Modelling Bluetongue Outbreaks and Control Using a Deterministic Model

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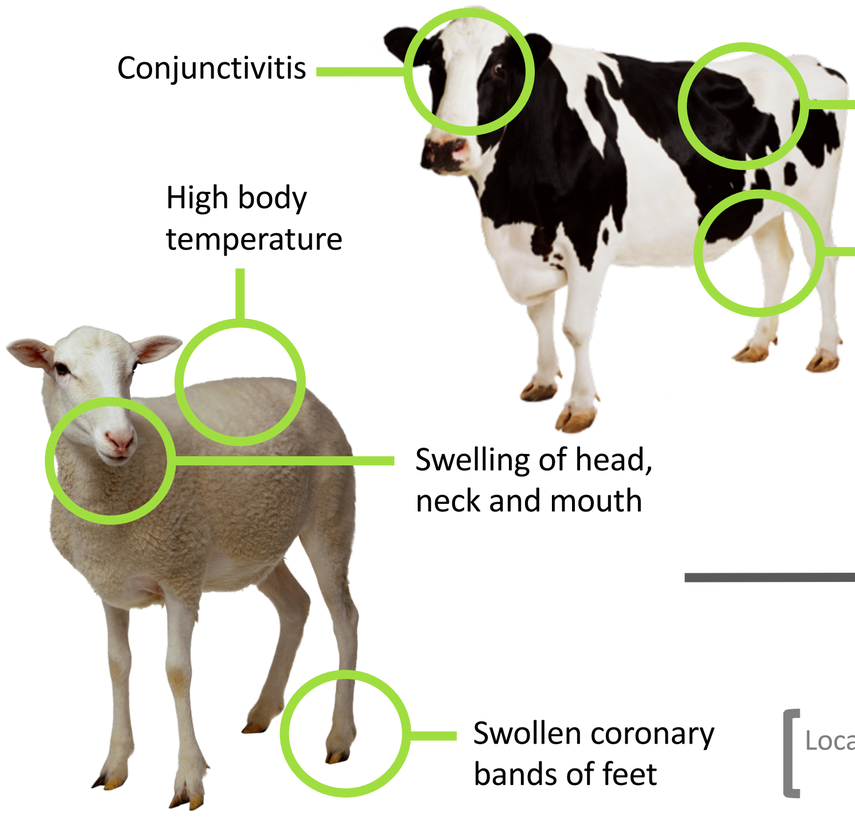
WHAT IS BLUETONGUE?

- Bluetongue is a virus spread from *Culicoides* biting midges to livestock
- Direct economic losses from deaths and decreased production
- Indirect economic losses from trade restrictions
- Control measures include vaccination, quarantine and movement restrictions

Global cost of Bluetongue is **$3 billion** annually[1]

Present on **all continents** apart from Antarctica

WOAH **'Listed Disease'** due to huge global impact[2]



WHY MODEL BLUETONGUE?

- **For prediction, in preparation for future outbreaks**
- **To understand optimal control measures**
- **To estimate economic impact of an ongoing outbreak**
- **To learn more about the drivers of the disease**
- **To experimentally explore differences in serotypes and host/vector species**

THE MODEL

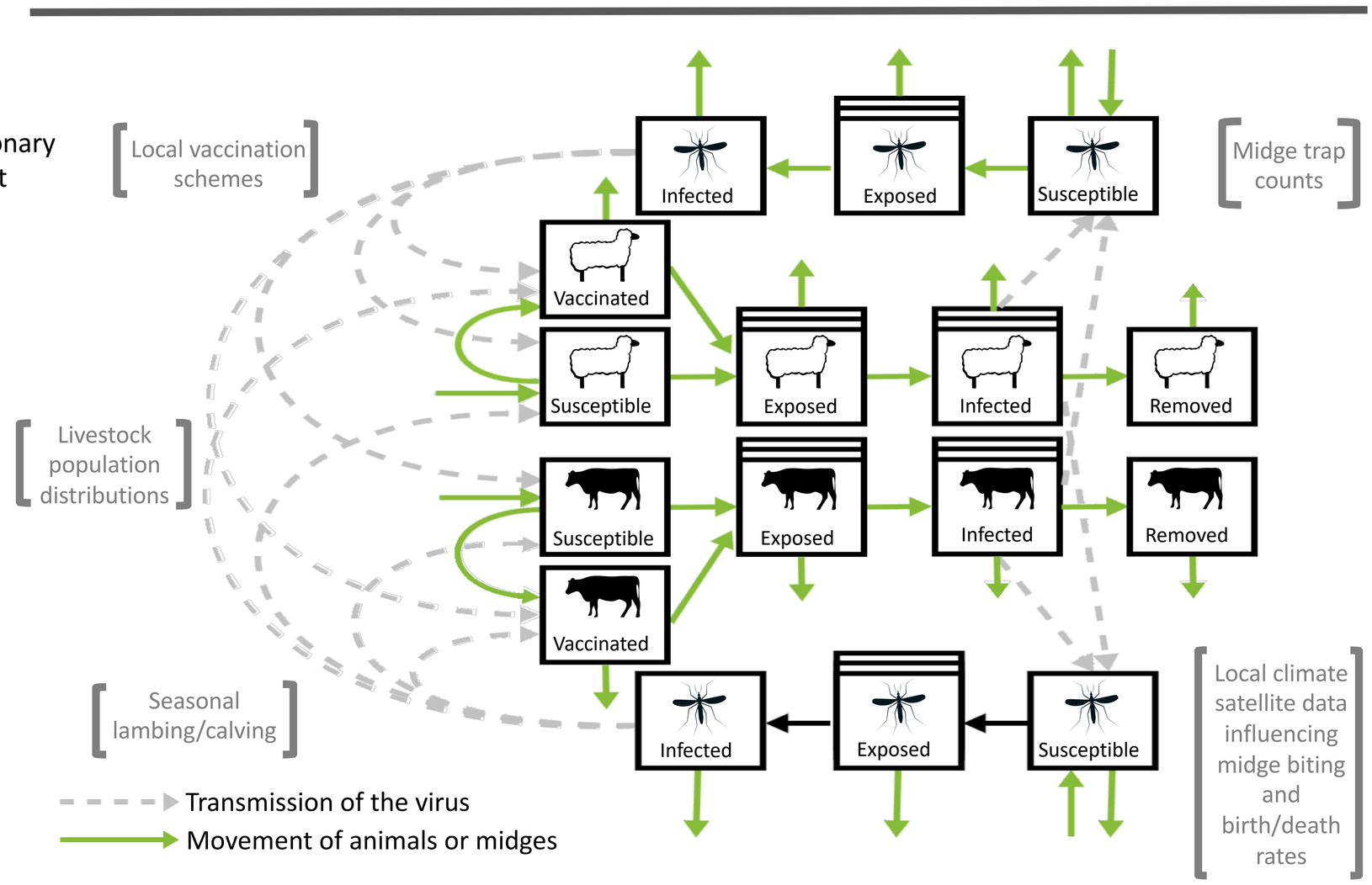
The mathematical model can be adapted to represent a local scenario by changing:

Seasonal birth or death rates

Vector species differences: transmission rates and biting preference

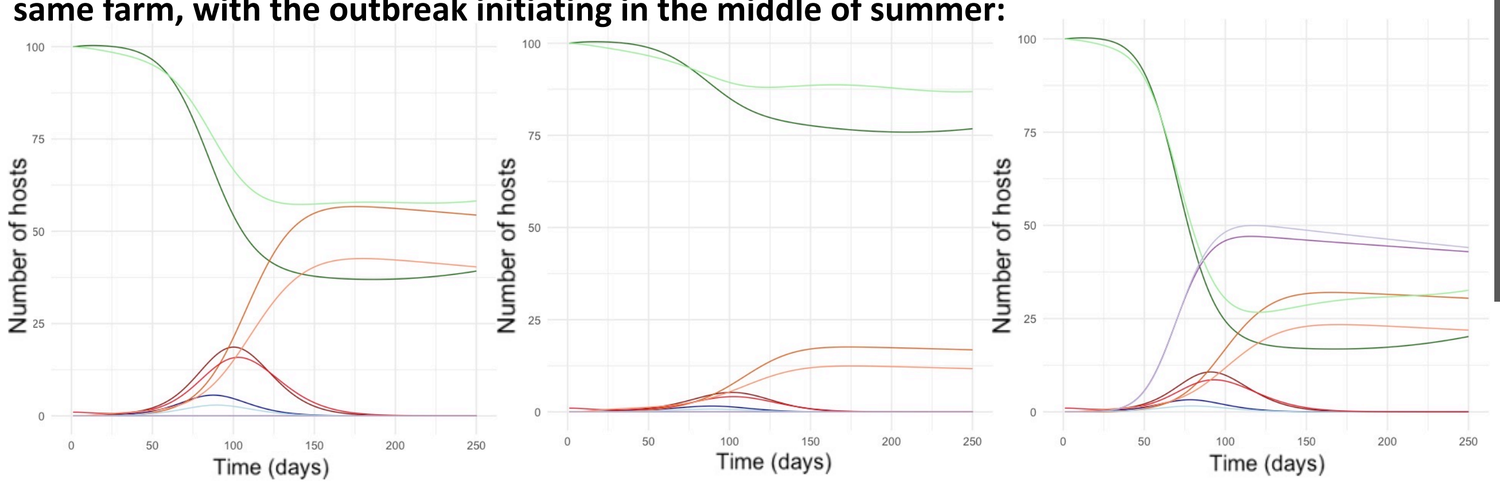
Vaccine protection and protocols

Climate variation



THE SIMULATION

A hypothetical simulation for 100 cattle and 100 sheep, housed on the same farm, with the outbreak initiating in the middle of summer:



No control measures
- Outbreak length = 171 days
- Number sheep affected = 42
- Number cattle affected = 56

Reduce biting rate: housing animals/fly repellents
- Outbreak length = 148 days
- Number sheep affected = 12
- Number cattle affected = 17

Quick vaccine response – 50% population
- Outbreak length = 152 days
- Number sheep affected = 23
- Number cattle affected = 32

FUTURE WORK

- Develop a "meta-population" model where midges can fly to neighbouring farms and livestock can travel to other locations
- Undertake an economic analysis to understand the cost of control versus the cost of losses
- Explore Bluetongue prediction under future climatic conditions

https://forms.gle/FPFYMELKgi8eiYnV7

THANK YOU