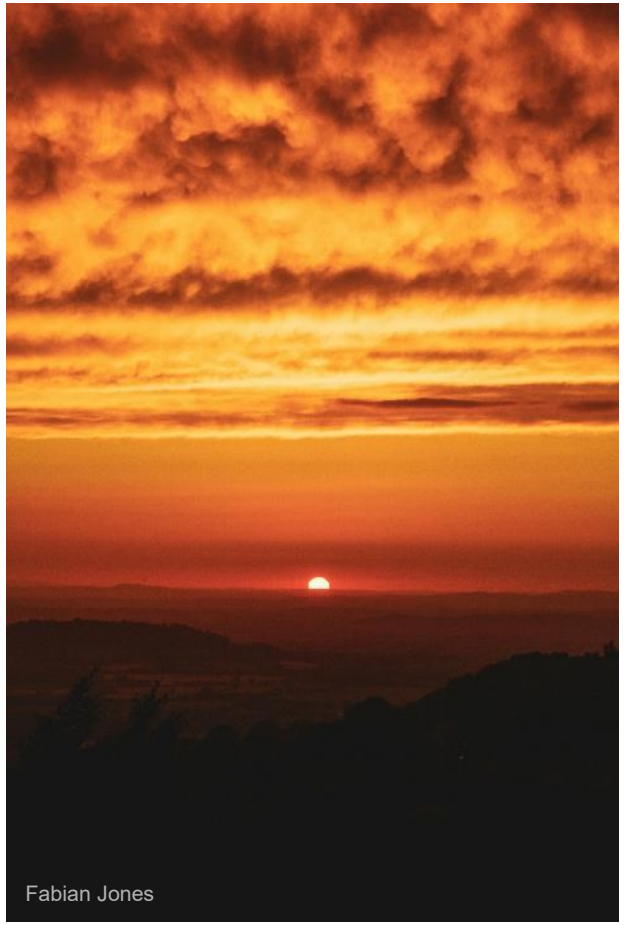
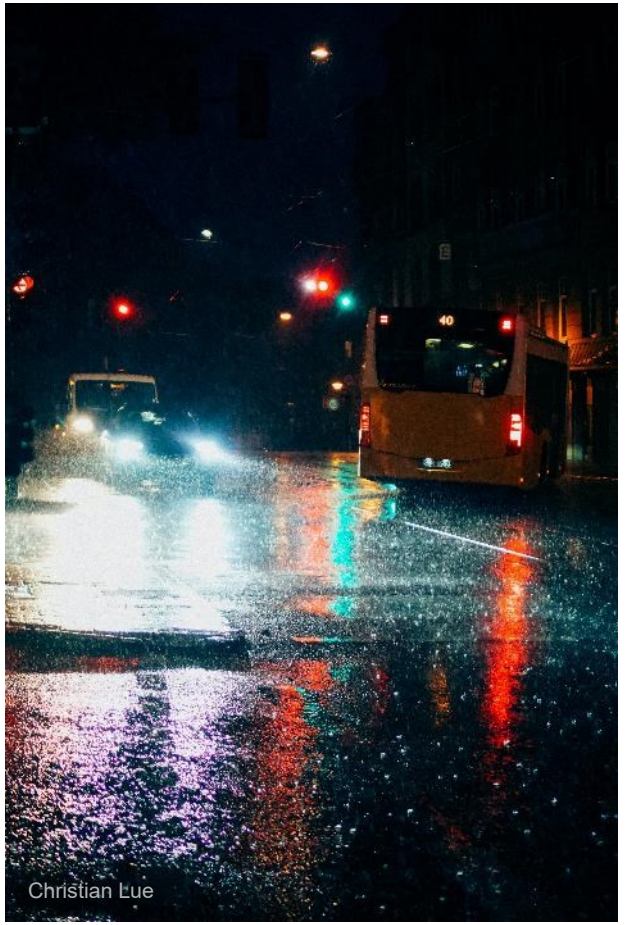
Leveraging Earth Observation data to predict climate-sensitive infectious disease dynamics

Martín Lotto Batista, PhD
Barcelona Supercomputing Center (BSC)
28 February 2025

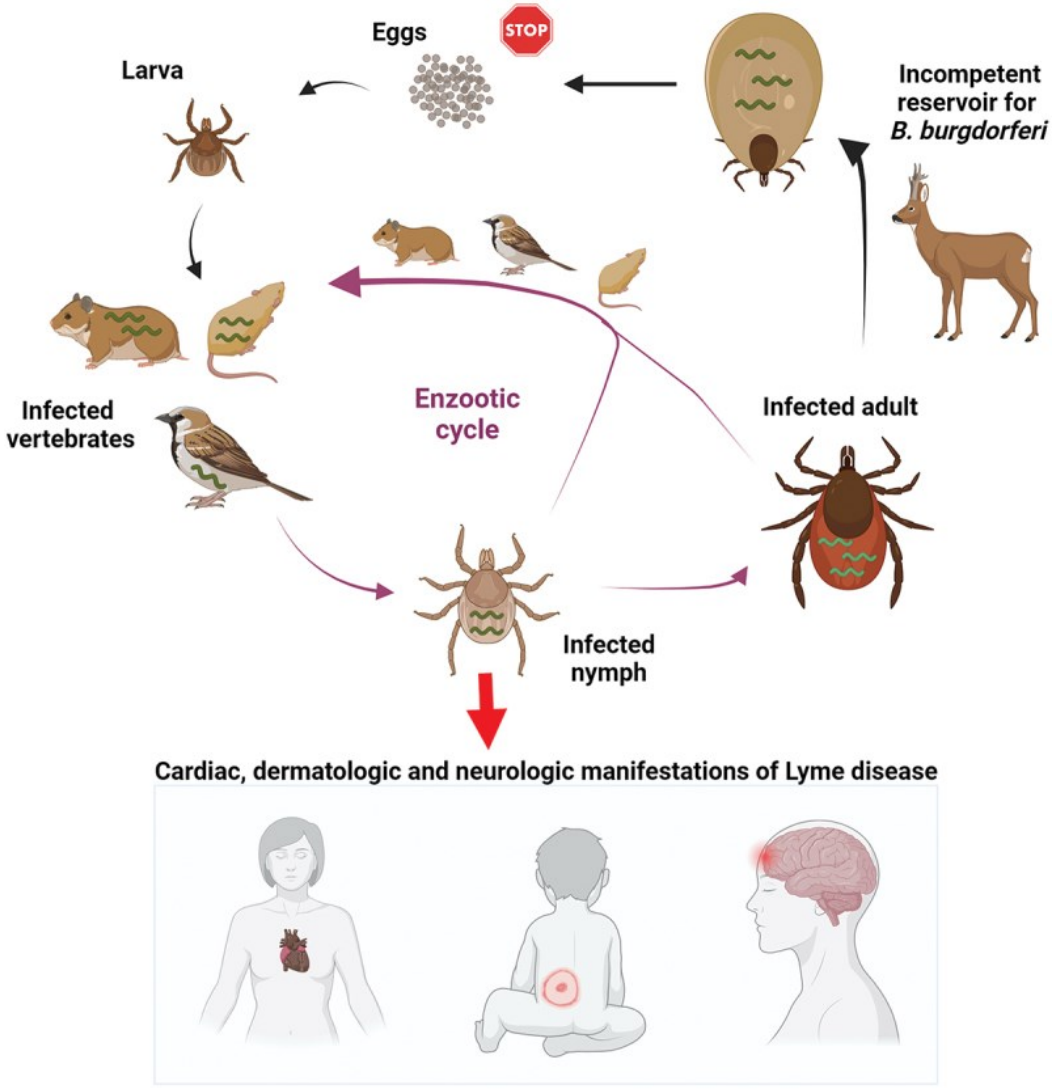
Climate sensitive infectious diseases (CSIDs)





Lyme disease

- Caused by *Borrelia* sp bacteria
- Endemic in Germany
- >128,000 cases in 2019
- >23 million euros each year in treatment



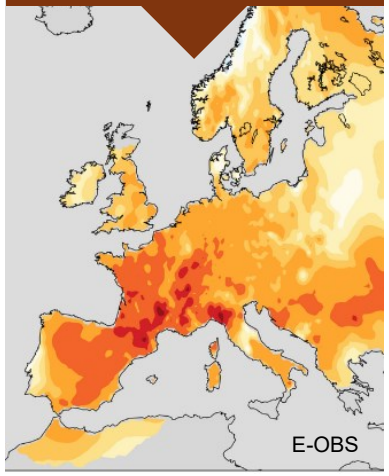
Strnad et al., 2023

HZI HELMHOLTZ Centre for Infection Research
PhD Programme "Epidemiology"

Leveraging publicly available data sources

Climate

Gridded interpolations

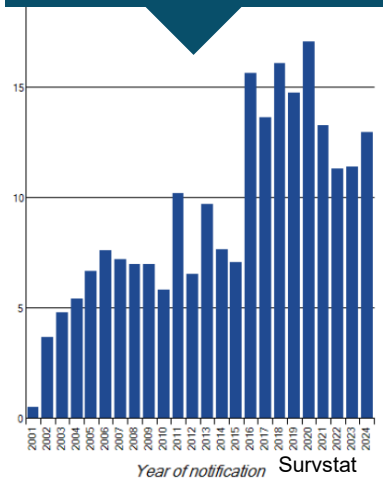


Environment

Land cover maps

Health

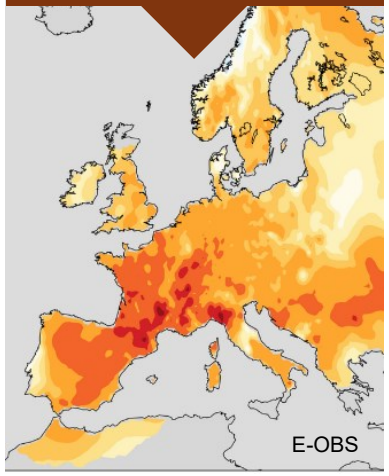
Surveillance records



Leveraging publicly available data sources

Climate

Gridded interpolations

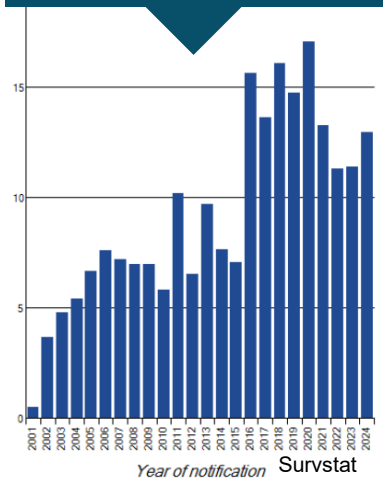


Environment

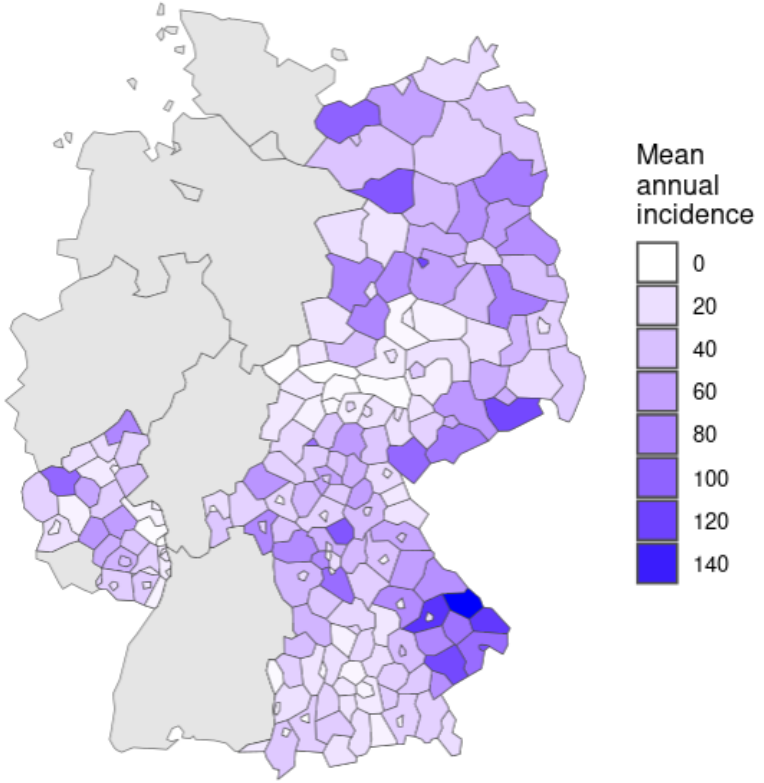
Land cover maps

Health

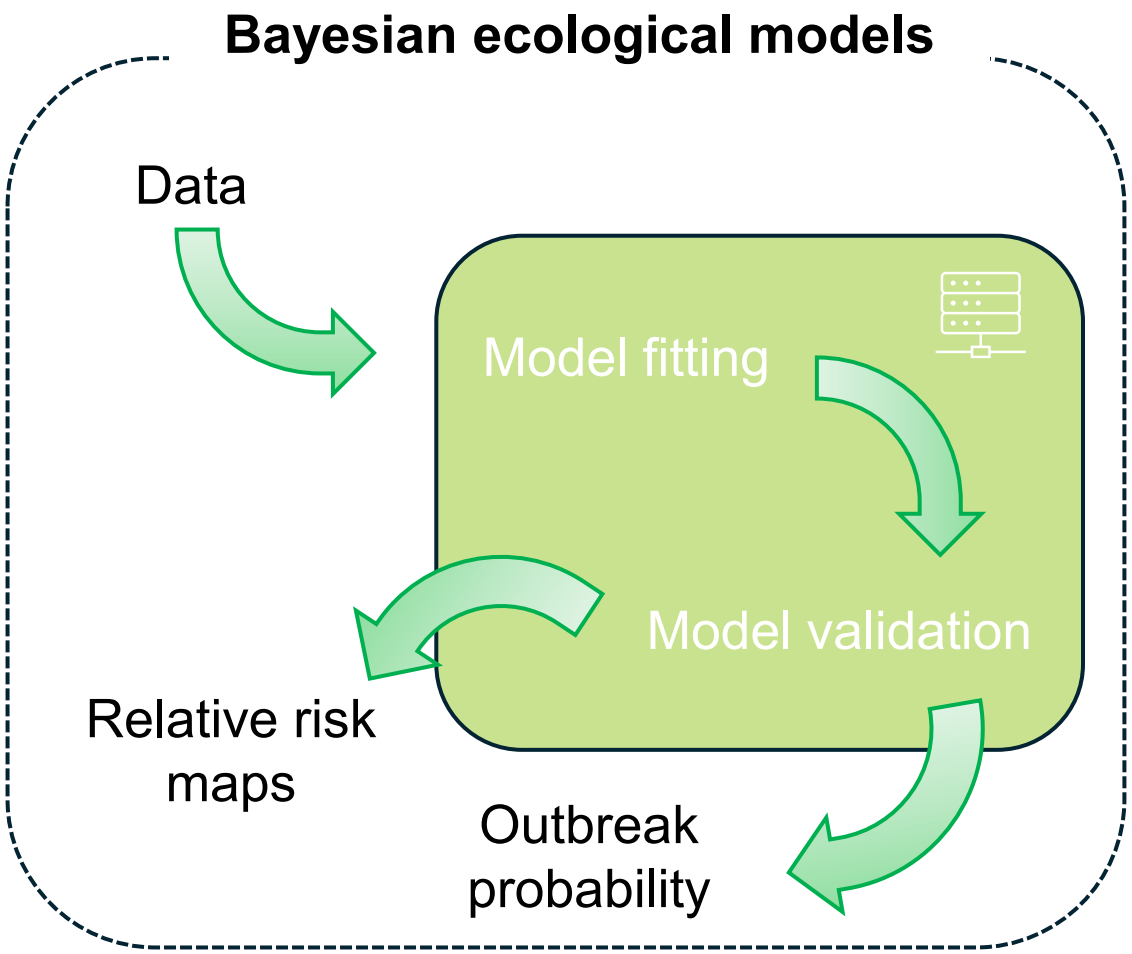
Surveillance records



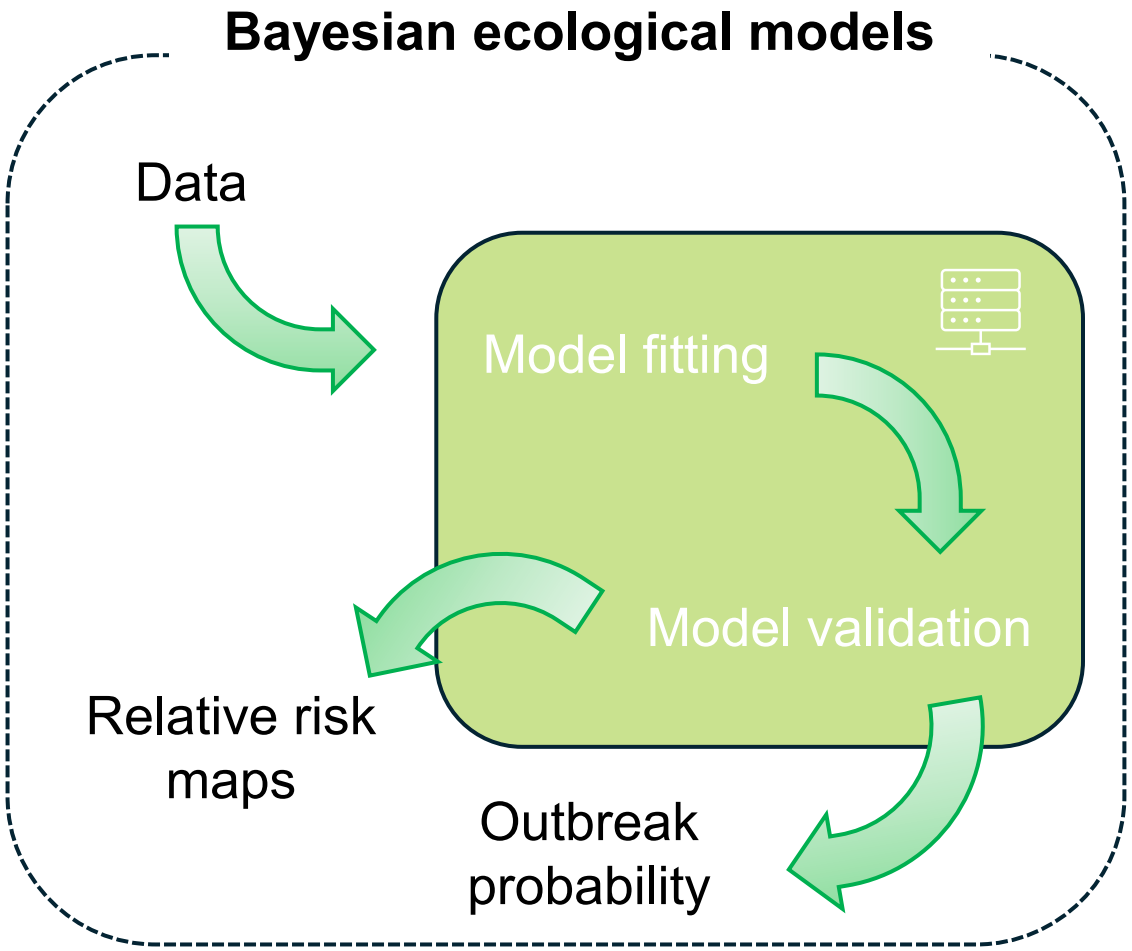
2019-2022



Modelling framework



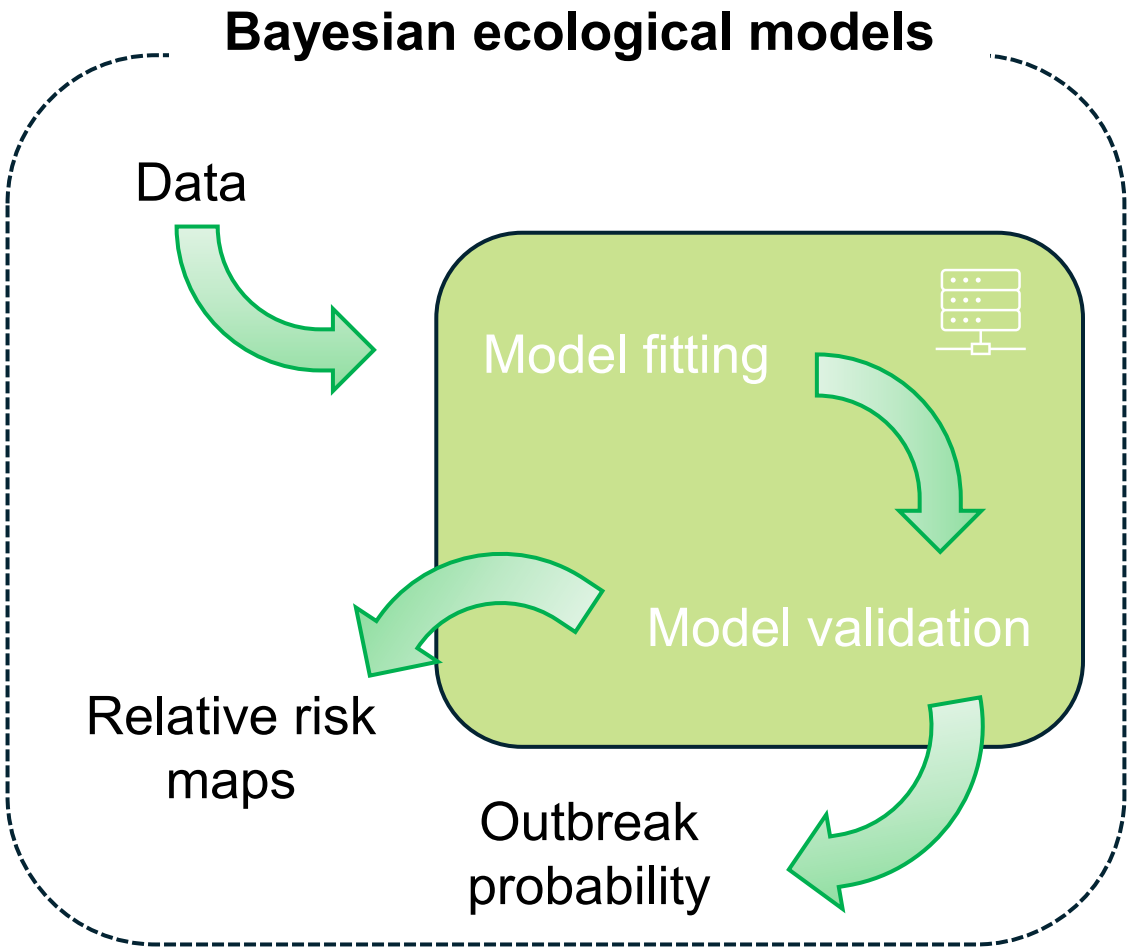
Modelling framework



$$Y_{i,t} \mid \mu_{i,t}, \phi \sim NegBin\ (\mu_{i,t}, \phi)$$

$$log(\mu_{i,t}) = \alpha + log(P_{a[t,i]}) + \sum_k \beta_k X_{i,t,k} + u_{a[i]} + \upsilon_{a[i]} + \delta_{m[t]}$$

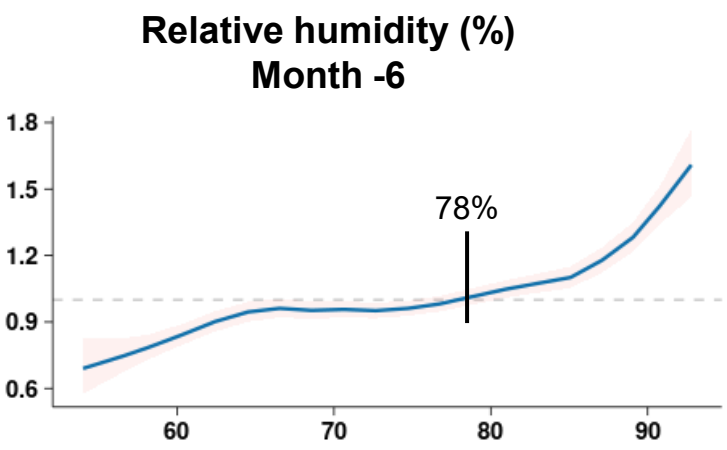
Modelling framework

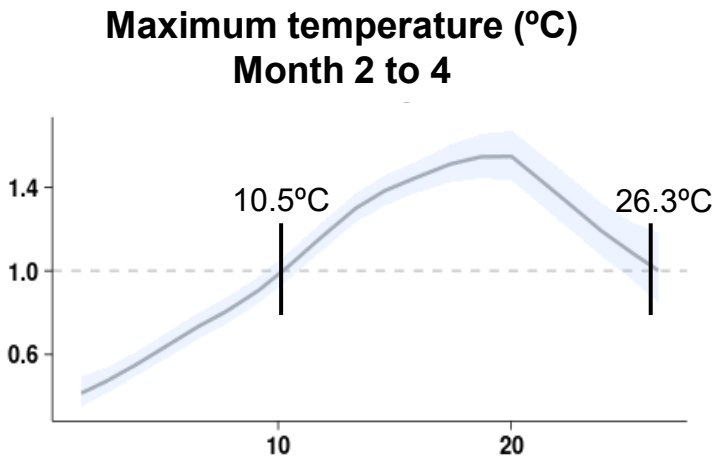


$$Y_{i,t} \mid \mu_{i,t}, \phi \sim NegBin(\mu_{i,t}, \phi)$$

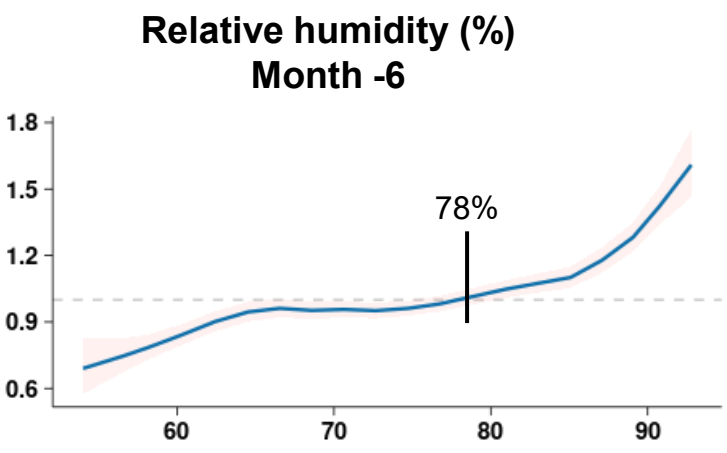
$$log(\mu_{i,t}) = \alpha + log(P_{a[t,i]}) + \sum_k \beta_k X_{i,t,k} + u_{a[i]} + \upsilon_{a[i]} + \delta_{m[t]}$$

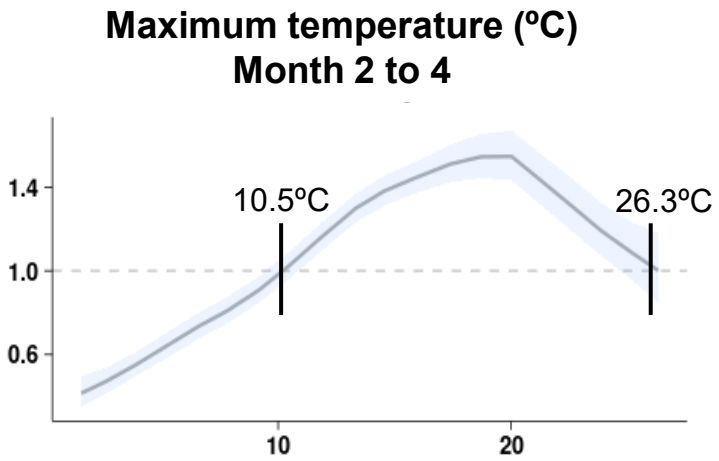
Climatic and environmental associations

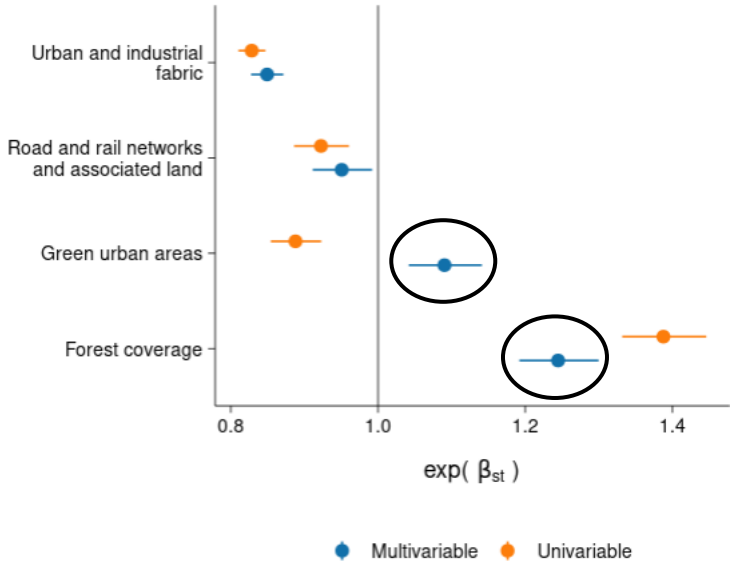




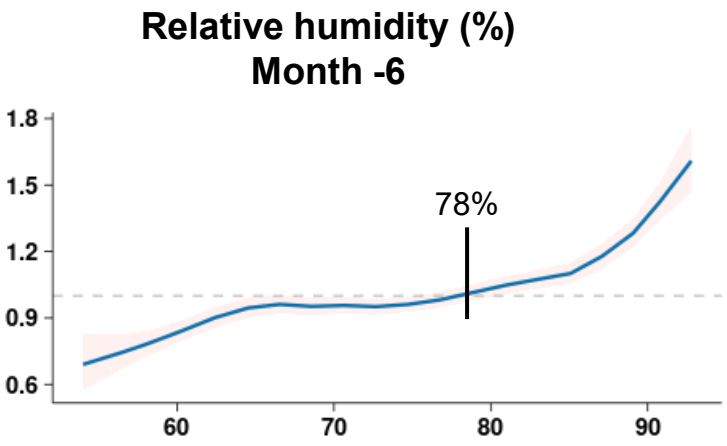
Climatic and environmental associations

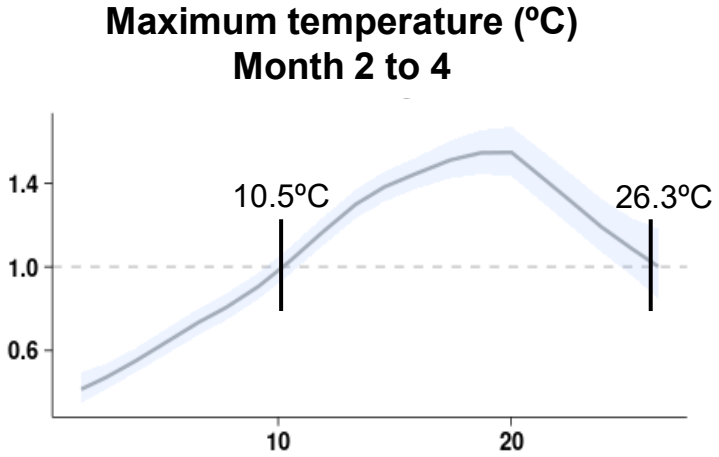


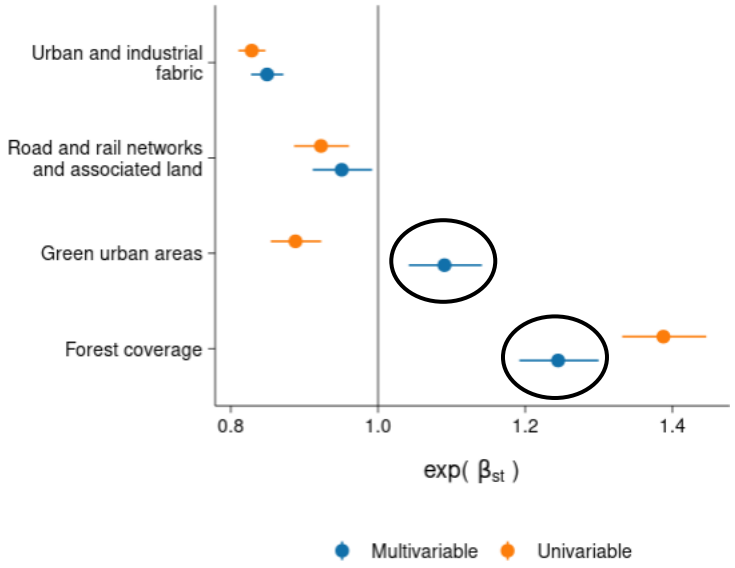


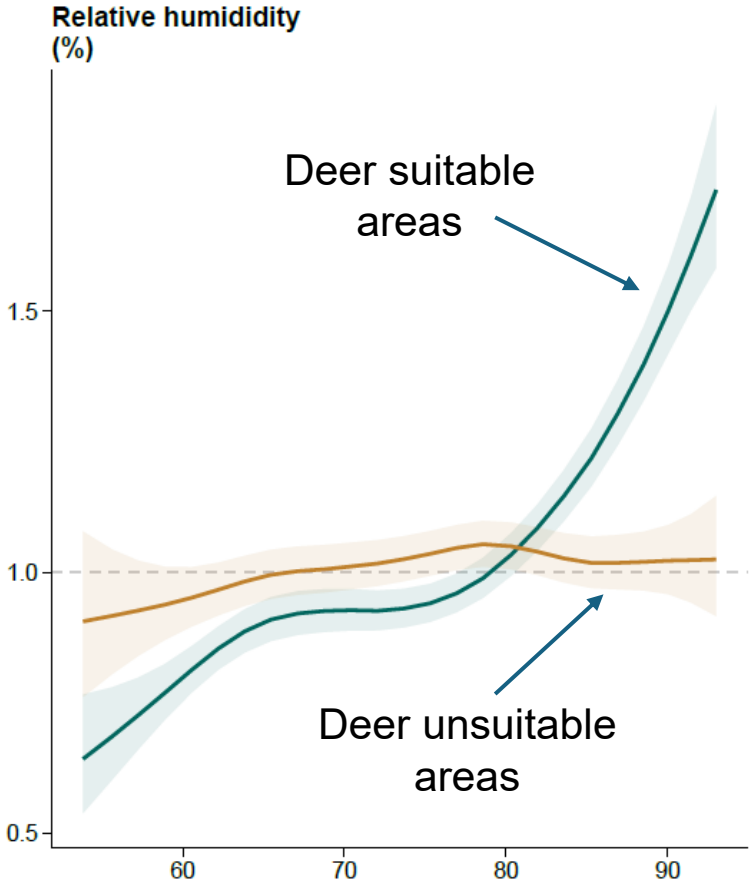


Climatic and environmental associations



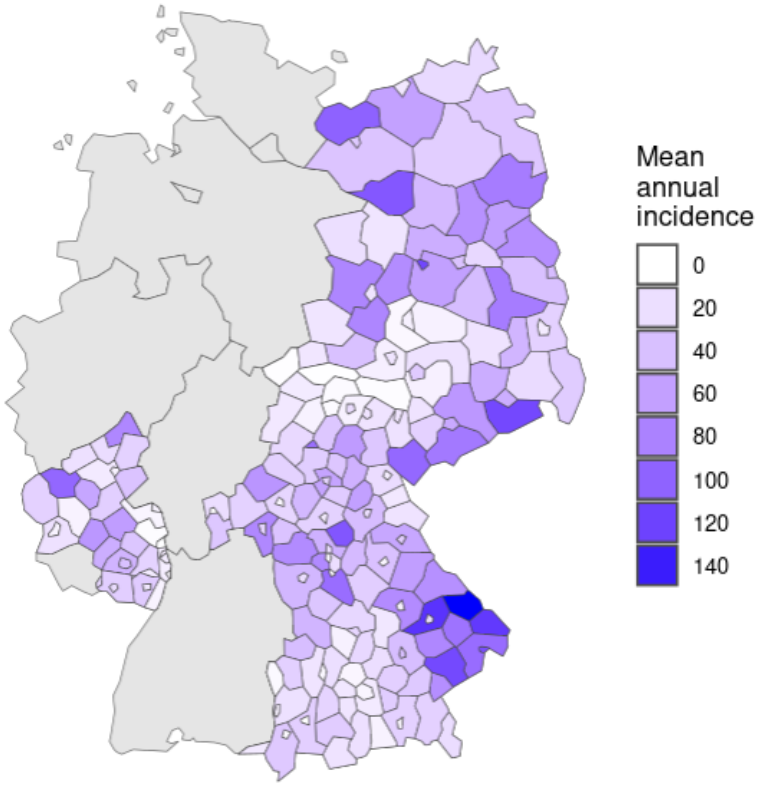




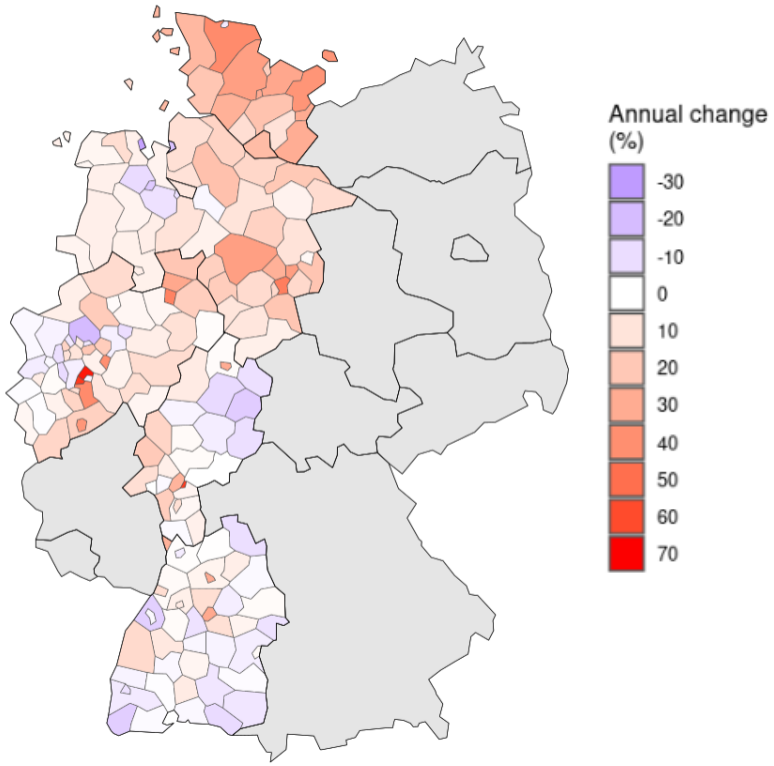


Areas without mandatory notification

2019-2022

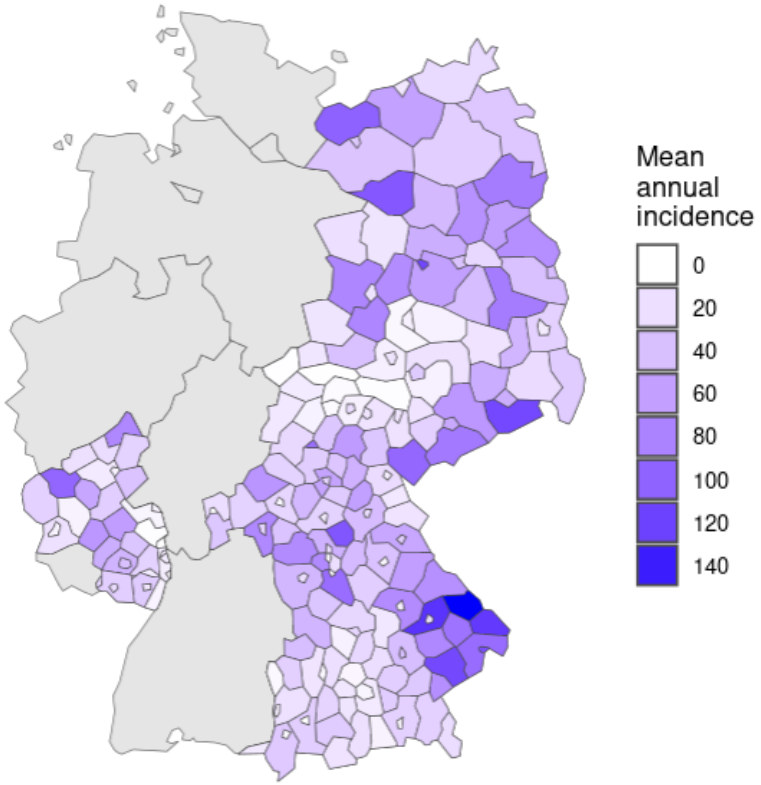


Areas without surveillance

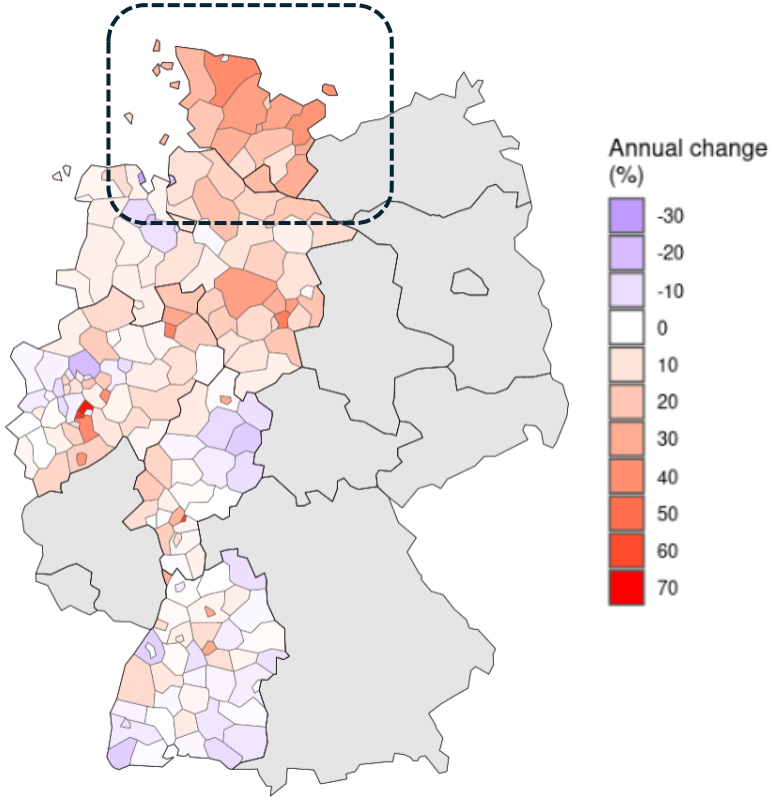


Areas without mandatory notification

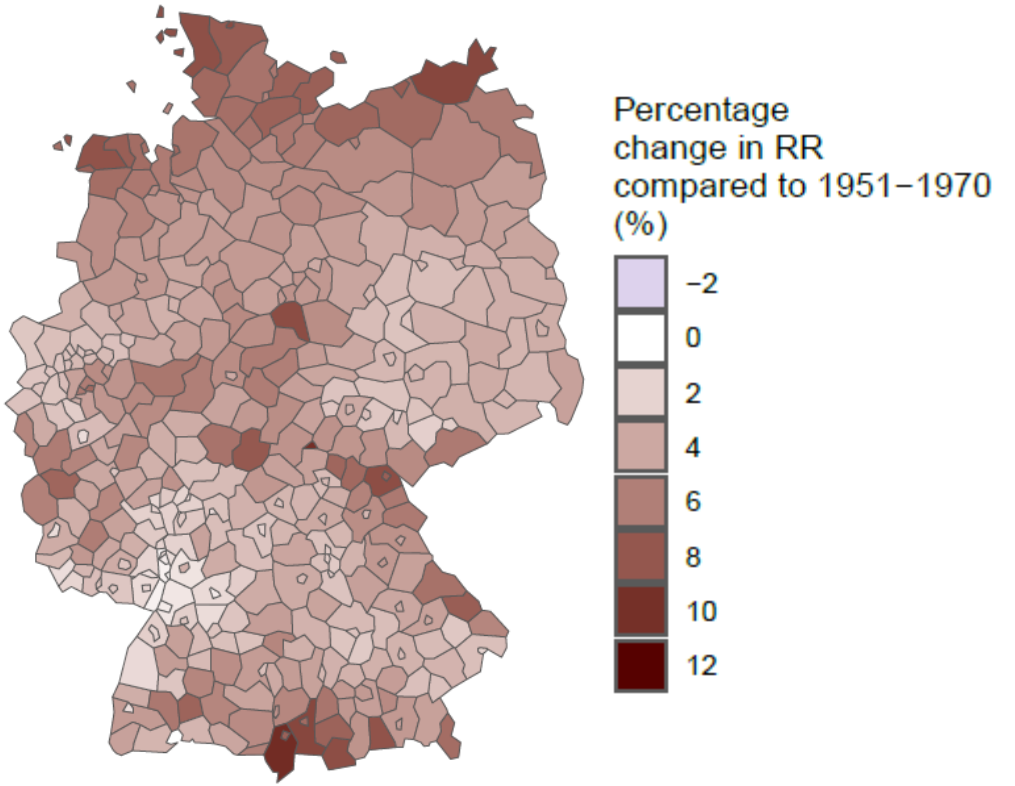
2019-2022

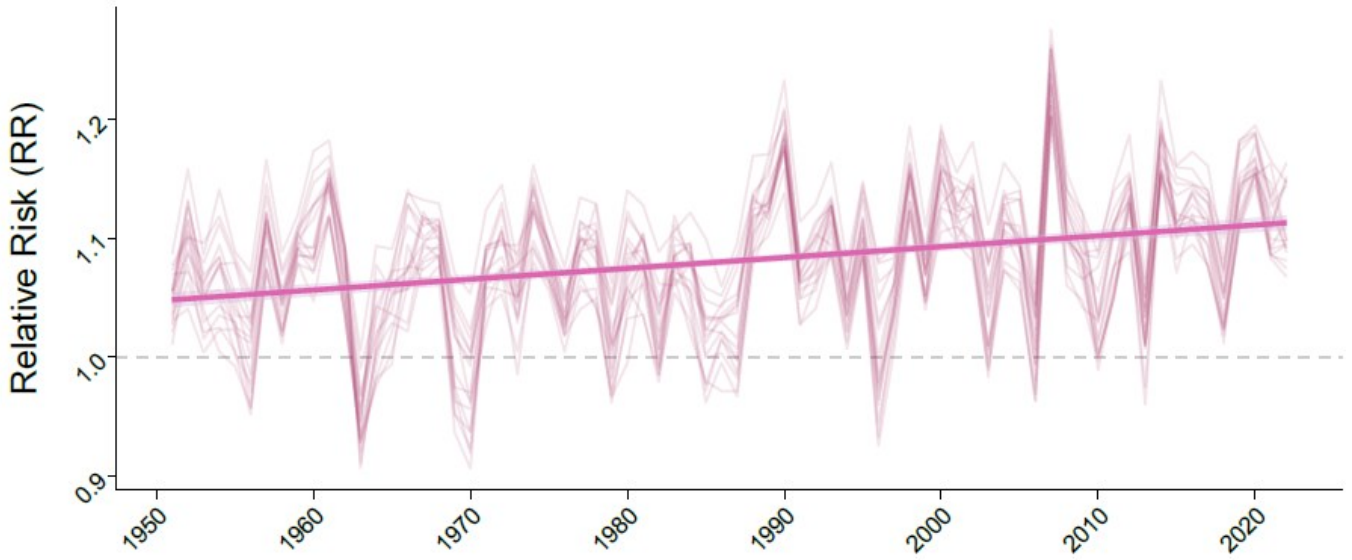


Areas without surveillance



Long-term trends



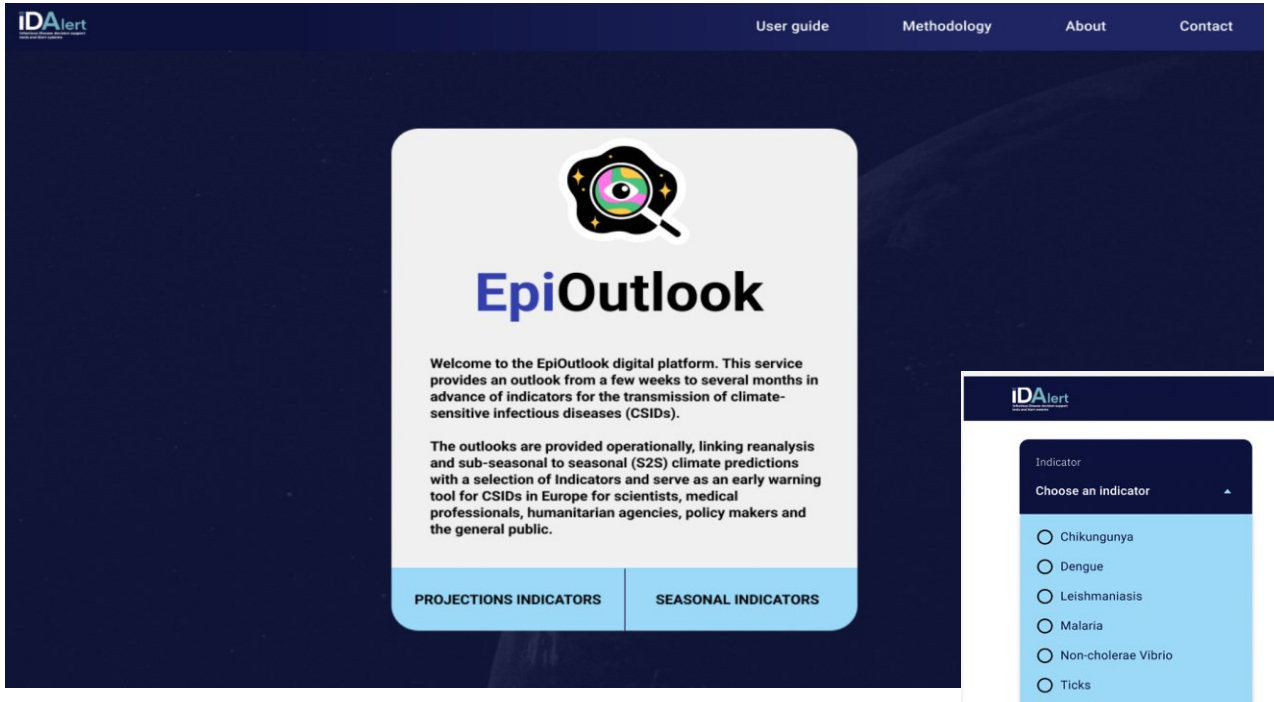


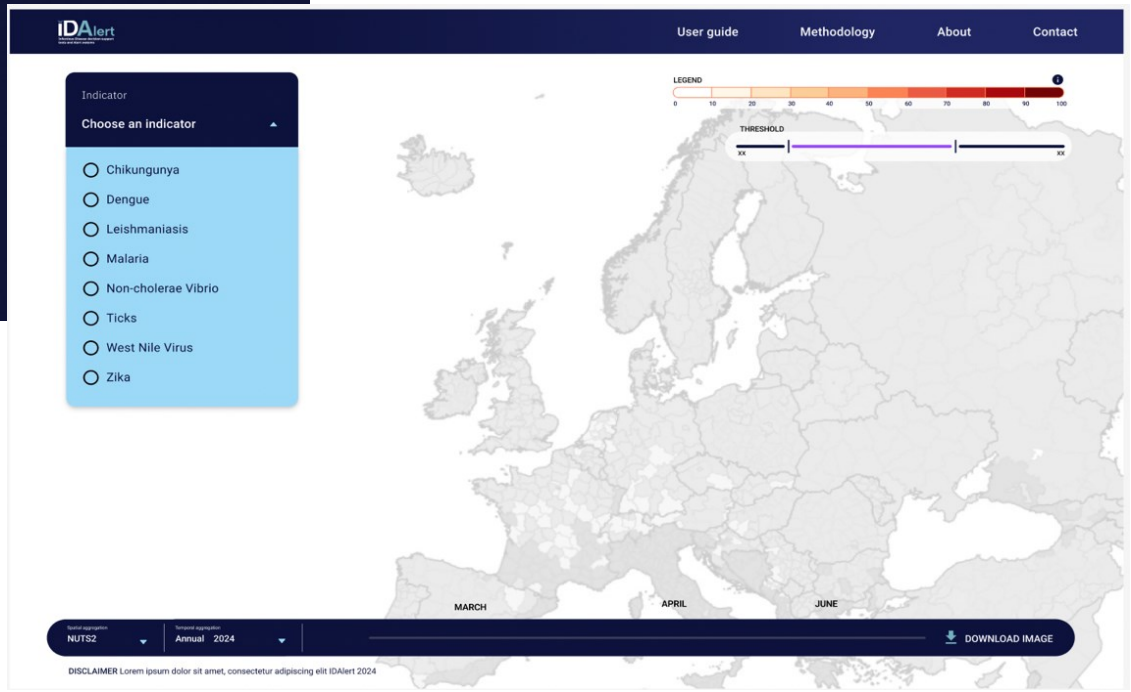
Public health implications

Tailored interventions

- Urban planning
- Awareness campaigns
- Nationwide surveillance system

Outlook





Funded by the European Union

climate-health cluster

Conclusions

How can we deliver actionable, tailored information to address public health needs across various scales and settings?

- Added value of integrating climate data into public health surveillance systems
- Disease risk prediction models to support evidence-based decision-making
- Required integration with public health agencies and stakeholders for coordinated action

Thank you

Martín Lotto Batista, PhD
martin.lotto@bsc.es

Barcelona Supercomputing Center
Centro Nacional de Supercomputación