GF-TADs Africa

GLOBAL FRAMEWORK FOR THE
PROGRESSIVE CONTROL OF
TRANSBOUNDARY ANIMAL DISEASES

Food and Agriculture
Organization of the
United Nations

World Organisation
for Animal Health
Founded as OIE

African
Union

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Understanding transmission thresholds for Rift Valley fever virus in East Africa

- Bernard Bett, Mathew Muturi, Dan Tumusiime, Canesius Nkundwanayo, John Juma and Sam Oyola
- International Livestock Research Institute (ILRI)

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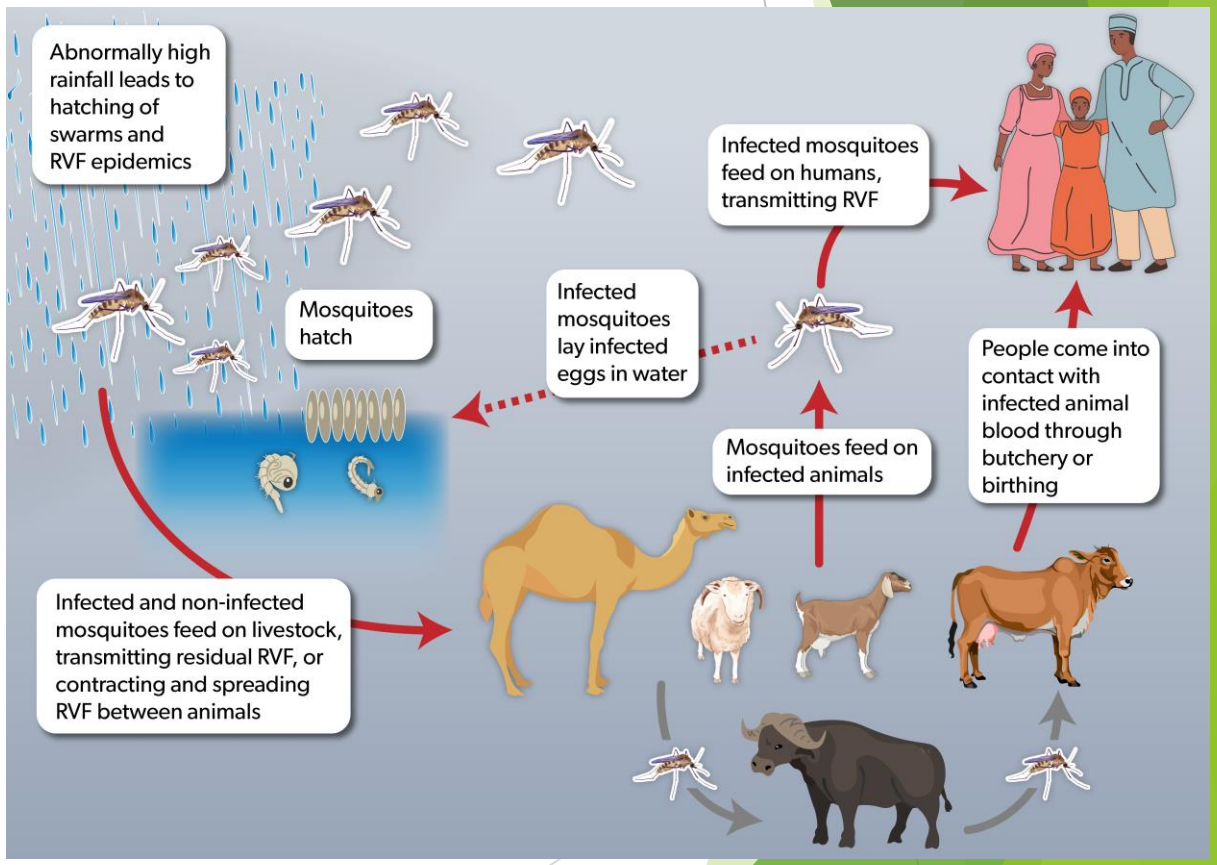
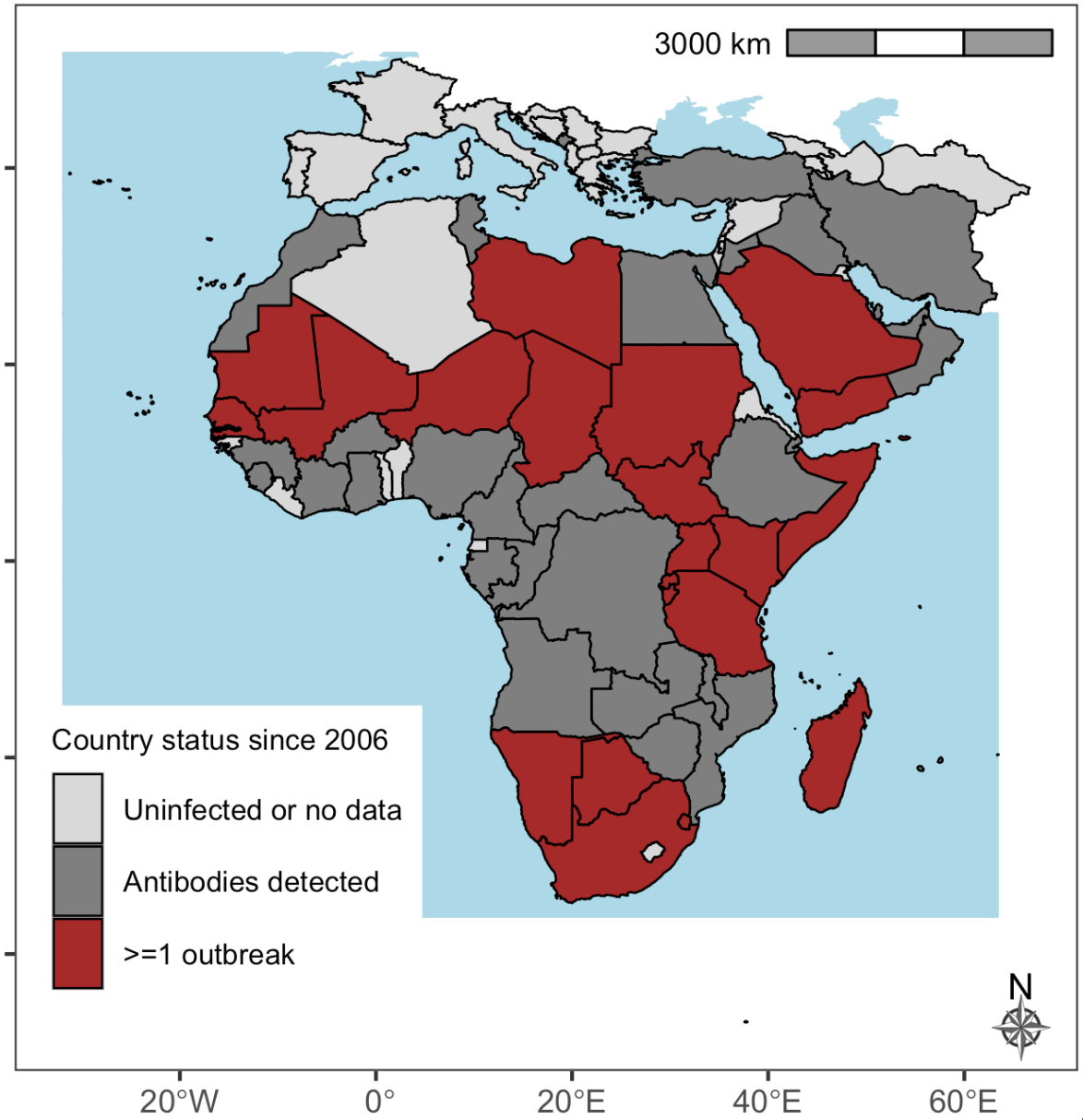
Introduction

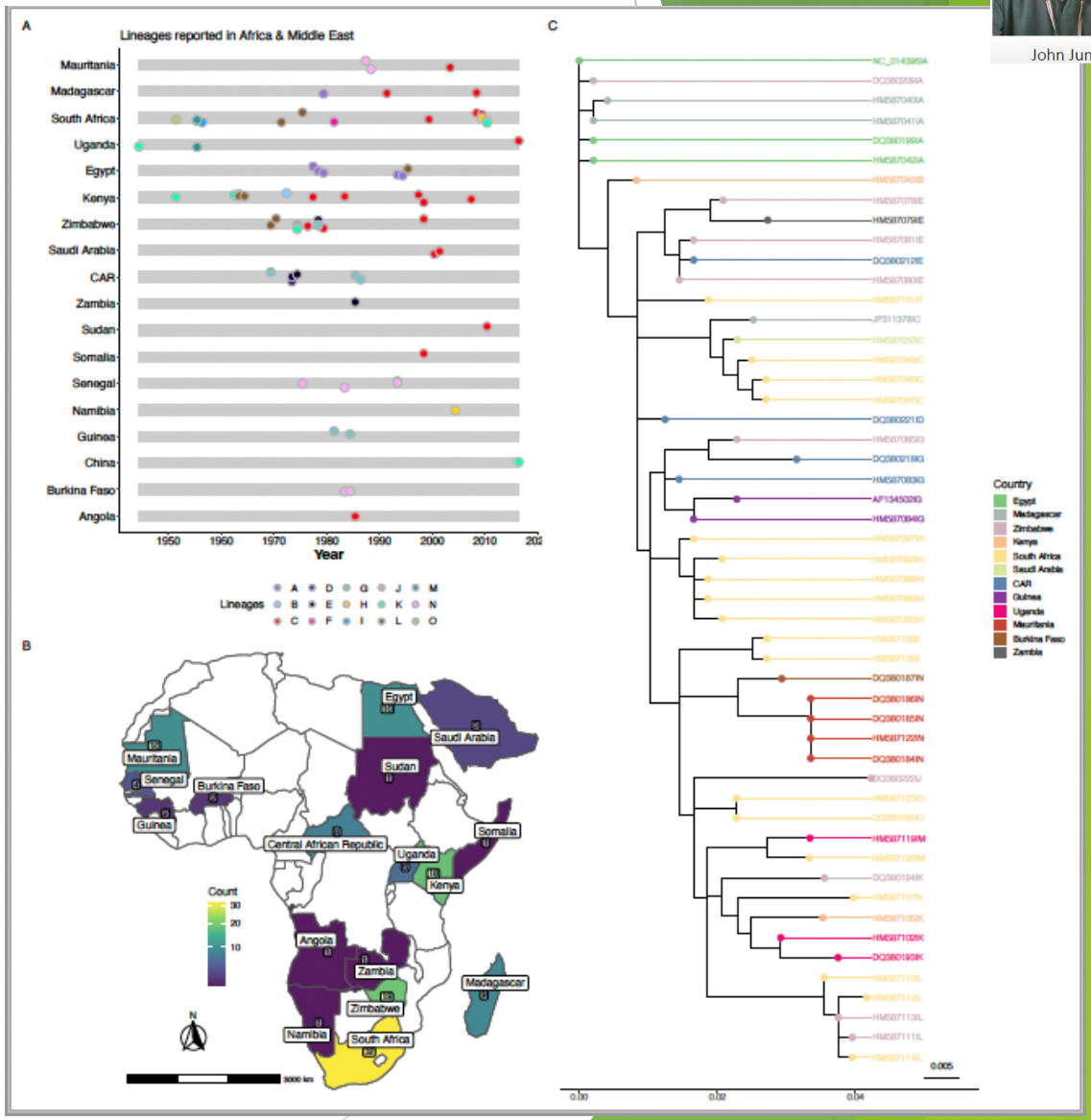
- RVF -- a priority zoonotic disease due to its outbreak potential
- Agent: negative sense segmented RNA virus transmitted by several mosquitoes
- Endemic and epidemic transmission cycles
- Impacts – trade embargoes, socioeconomic losses, human health impacts
- Available control measures – livestock vaccination, vector control, movement control



Infographic representing RVFV transmission processes

RSC Distribution of reported cases





Juma et al., 2022

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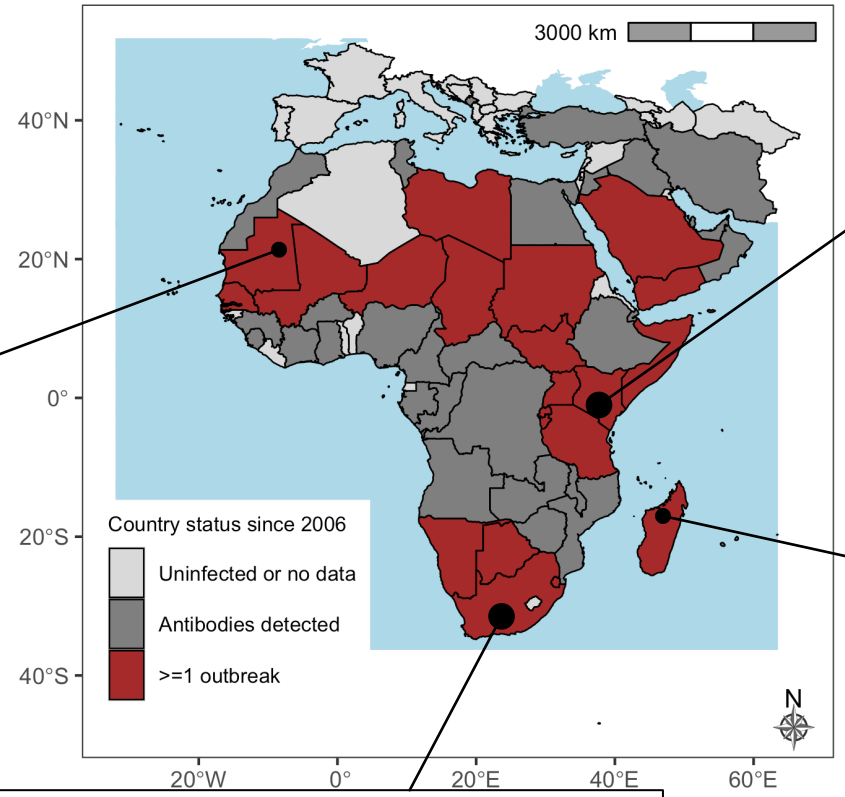
RVFV vectors in selected countries

- *Aedes vexans*
- *Ae ochraceus*
- *Ae dalziedi*

Fontenille et al. 1998



- *Aedes ochraceous*
- *Aedes mcintoshi*
- *Mansonia uniformis*
- *Aedes univittatus*

Lutomiah et al., 2014

- *Culex antennatus*
- *Anopheles squamosus*
- *Anopheles coustani*
- *Culex univittatus*
- *Culex pipiens*

Tentaly et al. 2015

- *Aedes mcinthoshi*
- *Culex theileri*
- *Aedes circumluteolus*
- *Culex zombaensis*

Makhanthisa et al., 2024

Manifestation of diverse RVFV ecologies across the continent which limits our ability to generalise some of the observations

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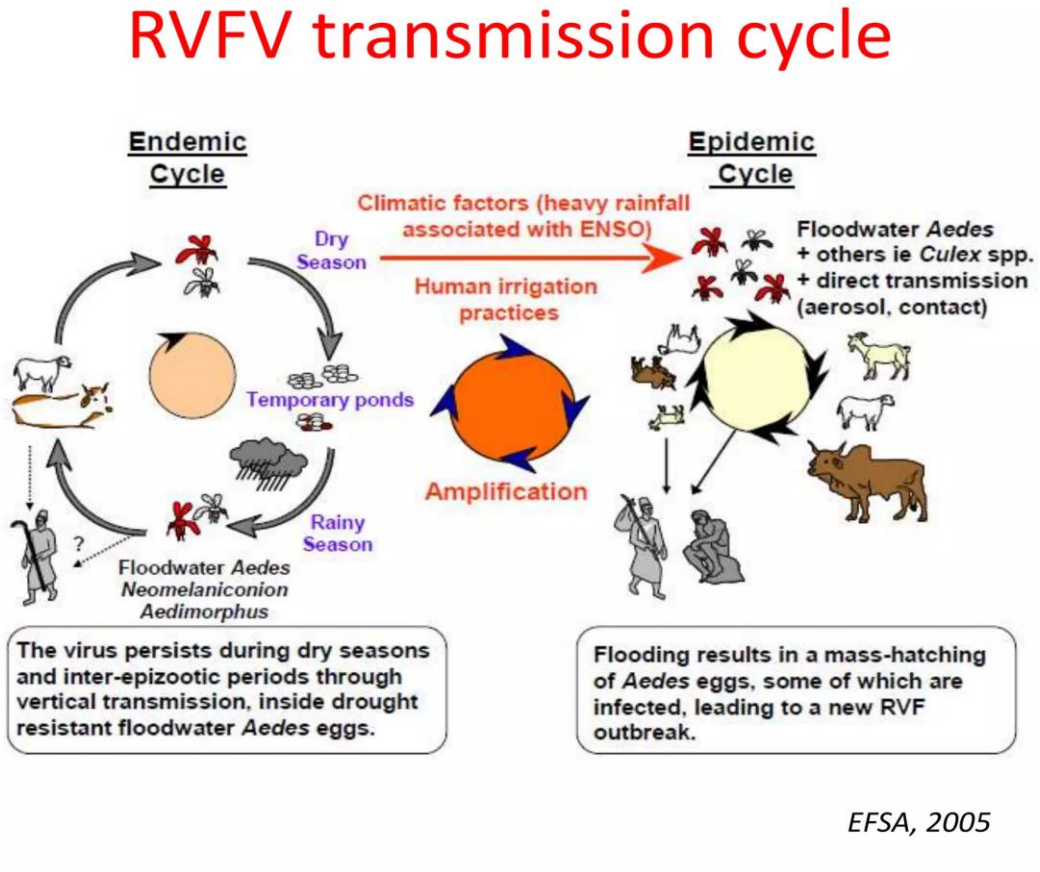
RVFV transmission cycles



- Much focus on outbreaks
- Endemic infections can provide greater insights, e.g.:
  - Diversity of RVFV?
  - Health and productivity losses?
  - Mitigating outbreaks?
- **Kenya, Uganda and Burundi case studies**

Kenya Case Study

- Studies on epidemics using historical data
- Field studies to detect endemic transmissions

Other studies

- Studies on RVF vaccination
- Gender and social studies – adaptation measures

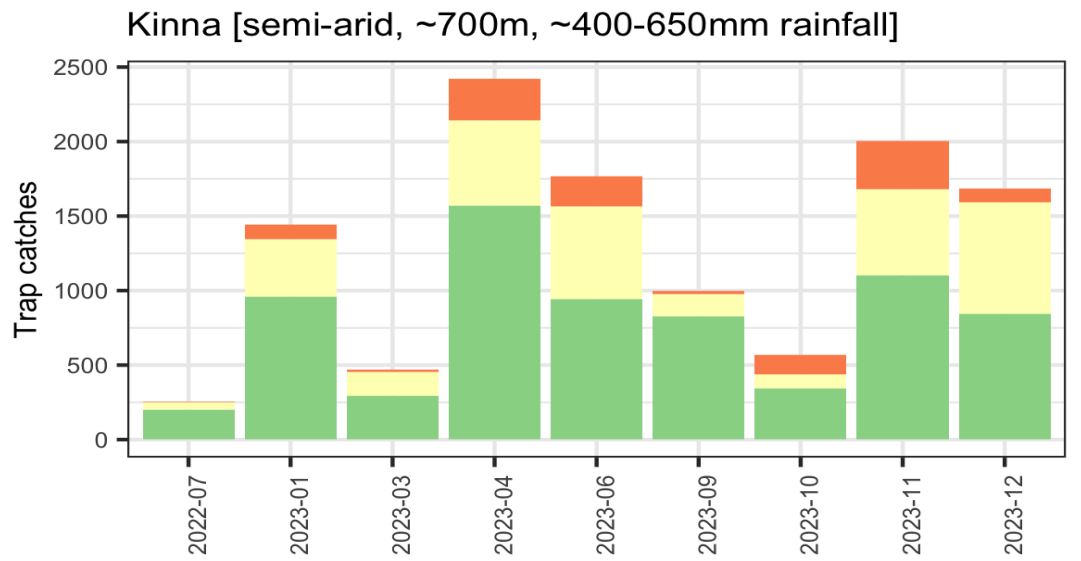
PhD students: Mathew Muturi and Irene Mutambo

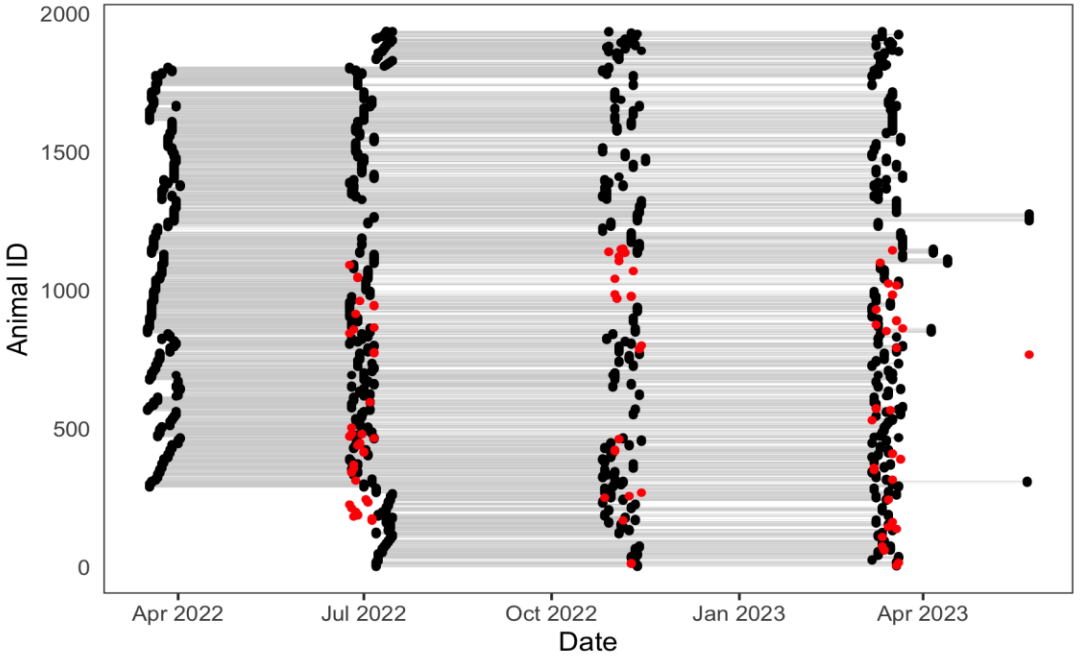
Mathew Muturi, ZDU/DVS

Longitudinal studies in RVF endemic zone – northen Kenya

- Seasonal changes in population densities and species diversity of mosquitoes → RVFV infection patterns
- Movement of animals to dry season grazing areas → further drives exposure

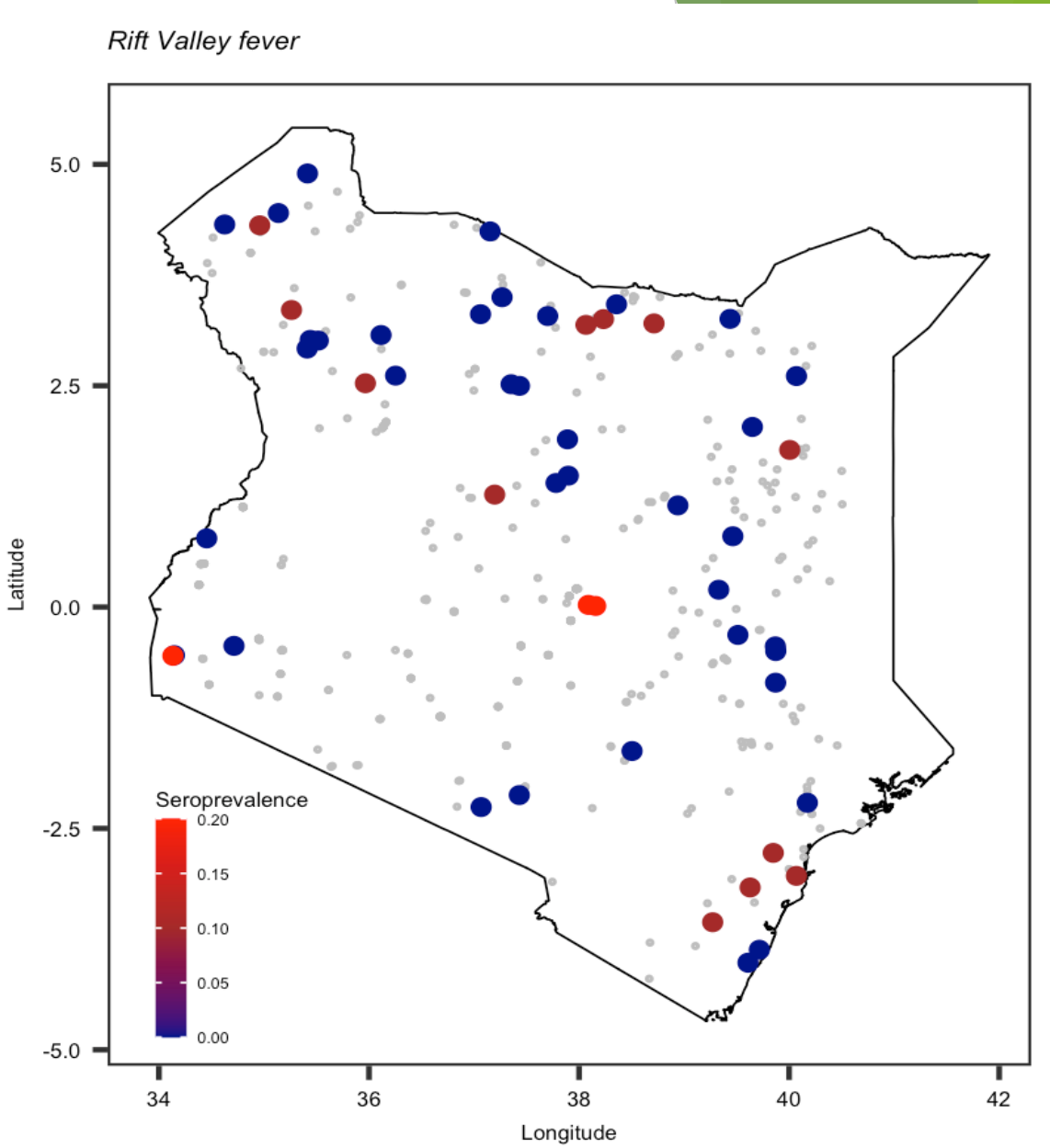
Changes in population densities of various mosquito species in Kinna and Garfasa





National serosurvey with the DVS Kenya

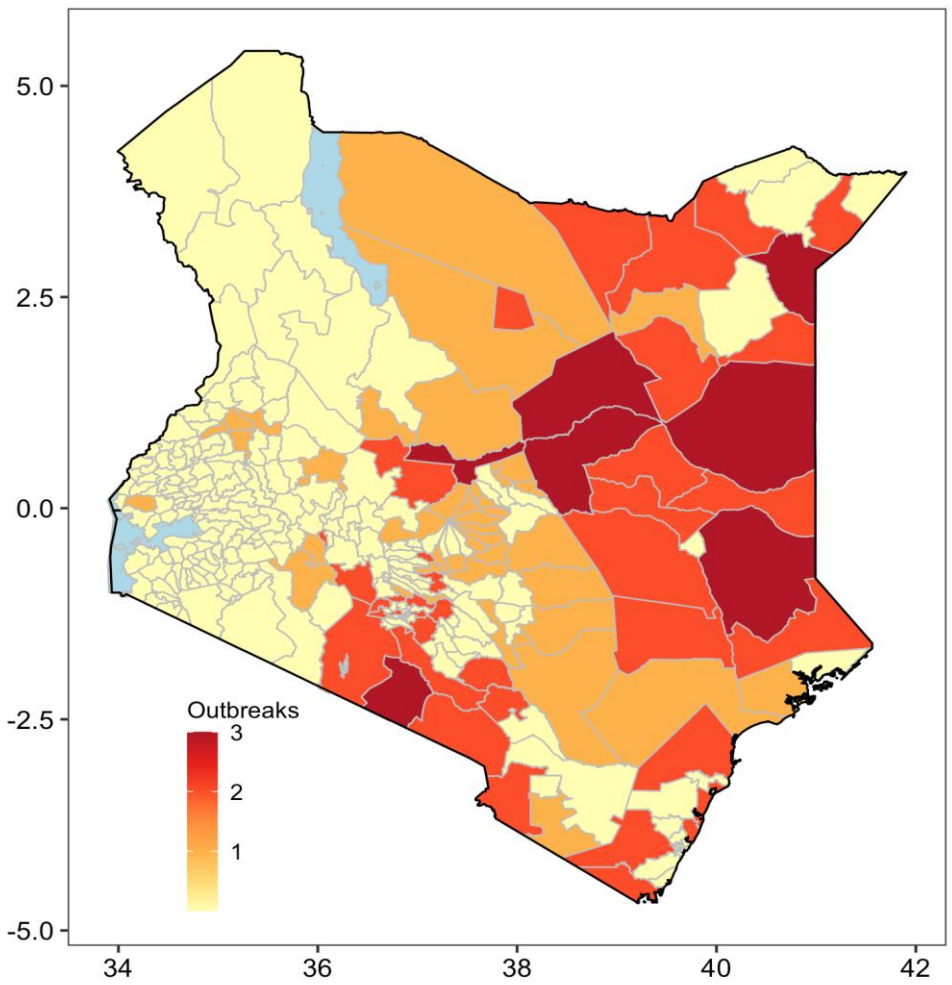
- Risk maps produced earlier are based on outbreaks → blind to endemic infections
- Samples screened using anti-IgG and IgM ELISA kits
- Many infections detected with IgM antibodies



Cases with anti-IgM antibodies

Epidemics

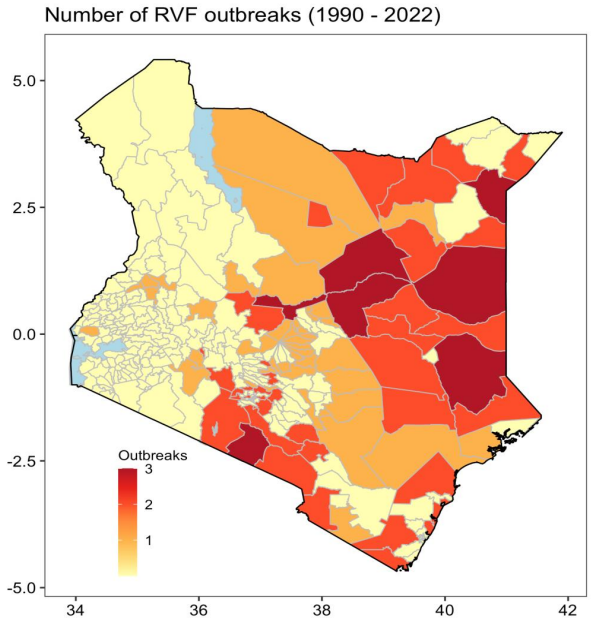
- Rift Valley fever surveillance data – from the Department of Veterinary Services
- Metereological data
  - Temperature and rainfall
- Soil and geological data
  - Soil type
- Land use/land cover data
- Topographical data
  - Slope
  - Altitude
- Livestock and human population

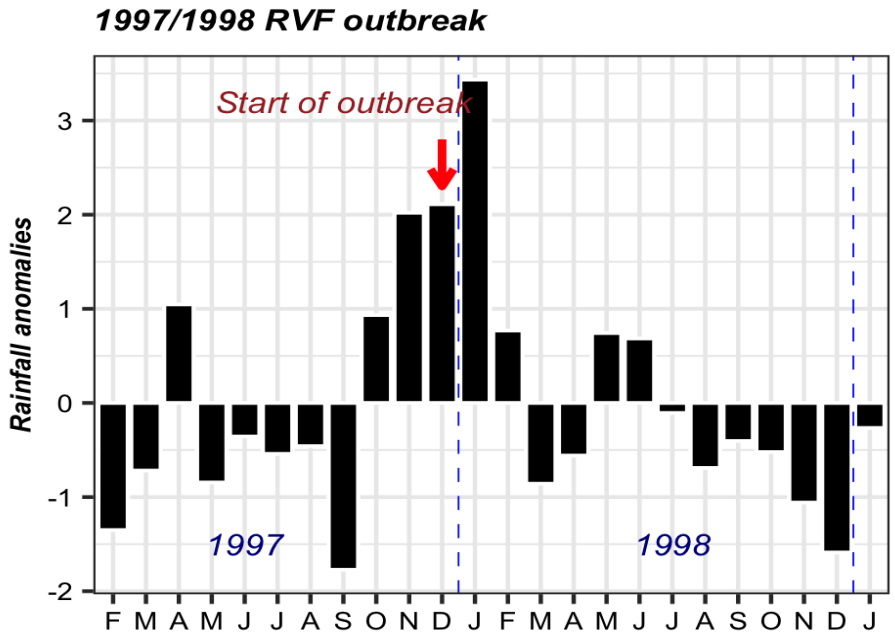


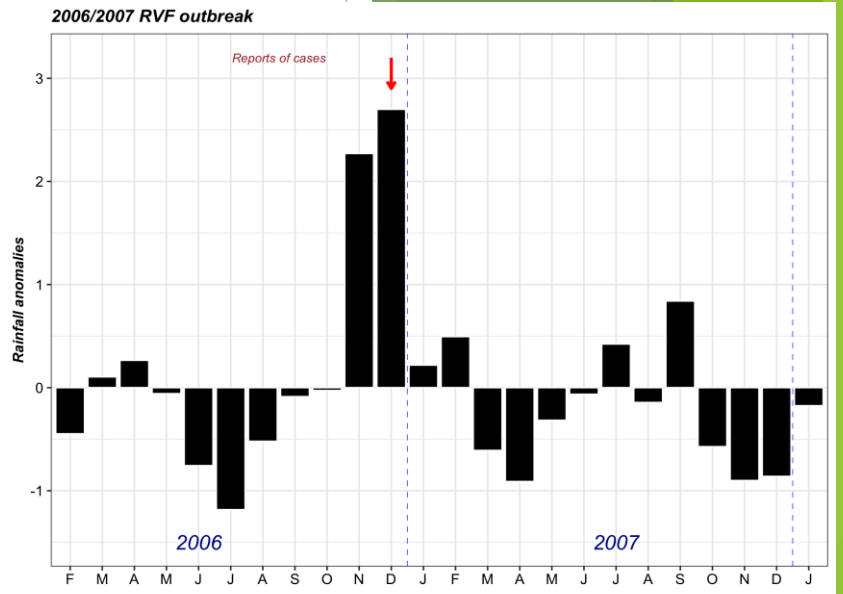
Number of Rift Valley fever outbreaks per subcounty

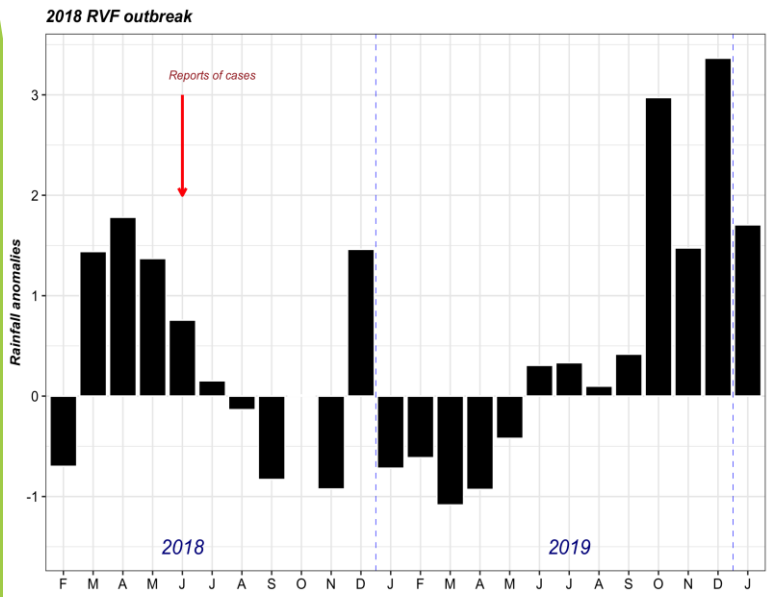
Results: Timing of outbreaks with respect to extreme-rainfall events

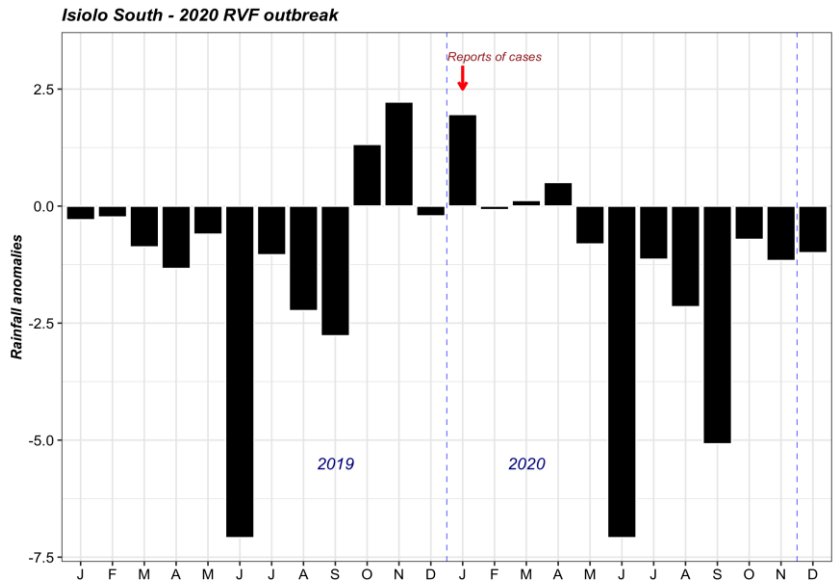
RVF outbreaks

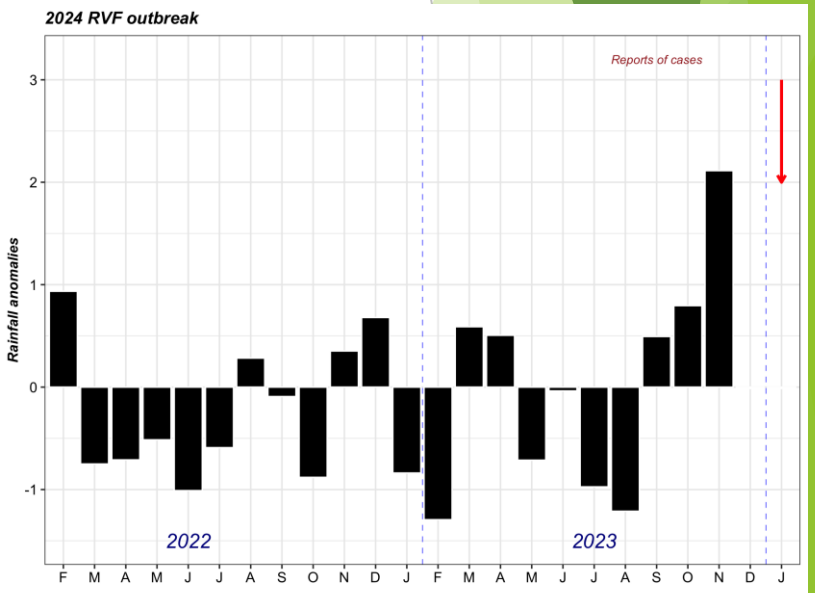










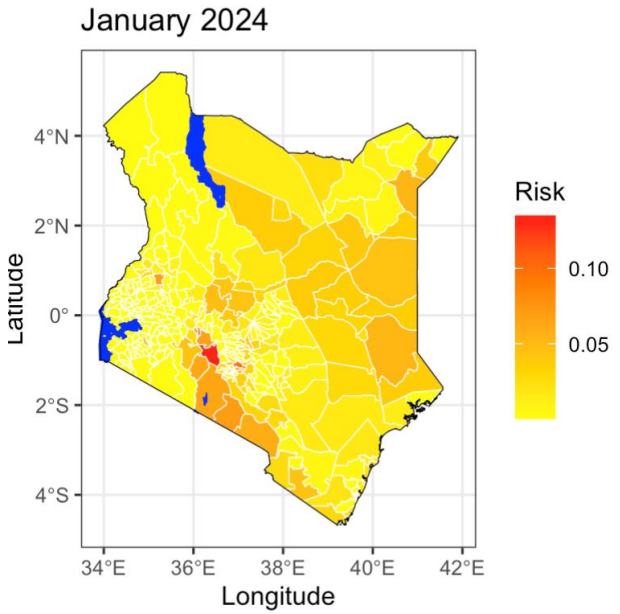


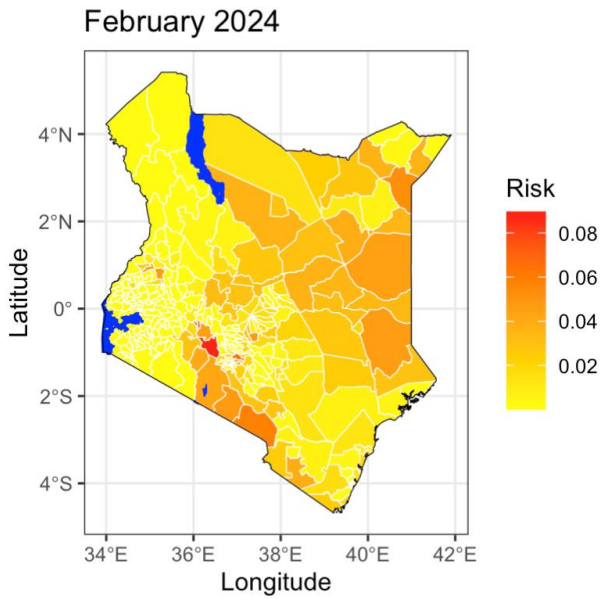
Hierachical regression model

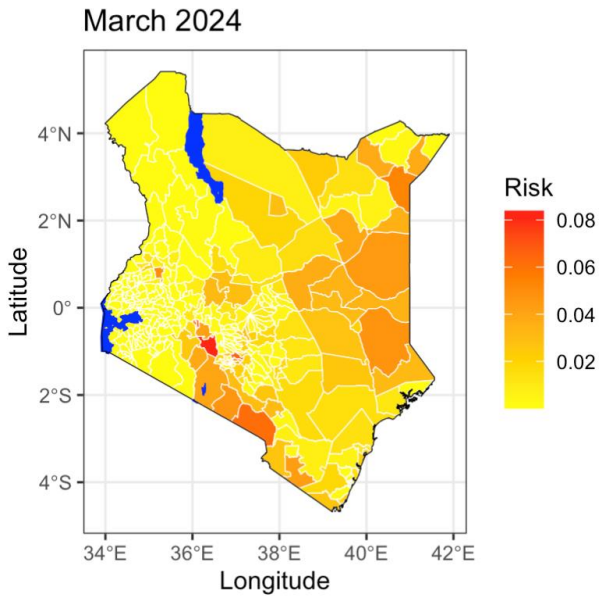
Variable	Mean	SD	Quantile interval	
			2.50%	97.50%
Intercept	-7.20	0.23	-7.69	-6.79
No. wet months	0.45	0.04	0.38	0.52
No. dry months	-0.71	0.11	-0.92	-0.50
Slope [SD]	0.14	0.07	0.01	0.27
Area under shrubs	2.80	0.82	1.20	4.44

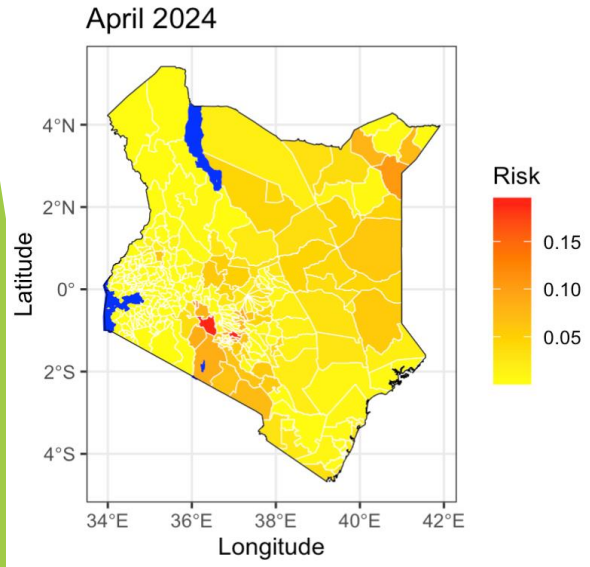
Random effects: Subcounty ID, bym model

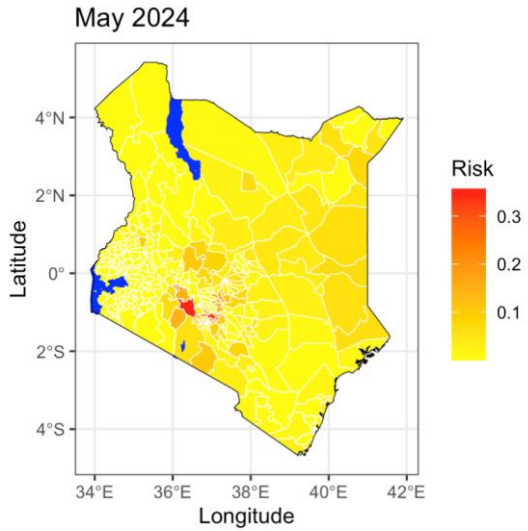
Validation of the model based on recorded cases in 2024

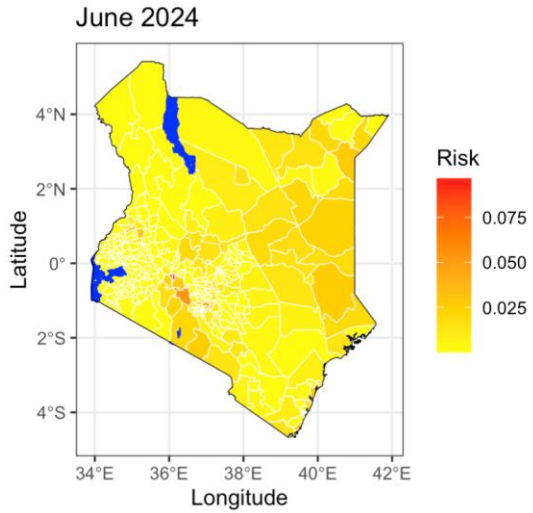


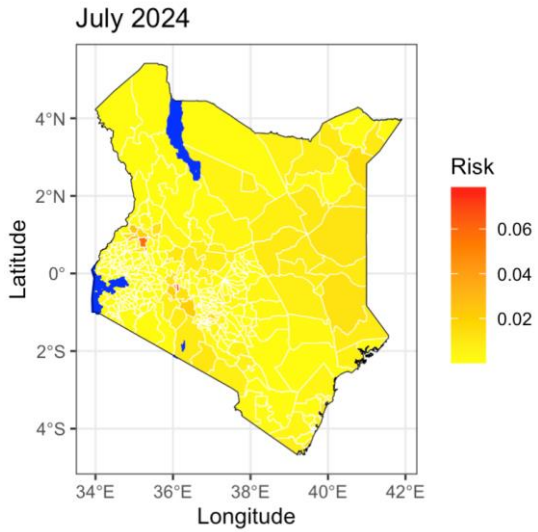












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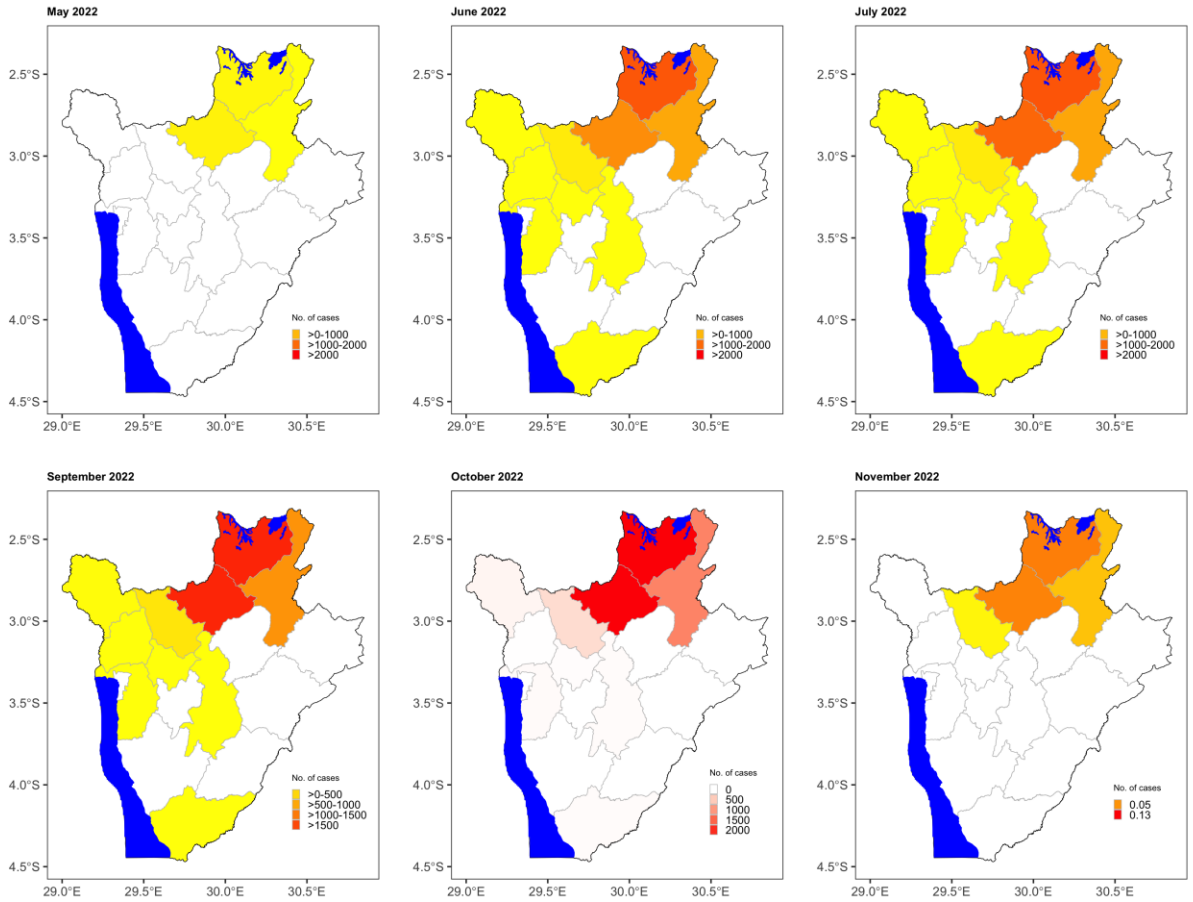
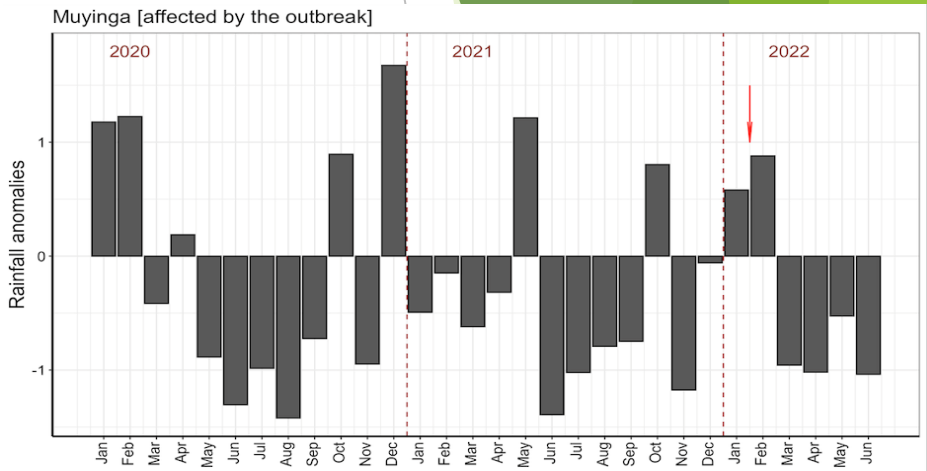
Burundi case study – PhD Canesius Nkundwanayo





- RVFV – Lineage C
- Outbreaks occurred 2-3 months after heavy rains
- Capacity building on diagnostics, surveillance and data management needed

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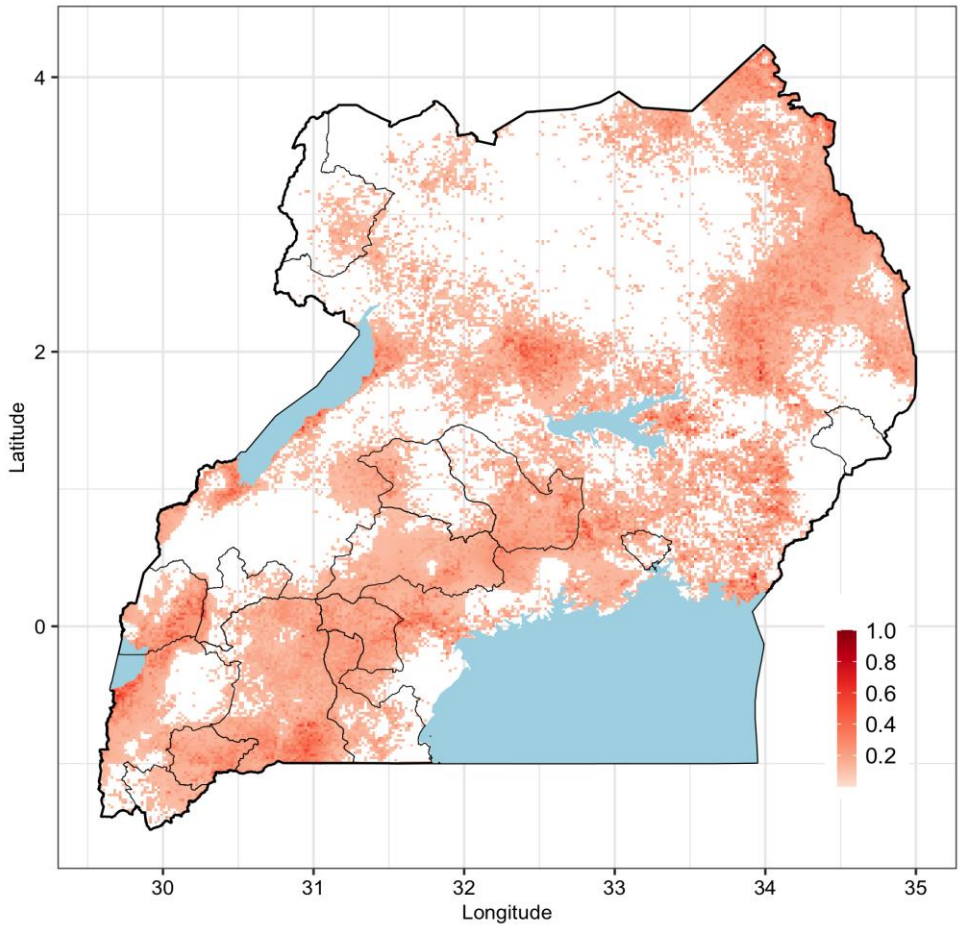
Uganda case study – PhD Dan Tumusiime



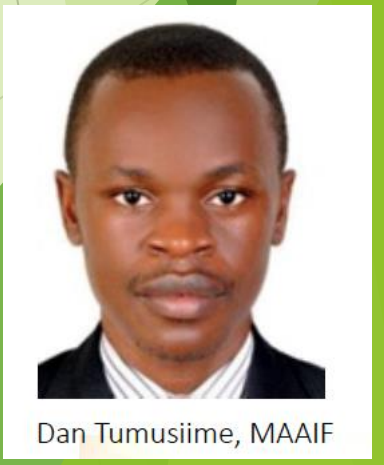
- Previous outbreaks in the western part of the country
- Serological evidence of RVFV infection in other parts of the country
- Capacity needs on improved surveillance to quantify the extent of the problem

PLOS Neglected Tropical Diseases

PLoS Negl Trop Dis. 2023 May 26;17(5):e0010482. doi: 10.1371/journal.pntd.0010482

Mapping the risk of Rift Valley fever in Uganda using national seroprevalence data from cattle, sheep and goats

Dan Tumusiime [1,2,3], Emmanuel Isingoma [1], Optato B Tashoroora [1], Deo B Ndumu [1], Milton Bahati [1], Noelina Nantima [1], Denis Rwabiita Mugizi [2], Christine Jost [4,5], Bernard Bett [6,*]



Dan Tumusiime, MAAIF

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Conclusions

- Integration of findings from case studies will help address knowledge gaps on RVF epidemiology
- Preliminary framework – “staircase effect”
  - Level 1: Uninfected – concerns on introduction
  - Level 2: Endemic status: need for us to identify ecological conditions that support endemic transmissions
  - Level 3: Epidemics: What triggers epidemics
- Update contingency plans based on findings

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