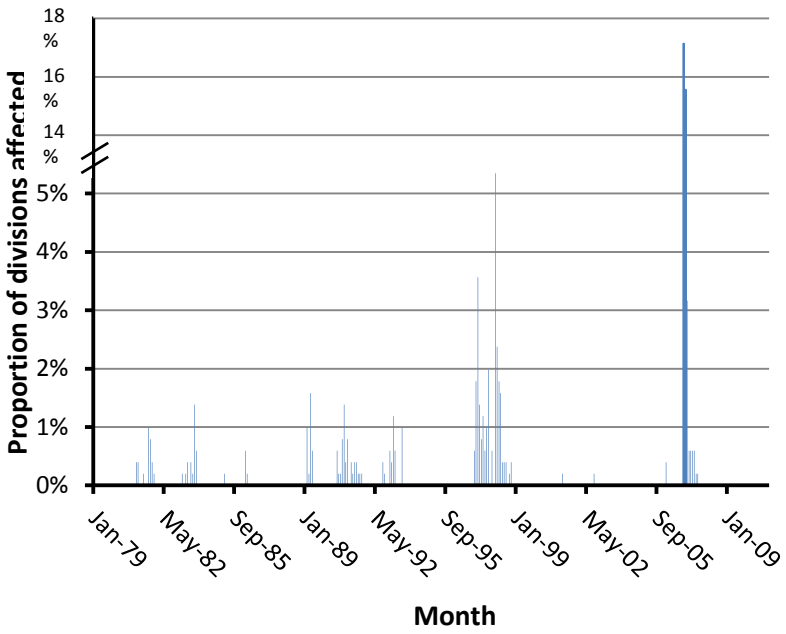
- Data on RVF outbreaks (Kenya)
  - Case – laboratory confirmed outbreak of RVF (RT-PCR) by division/month from Vet. Department

- GIS datasets:
  - Land use and land cover
  - Precipitation
  - NDVI
  - Human population
  - Elevation
  - Soil types

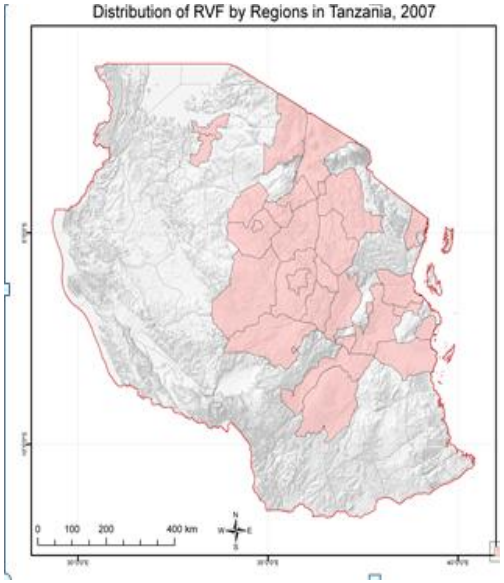
Divisions that have had RVF outbreaks in Kenya between Jan 1912 and Dec 2010



Temporal distribution of RVF outbreaks in Kenya: 1979 - 2010



Distribution of RVF affected regions, Tanzania (2007)

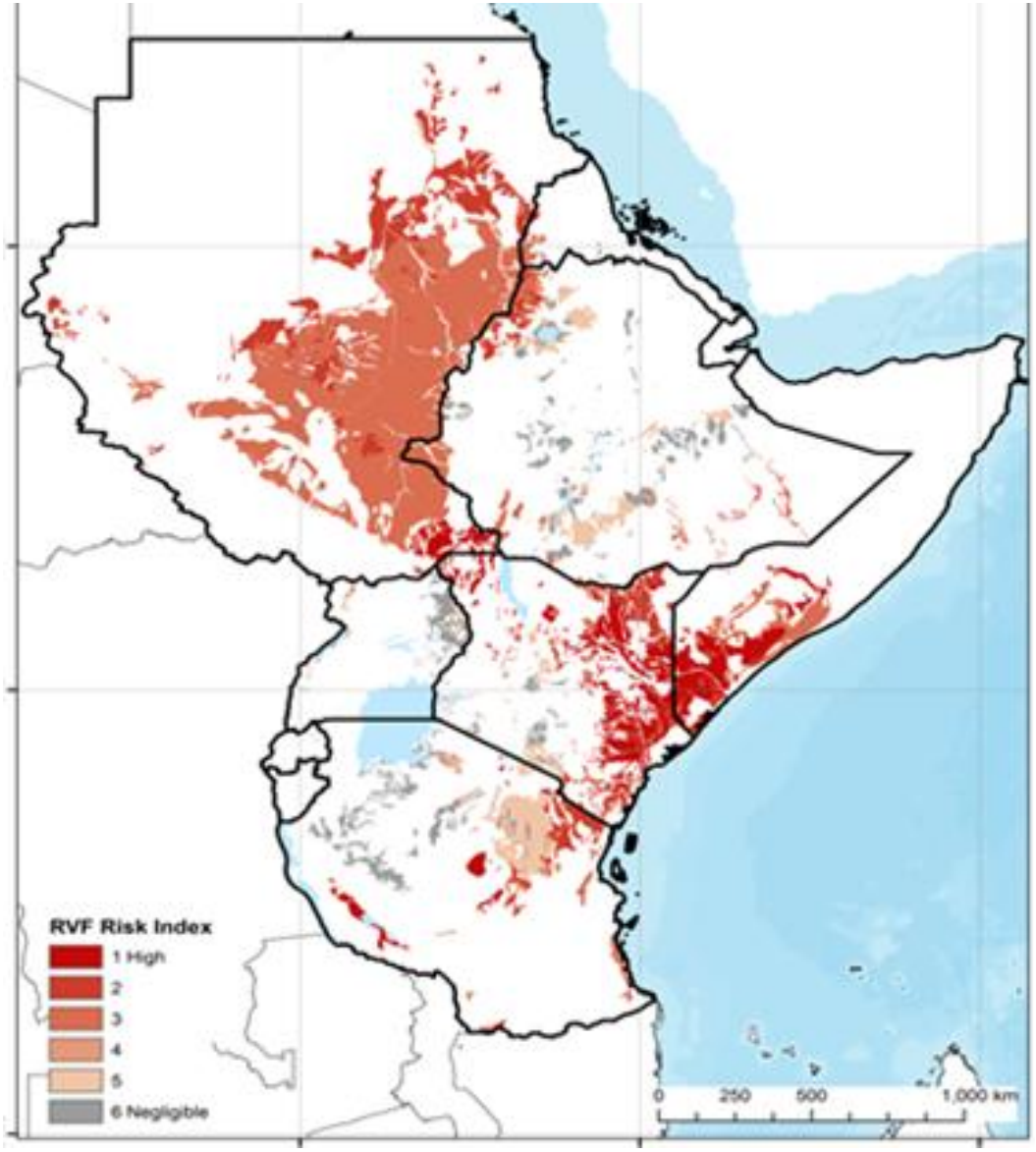


Mixed effect logistic regression models fitted to RVF data from Kenya

Variable	Levels	Mixed logit model		MCMC Model		SMM Model	
		β	SE(β)	β	SE(β)	β	SE(β)
Soil type	Vertisols	0.59	0.27	0.66	0.31	0.84	0.52
	Solonetz	1.32	0.35	1.19	0.44	1.54	0.60
	Luvisols	0.72	0.38	1.21	0.58	0.86	0.63
	Others	0.00	-	0.00	-	0.00	-
Elevation (m)	0 - 1000	0.97	0.39	2.74	0.38	1.51	0.57
	>1000 - ≤2000	0.00	-	0.00	-	0.00	-
	>2000	-2.08	0.44	-1.99	0.48	-2.13	0.62
Precipitation		0.99	0.09	1.07	0.08	1.02	0.12
Precipitation_sq		-0.04	0.01	-0.04	0.01	-0.04	0.01
NDVI (max)		-11.88	4.96	-10.89	1.79	-10.93	1.66
NDVI_sq		16.17	3.95	15.75	1.31	16.81	1.52
Case no	<2	0.00	-	0.00	-	0.00	-
	2 – 5	2.57	0.22	3.62	0.34	3.85	0.62
	> 5	2.62	0.23	3.59	0.38	4.09	0.71
Constant		-11.65	1.60	-14.63	0.75	-14.67	1.21
Random effects							
Livelihood zone (n = 19)		1.84	0.48	3.34	0.97	4.12	2.67
AIC/DIC			1749.9		1648.9		1611.6

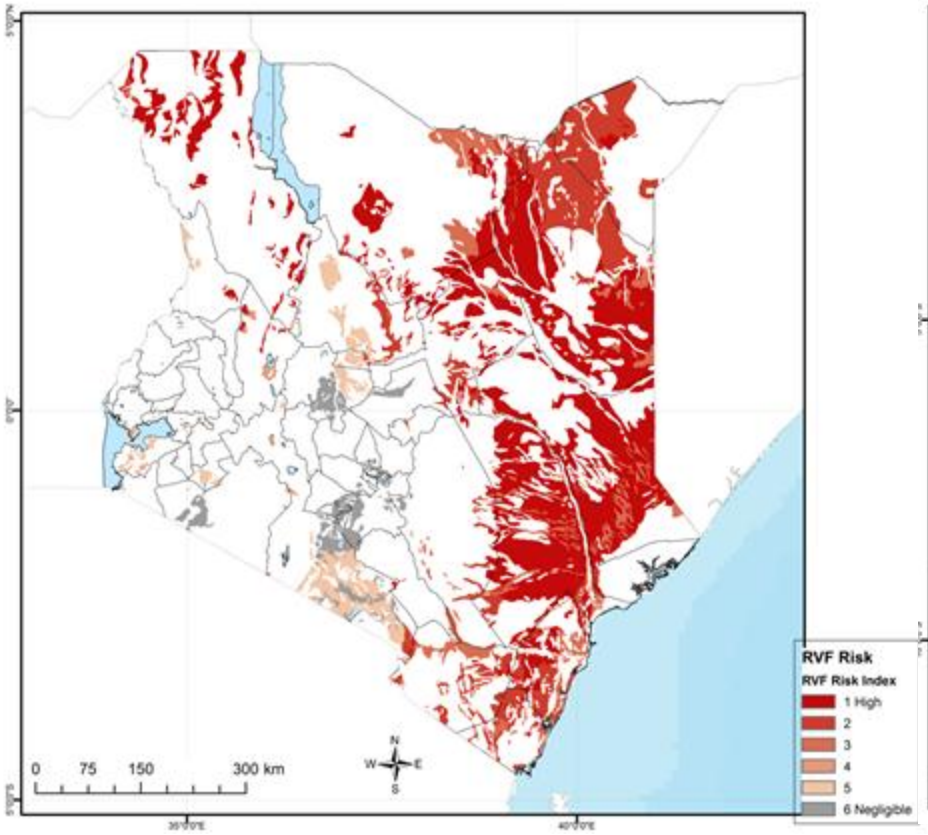
Predicted RVF hotspots in eastern Africa (holding climate factors constant)

- Areas likely to get outbreaks

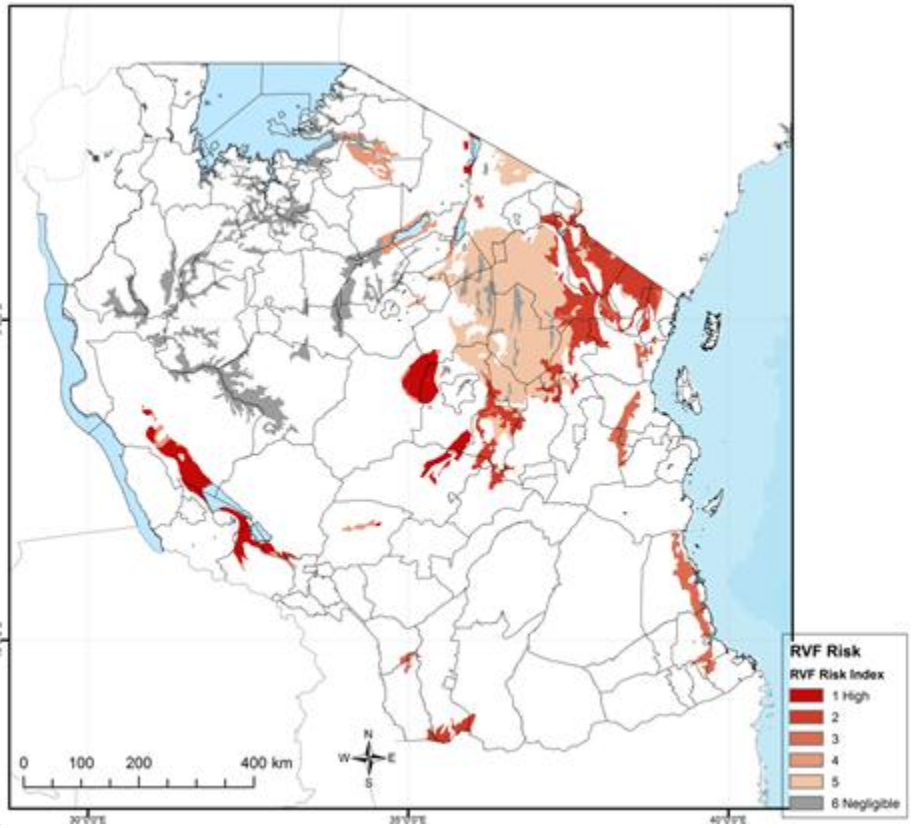


ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Potential RVF hotspots in eastern Africa (predictions at 1x1 km)



Kenya



Tanzania

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

1. Key predictors: rainfall, NDVI, soil, altitude
   - Rainfall
   - NDVI
   - Soil
   - Altitude

2. Risk maps – important tool for disease control

Acknowledgements

Centres for Disease Control - Kenya
Department for Veterinary Services – Kenya
EU Funding (QWeCI)