Modelling indirect transmission between wildlife and cattle to improve biosecurity

Natalia Ciria[1], Giovanna Ciaravino[1], José Luis Sáez[2], Alberto Allepuz[1]

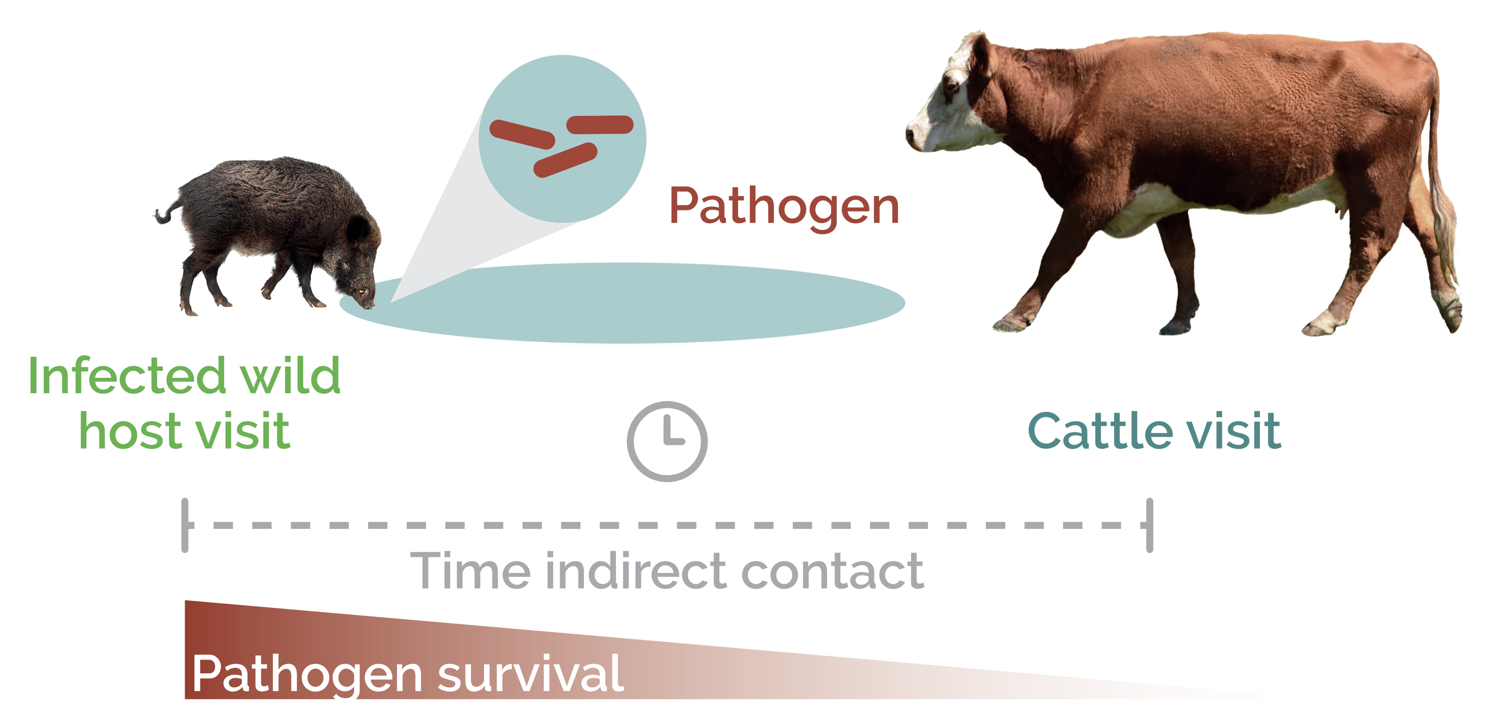
[1] Universitat Autònoma de Barcelona, Spain

[2] Ministerio de Agricultura, Pesca y Alimentación, Spain

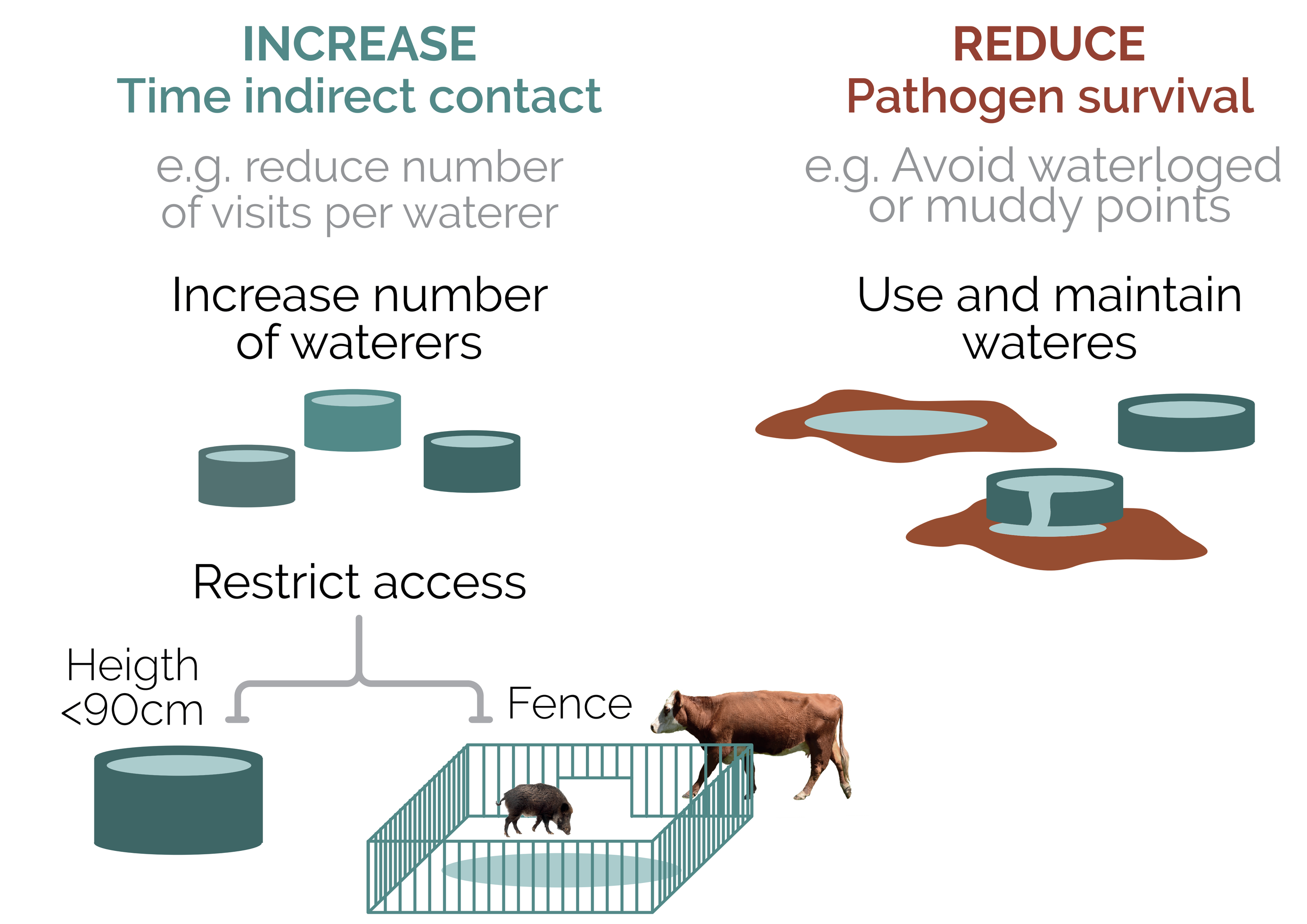
Introduction

- The implementation of **biosecurity measures** against environmentally resistant, multi-host pathogens (such as tuberculosis) is a challenge in **extensive farming**.
- **Water** and **feed** are the main risk points for indirect transmission of tuberculosis between wildlife and livestock and are usually the target of biosecurity measures in extensive farming.
- Providing tools to **quantify the impact** of these biosecurity measures can aid **decision making** and **raise awareness** of the effectiveness of biosecurity.

Indirect transmission at water point



What can we do to reduce risk?



Objective

To develop a **quantitative risk analysis** model for indirect transmission of pathogens between wildlife and cattle to **assess the impact of biosecurity** measures on risk points.

Material and methods

Data inputs

Geospatial
- Wildlife disease surveillance
- Animal Density

Survey
- Observed wild animals visits
- Number of water points
- Access to water point
- Type of water point

Literature
- Activity Pattern
- Survival time on diferent surfaces
- Indirect contact transmissibility

Model parameters

Wild host
- Disease prevalence p
- Visit probability w

Cattle
- Visit probability c

Pathogen
- Survival curve s_0, k
- Transmissibility i

Model steps

1 Probability of infected wild host visit

$$w_{inf} = w \cdot p$$

2 Probability of time t of indirect contact

$$f(t) = \frac{d}{dt}\left[\left(1-(1-c)^t\right)\left(1-(1-w_{inf})^t\right)\right]$$

3 Probability of pathogen survival

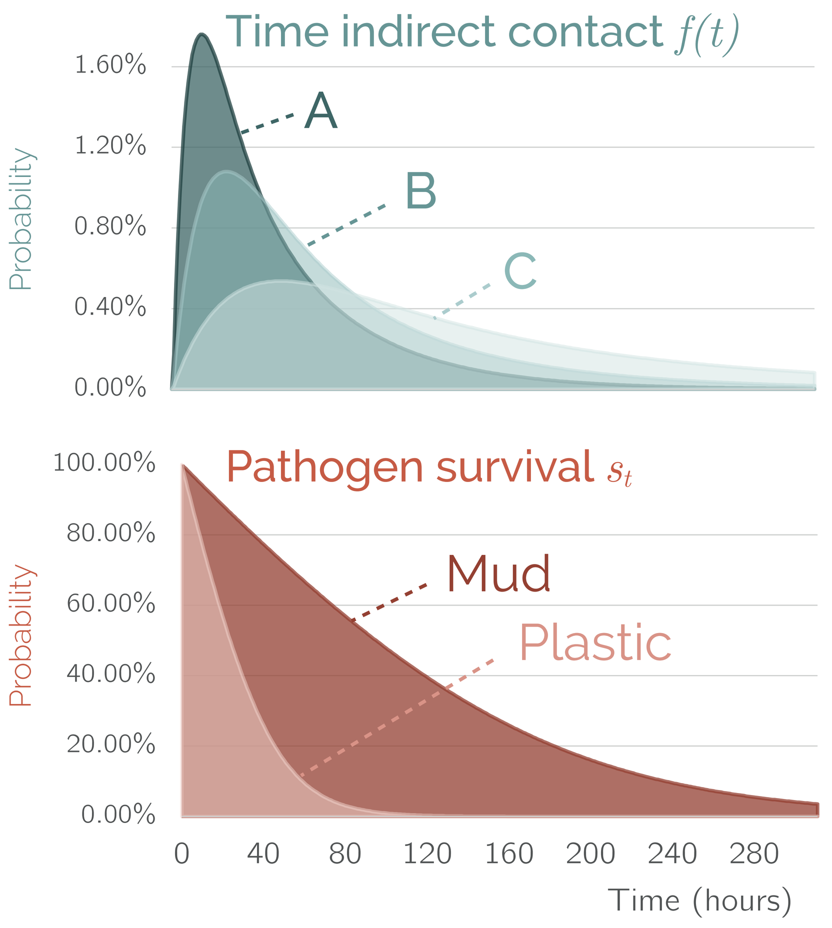
$$s_t = log((10^{s_0}-1) * e^{(-k*t)}+1)$$

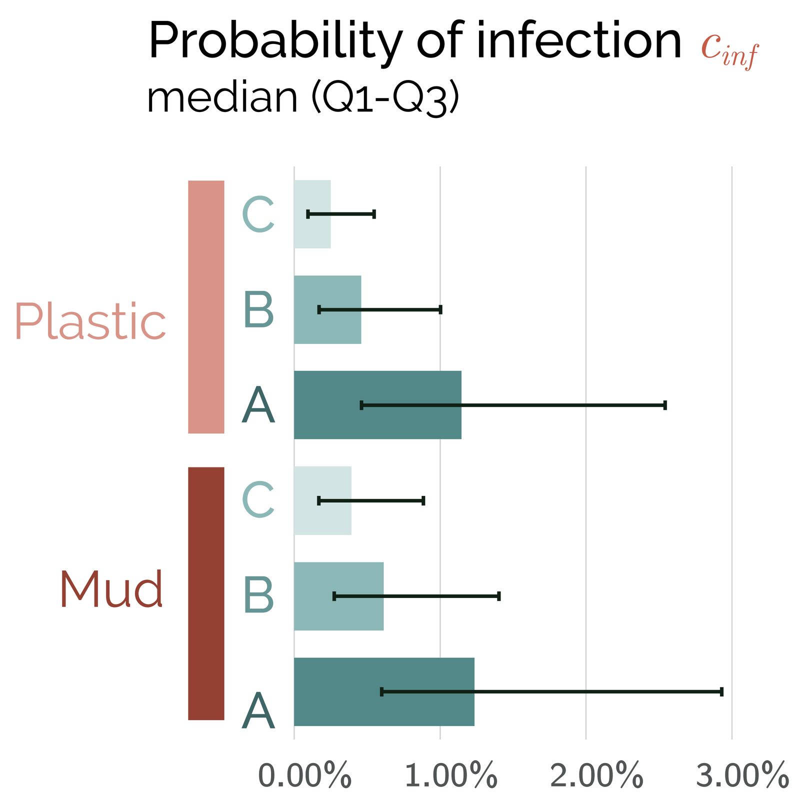
4 Probability of infection in cattle

$$c_{inf} = s_t \cdot i$$

Model outputs

Diferent visit frequencies and surfaces





Discussion and further steps

- Modeling the risk of disease entry through wildlife interactions addresses the specific need for feasible and effective biosecurity plans adapted to the extensive farm context.
- Limitations include estimating pathogen prevalence in wildlife and visit frequency from fragmented data. However, the aim is to balance complexity and applicability for useful biosecurity assessments.
- This model will be extended to other risk points, pathogens and animal species. It will be part of a general biosecurity assessment model to improve risk management, tested on real farms and used to support biosecurity decision making.

Contact: natalia.ciria@uab.cat

This research project was funded by BIOSECURE Horizon Europe project and it is part of the BETTER COST action (www.better-biosecurity.eu) funded by COST (www.cost.eu)

Universitat Autònoma de Barcelona

BETTER

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Funded by the European Union