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Monitoring and modelling vector-borne and zoonotic diseases: opportunities and challenges for complex ecological systems

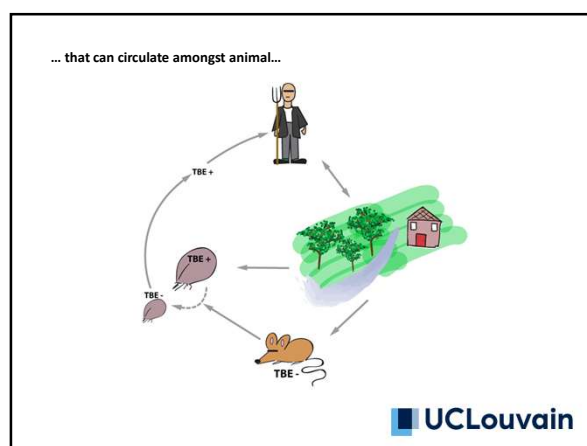
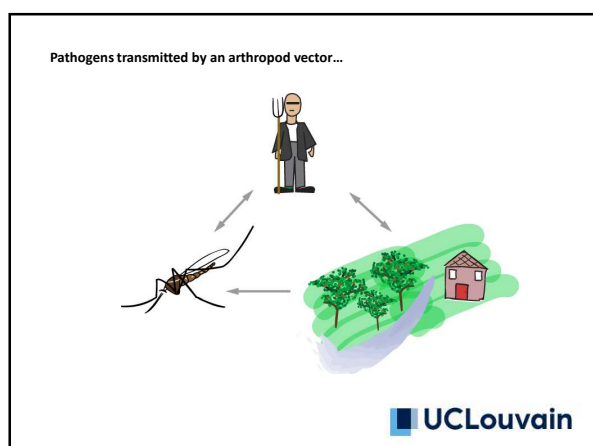
Sophie Vanwambeke Nov. 5, 2018

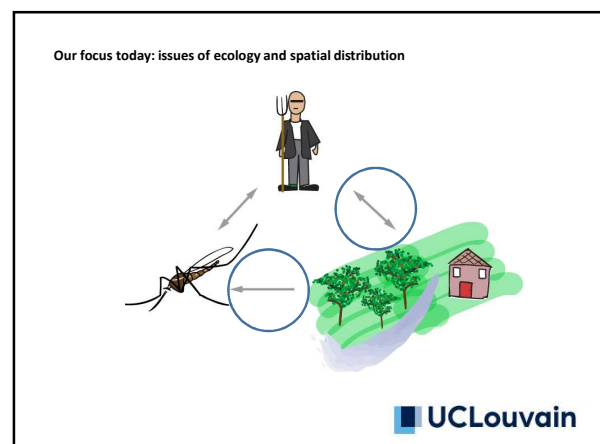
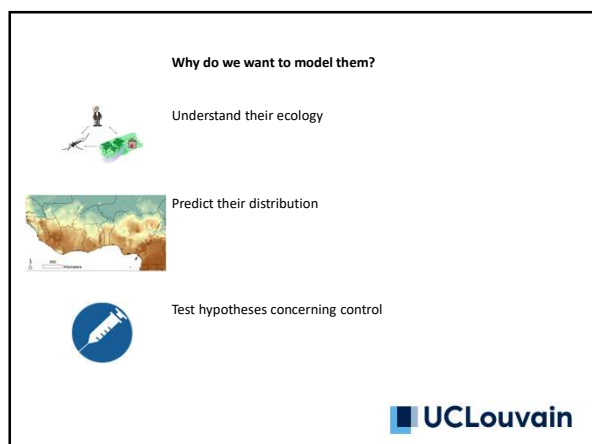
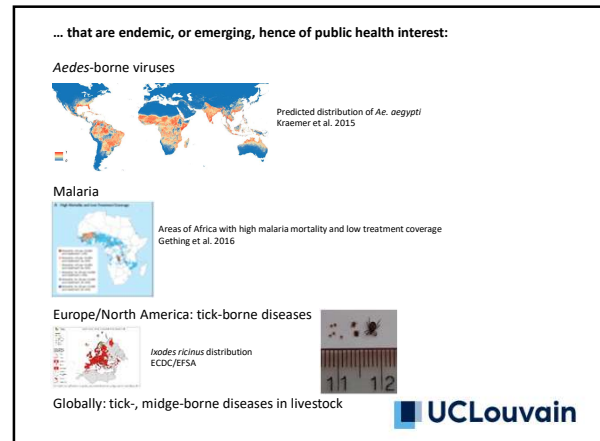
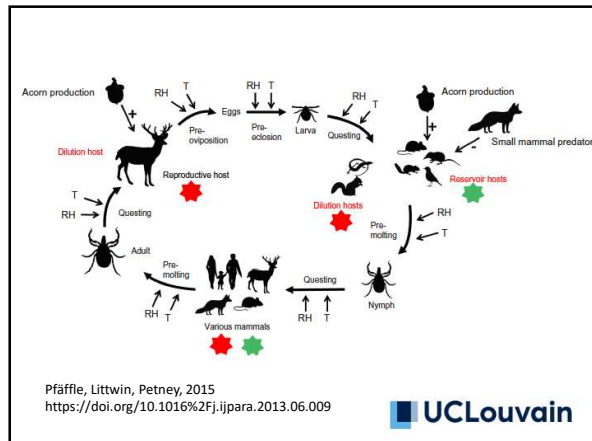
La Chasse aux Microbes.

Outline

- Vector-borne diseases: an overview
- Modelling vector-borne diseases
- Measuring vector-borne diseases: challenges
- Across the modelling spectrum: cross-breeding opportunities
- ... in progress ...

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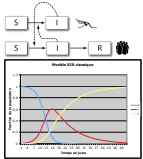




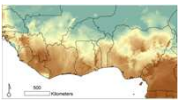
How have we been using models in this area?

Data hunger

Mechanistic models, e.g. R_0



Statistical models:
e.g. species distribution models, regression models.



Processes explicated

Spatial processes?
Environment?

Meaning of correlation?

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Data collection challenges:

- Difficulty to observe phenomena
- Time/resource expense associated with data collection or processing
- Data are keyhole
- Data are proxies

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Difficulty to observe phenomena

- It happened a while ago
- It concerns wild animals and their interactions
- It concerns pathogen circulation in the wild, in a herd or a flock,...

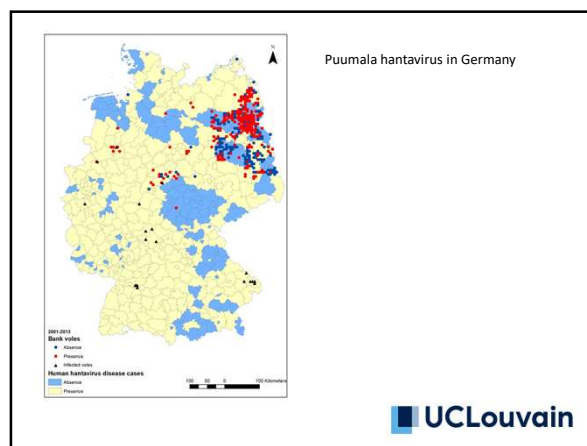
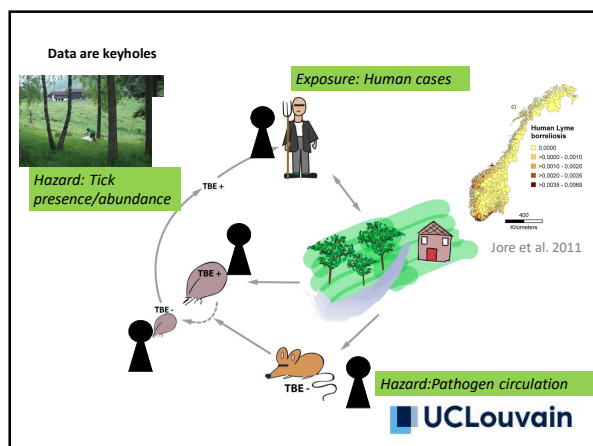
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Time/resource expense associated with data collection or processing

- Sampling/collecting is time intensive: e.g. blood sample collection, animal sampling in the wild
- Some methods produce large numbers of samples, that subsequently need processing (eg identification)
- Some information (eg pathogen presence) is costly to collect



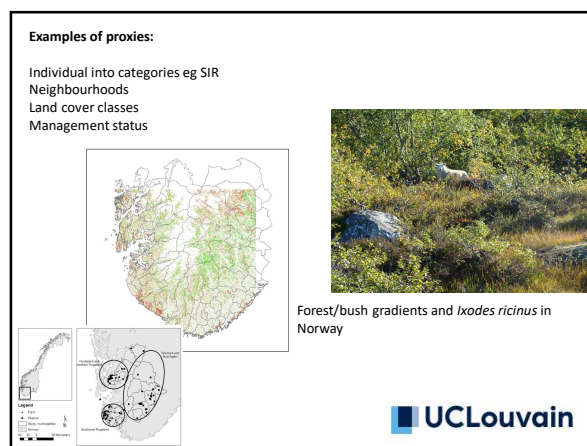
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Data are proxies

- Measurements are indirect with regard to the variable of interest
- Measurements may relate to various variables of interest

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Why do we use them at all? Why should we sometimes choose them?

→ practical compromise: what is available
→ what is understandable and « actionable »

But all this should be guided by what is relevant from the ecological point of view

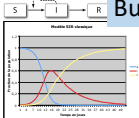
Plenty of questions...

- More data... more uncertainty?
- Should we model the data we have... or collect data for the models we want to build?
- What are the consequences of the assumptions we make?
- What about heterogeneous behaviour?

How have we been using models in this area?

Data hunger

Mechanistic models, e.g. R_0



Statistical models:
e.g. species distribution models, regression models.



Building on assets of both

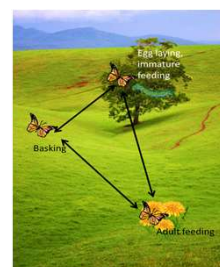
Processes explicit

Spatial processes?
Environment?

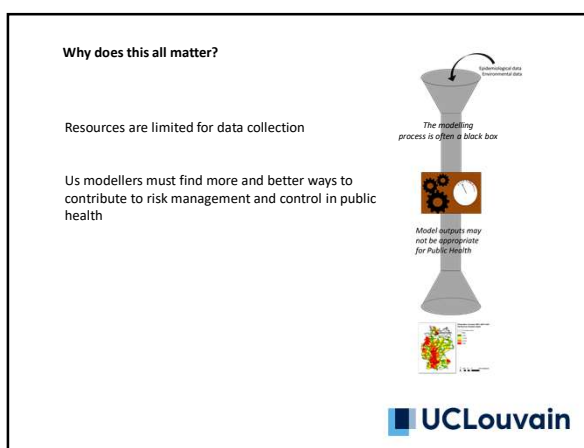
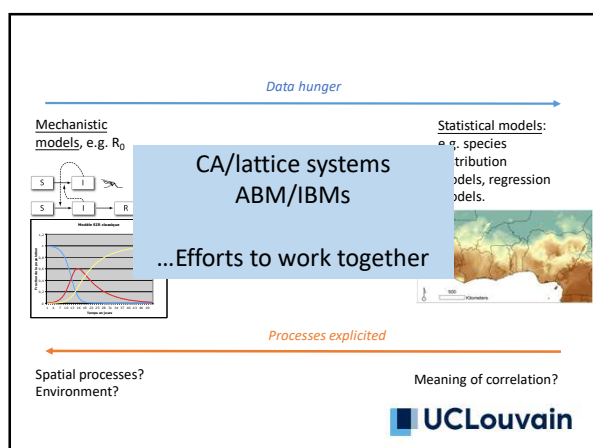
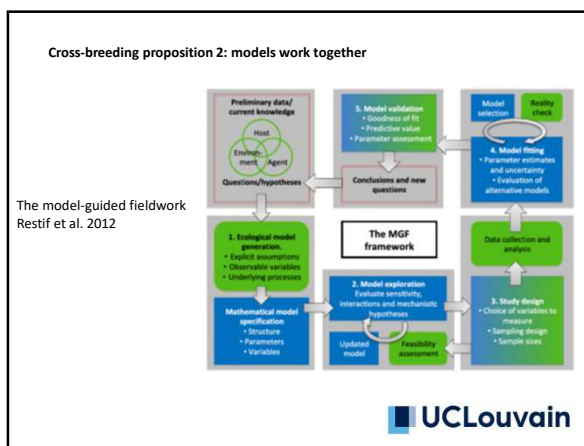
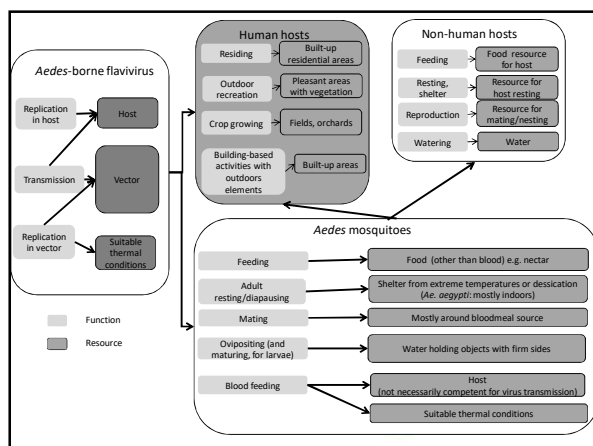
Meaning of correlation?

Cross breeding proposition 1: an empirical model is not a shot in the dark

A resource-based habitat concept, drawn from the field of conservation ecology



Hartemink et al., 2015; Vanwambeke, Li, Hartemink, 2016; Vanwambeke, 2017



UniNove-UCL collaboration

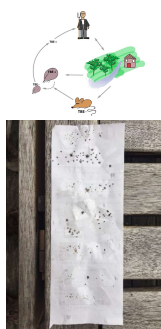
Risk= hazard * exposure

Which areas yield the greatest risk? Could it be areas of medium tick abundance but high human frequentation?

Risk= hazard*exposure*vulnerability

Are people encountering ticks more often better able to protect themselves? What is the results of high tick abundance avoidance/exclosures?

How to use the model to collect better data, and the data to make better use of the model?



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This work has been contributed to by previous and current team members and collaborators:

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