

# Key premises for disease transmission in movement networks

Theo Pepler

theo.pepler@glasgow.ac.uk

Rowland Kao

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How to define “key premises” in an animal movement network?

## Some proposals:

- Number of **premises** affected
- Maximum number of infected **animals** at any time
- Final **outbreak size** at end of simulation run
- Number of outbreaks where each of the premises were **involved**

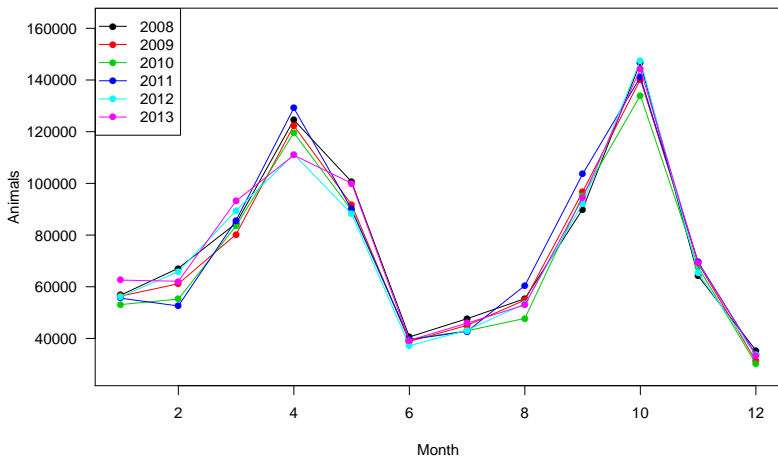
## Some proposals:

- Number of **premises** affected
- Maximum number of infected **animals** at any time
- Final **outbreak size** at end of simulation run
- Number of outbreaks where each of the premises were **involved**

## Or maybe *epidemic potential*?

- epidemic: infections increase, 5+ premises
- *large* epidemic: infections increase, 20+ premises

### Movements between Scottish premises (excl. births, deaths, to SHs)



# Data

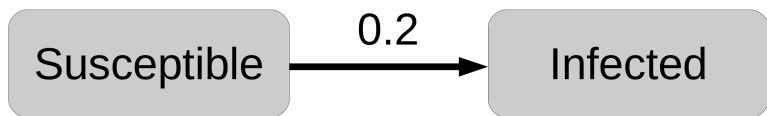
- Cattle Tracing System (CTS)
- 1 Sep – 31 Oct 2013
- 9,482 Scottish premises (county  $\geq$  66)
- 145,237 cattle at start
  
- 1,542 premises with no between movements (9,067 cattle)
- Exits: deaths, exports and moves to slaughter
- Entries: births, imports

# Simulation model



Source:  
<http://siminf.org/>

Compartmental model (animal-level, per premises):



# Premises ranked in top 30

(according to potential for a large epidemic outbreak)

96 Agricultural holdings

Large epidemic potential: 18–43% probability

In case of an epidemic outbreak:

- Premises affected (median): 29
- Outbreak size at 28 days (median): 127 animals



What would happen if there is an infected animal on the single premises most likely to cause an epidemic outbreak?

# Some insights

- Node involvement correlated with eigenvector centrality, but not with outbreak size or epidemic potential
- Much variability between premises w.r.t. epidemic potential
- SimInf framework is fast—useful for quick response in real outbreak

# Future work

- Consistency of “key status” over time
- Rankings for slower moving diseases
- Different compartmental model types  
(incl. environmental contamination and spatial spread)
- Multi-species models

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University  
of Glasgow

More information: [theo.pepler@glasgow.ac.uk](mailto:theo.pepler@glasgow.ac.uk)