# Missed Rift Valley Fever infections among cattle in Uganda: Agent Based Modelling

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# Acknowledgements: The Story

African Population and Health Research Center

IDM INSTITUTE FOR DISEASE MODELING

REPUBLIC OF UGANDA
MAAIF
Ministry of Agriculture, Animal Industry and Fisheries

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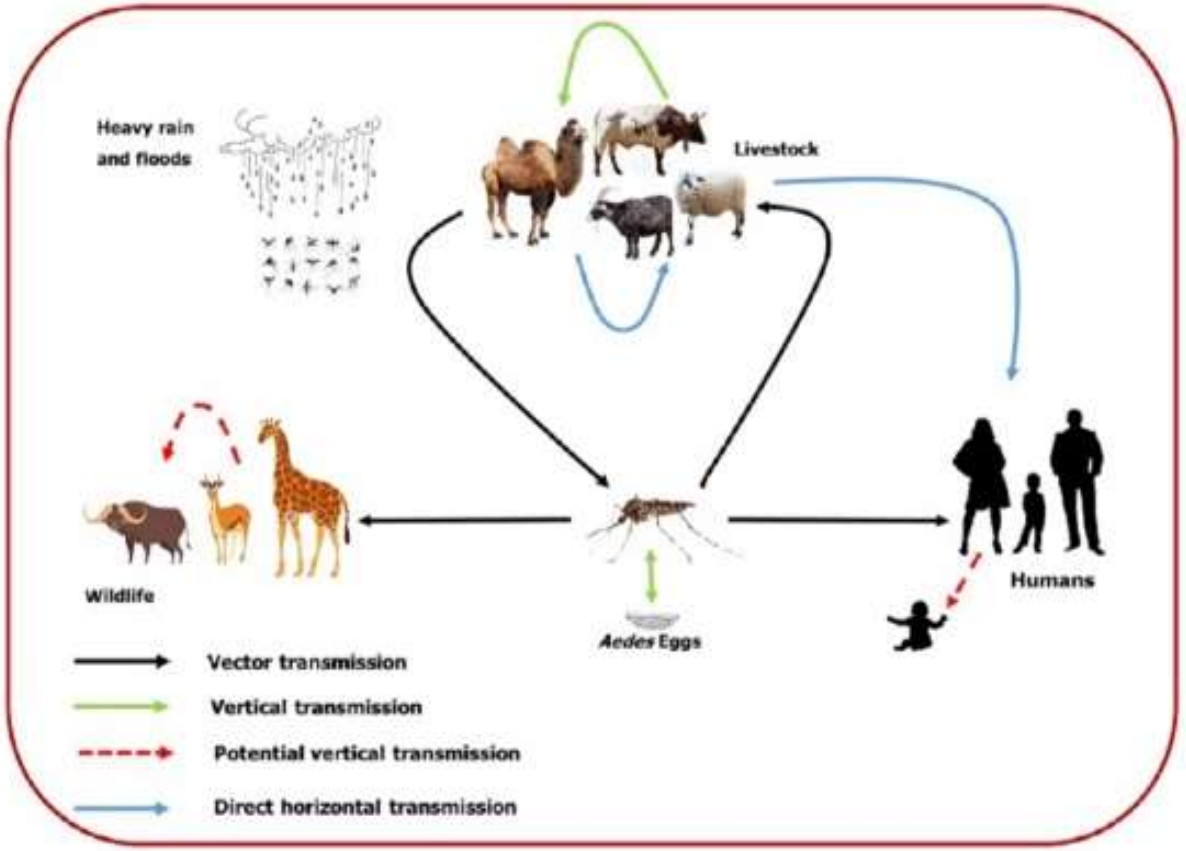
# The Biology of Rift Valley Fever disease

- RVFV is the causative agent for RVF
- RVF is characterised by mortality and increased abortions
- Sheep and calves are highly susceptible, mortality rates of 20%-70%
- (ILRI, 2023)
- Mortality rate is at  90% in lambs, 10-30% adult ruminants and abortions 40-90% (WOAH, 2023)




https://doi.org/10.1016/j.onehlt.2023.100583
One Health
Volume 17, December 2023, 100583

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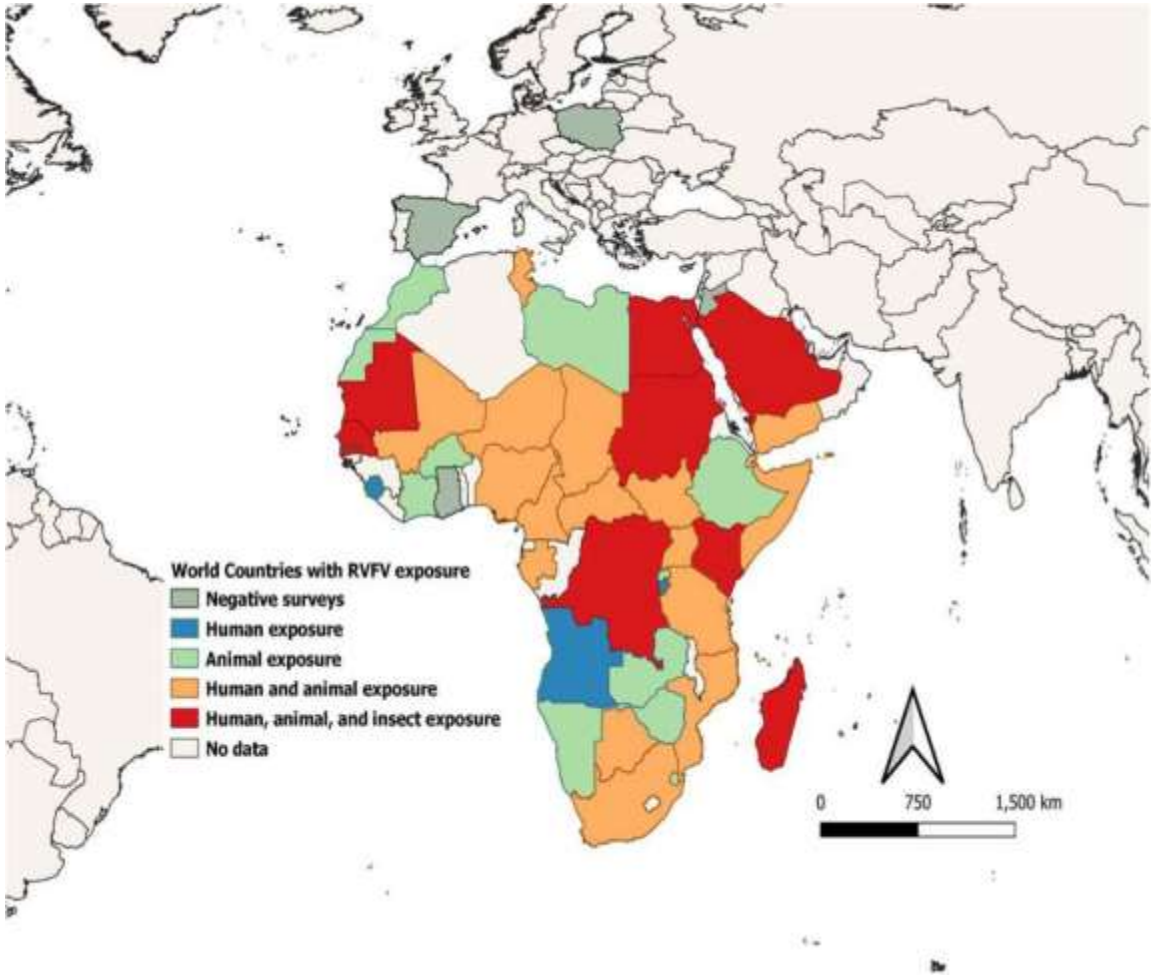
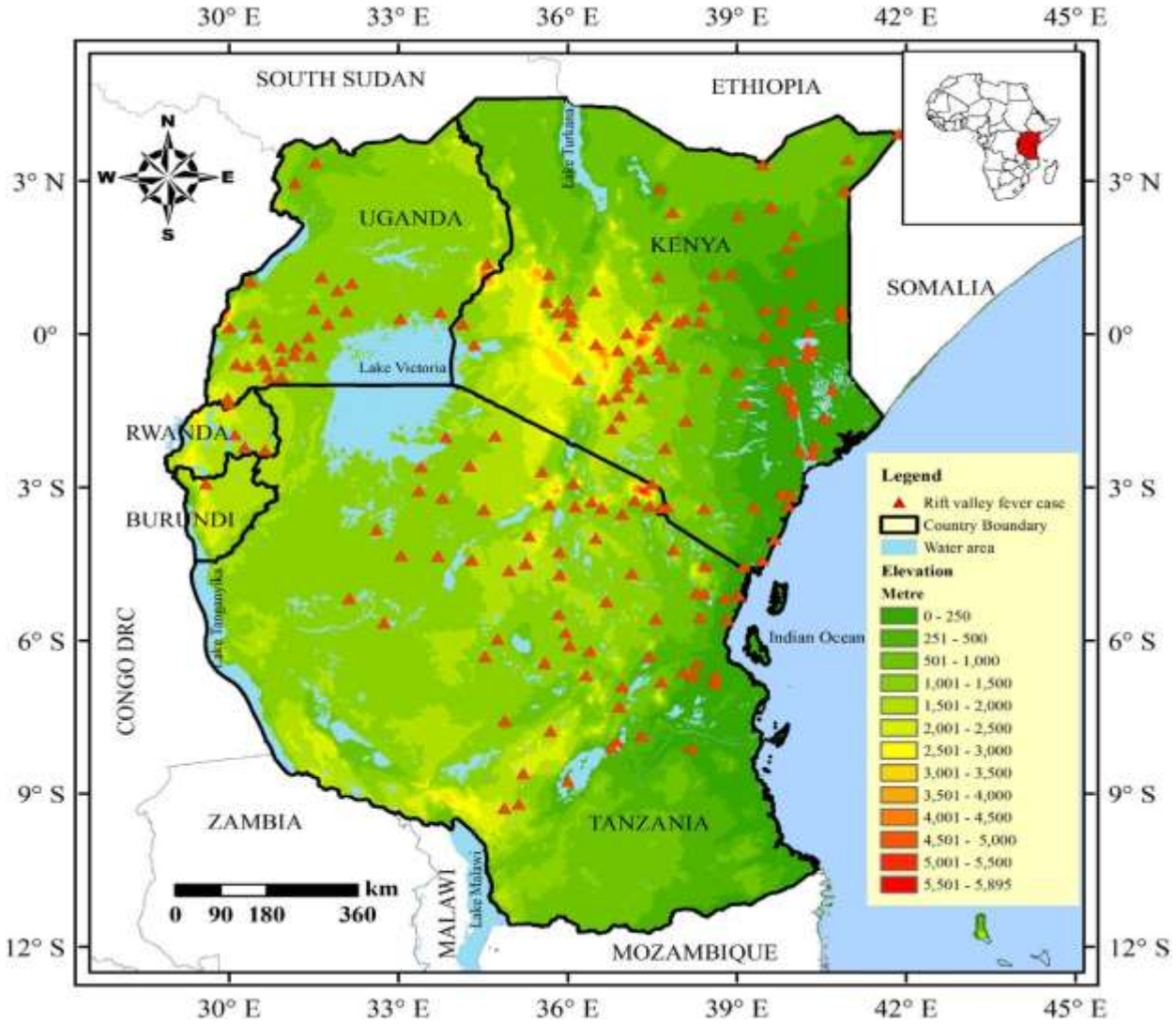
# Geographic distribution of RVF




doi: https://doi.org/10.1101/2021.09.29.21264307




doi: https://doi.org/10.1101/2021.03.03.433832

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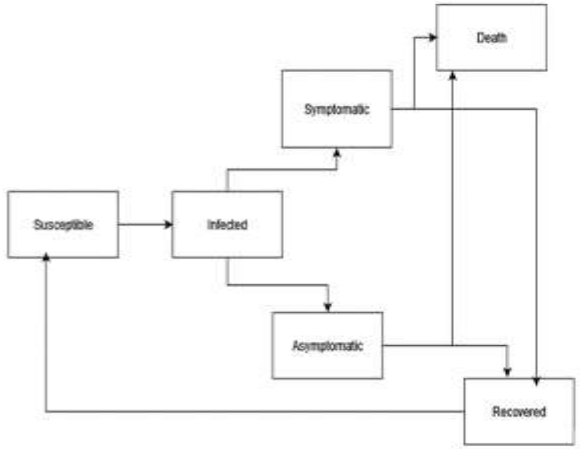
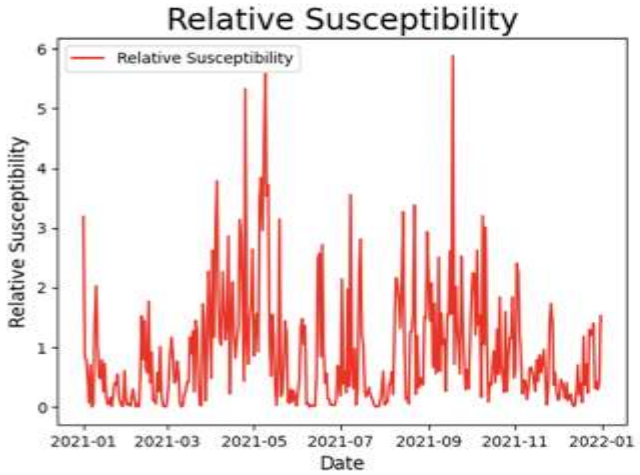
# Aim of the study

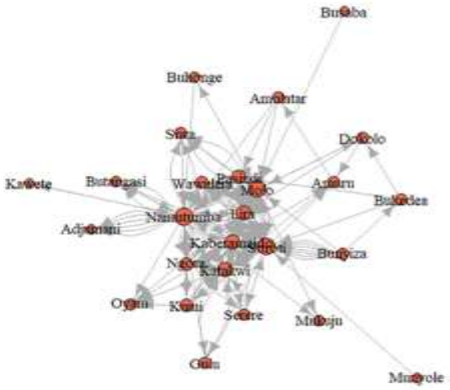
To estimate the number of missed cattle RVF infections that happen in Uganda throughout an epidemic.

# Approach: Model components

- Adopted the Starsim framework from IDM
- Built agent based SIS model to simulate RVF infections
- Used cattle density (2023 Animal Census), movement data (2015-2021) and Climate Hazards Group InfraRed precipitation with Station data for model parameterisation.



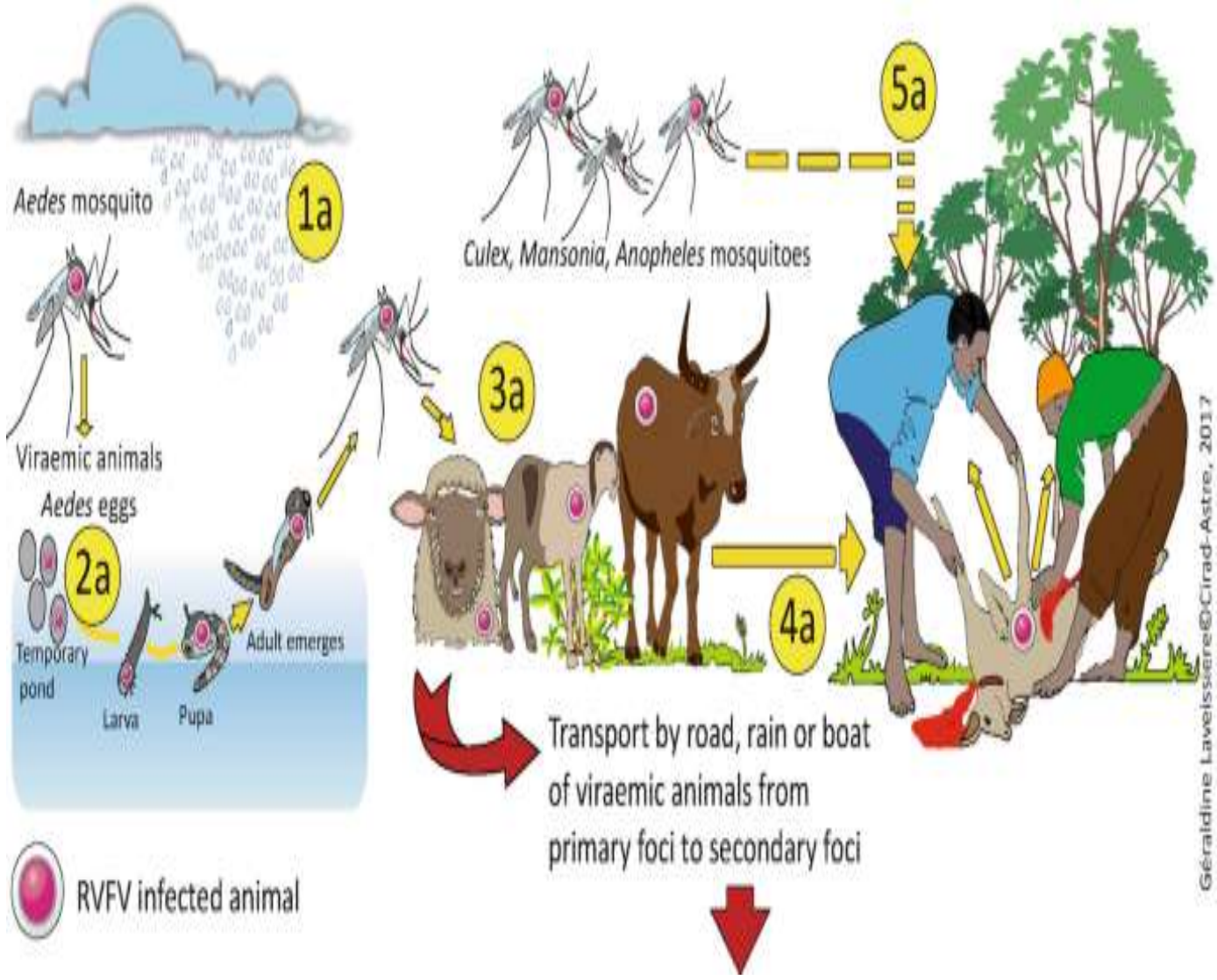



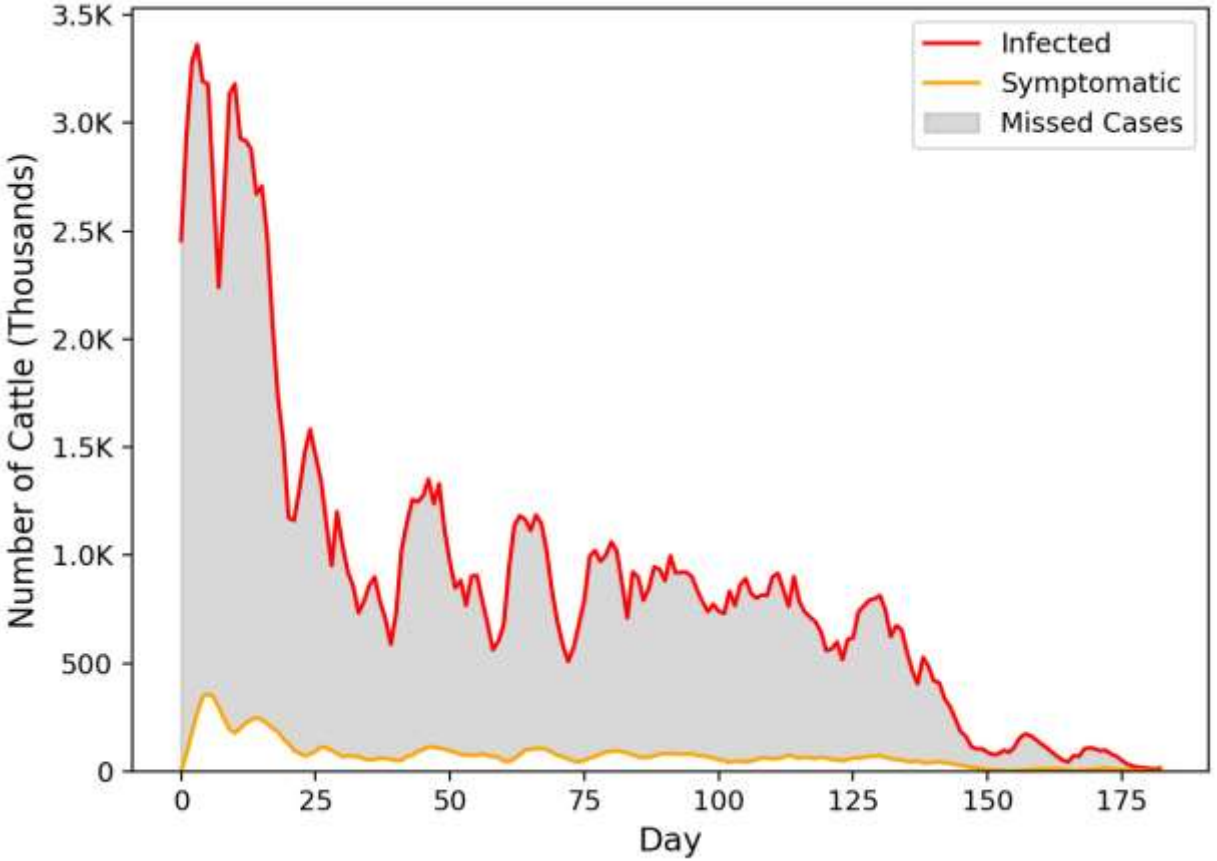
Weighted distance paths of the cattle trade network.
DOI:10.3389/fvets.2021.611132

# Model assumptions and input

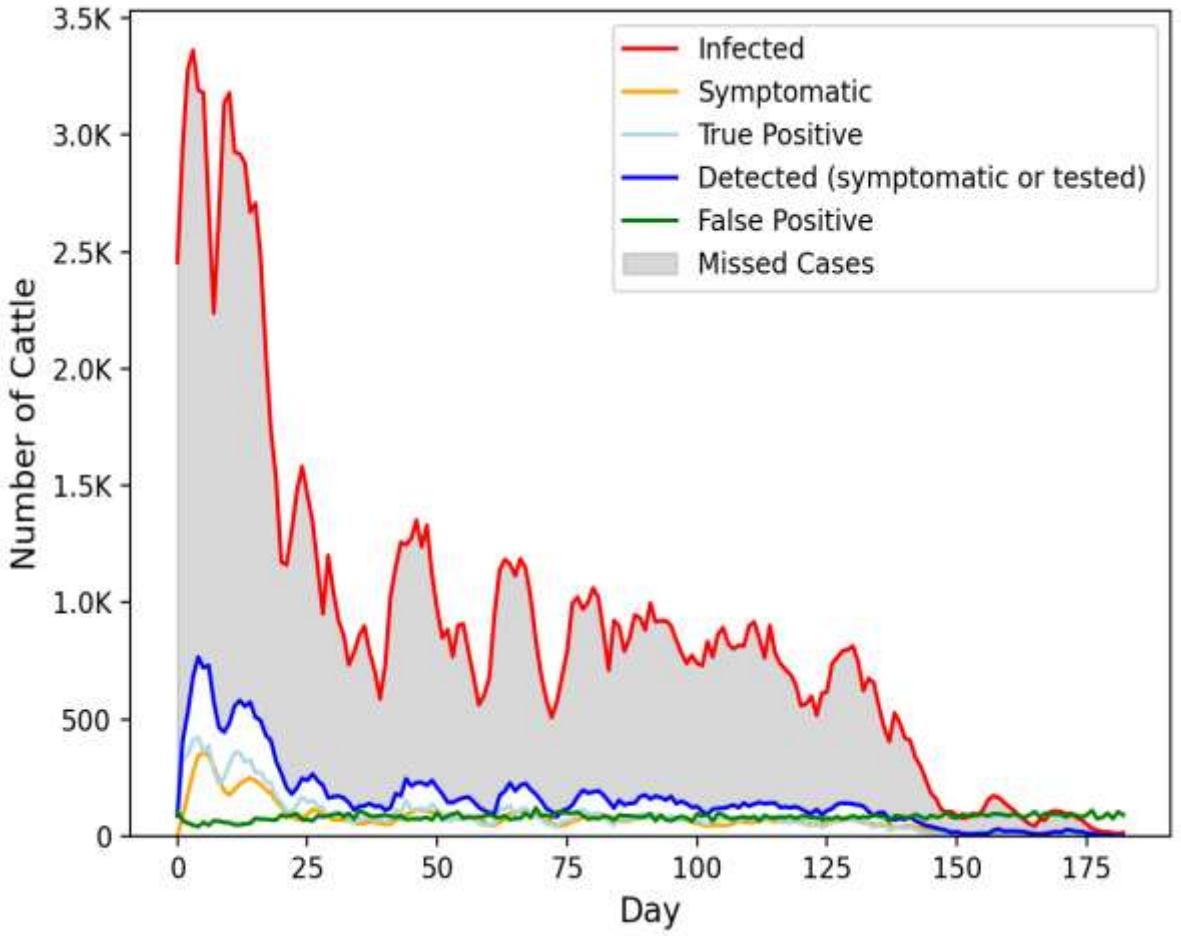
- **Agents:** Relative susceptibility of each agent defined as a function of the environment and acquired immunity.
- **Environment:** Rainfall, temperature and vegetation cover
- **Agent interaction:** Dynamic network of contacts between cattle within districts
- **Routine testing**: Commercial ELISA (Sp: 90%, Se: 84%)



# Results




**92 % missed cases:** No testing




**73 % missed cases: with routine surveillance**

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# Conclusions

- No action: 92% missed compared to 73% (Routine testing)

**Next Steps/Future work:**

- Model presentation to MAAIF for calibration/validation with national-level records
- Incorporating the vector dynamics/populations
- Cost- effectiveness for routine testing Vs targeted testing
- Applied to other ruminants (sheep, goats), wildlife and humans

# Strengths and limitations

**Strengths**

- Available and Validated Starsim framework
- Recent and updated Cattle density, movement data, Diagnostic Accuracy Systematic review data.
- Application of the ABM approach which allows complex interaction fit for RVF
- Other on-going RVF work, gave realistic estimations and assumptions.

**Weaknesses**

- Failure to incorporate the vector
- We were unable to validate our model with national-level facts on the number of cattle infections.
- Several important model parameter estimates were obtained from expert opinion

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