

Suitability of Anthrax in the Black Sea Basin through the scope of distribution modelling

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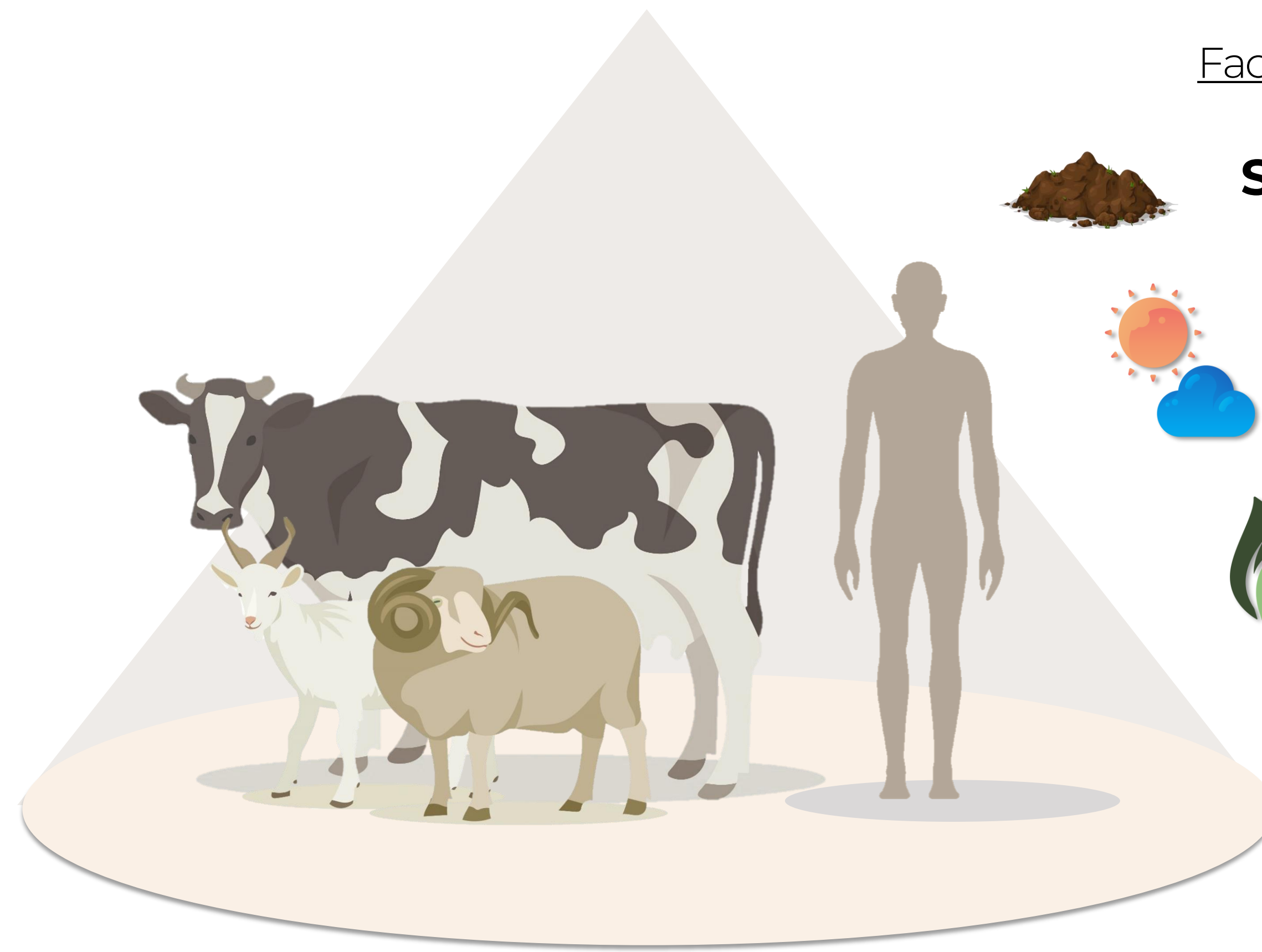
Bacillus anthracis

It is a spore-forming bacterium, for which the most susceptible hosts are **domestic and wild ruminants**.

It causes **↑ mortality rates** and **presents a public health threat**.

Anthrax spores germinate once ingested,
 → vegetative cells rapidly replicate,
 → produce exotoxins,
 → lead to septicaemia and death.

Human infection happens through contact with infected animals or carcasses.



Factors influencing the distribution of anthrax

SOIL is the main reservoir of anthrax

ENVIRONMENTAL CONDITIONS

Temperature & Moisture

VEGETATION

RUMINANTS are likely to be infected while grazing, ingesting forage and contaminated soil

- dead infected bodies may contaminate the environment

AIM: To predict the potential suitability of anthrax in the Black Sea basin

1 How?

Ecological Niche Modelling (ENM)

was used to predict suitable environments for *B. anthracis*, using a

Maximum entropy approach

MaxEnt software is a machine-learning algorithm based on:

[Anthrax •] occurrence data
 background information
 obtained from a defined
calibration region



When & Where?

92 anthrax occurrences from 2015 to 2021 in **9 countries of the Black Sea basin**

2

We built
3 ENM approaches

- Joint PCA's ENV+VEG+SOIL
 - continuous
 - threshold (5%)
 - uncertainty
- Individual PCA's ENV+VEG+SOIL
 - continuous
 - threshold (5%)
 - uncertainty
- Individual PCA's ENV+VEG+SOIL+#RUMs
 - continuous
 - threshold (5%)
 - uncertainty

3

The **BEST MODEL** was selected, based on Parameter information and Statistical ground

was the 3rd model approach

The inclusion of ruminant abundance improved the model predictive ability

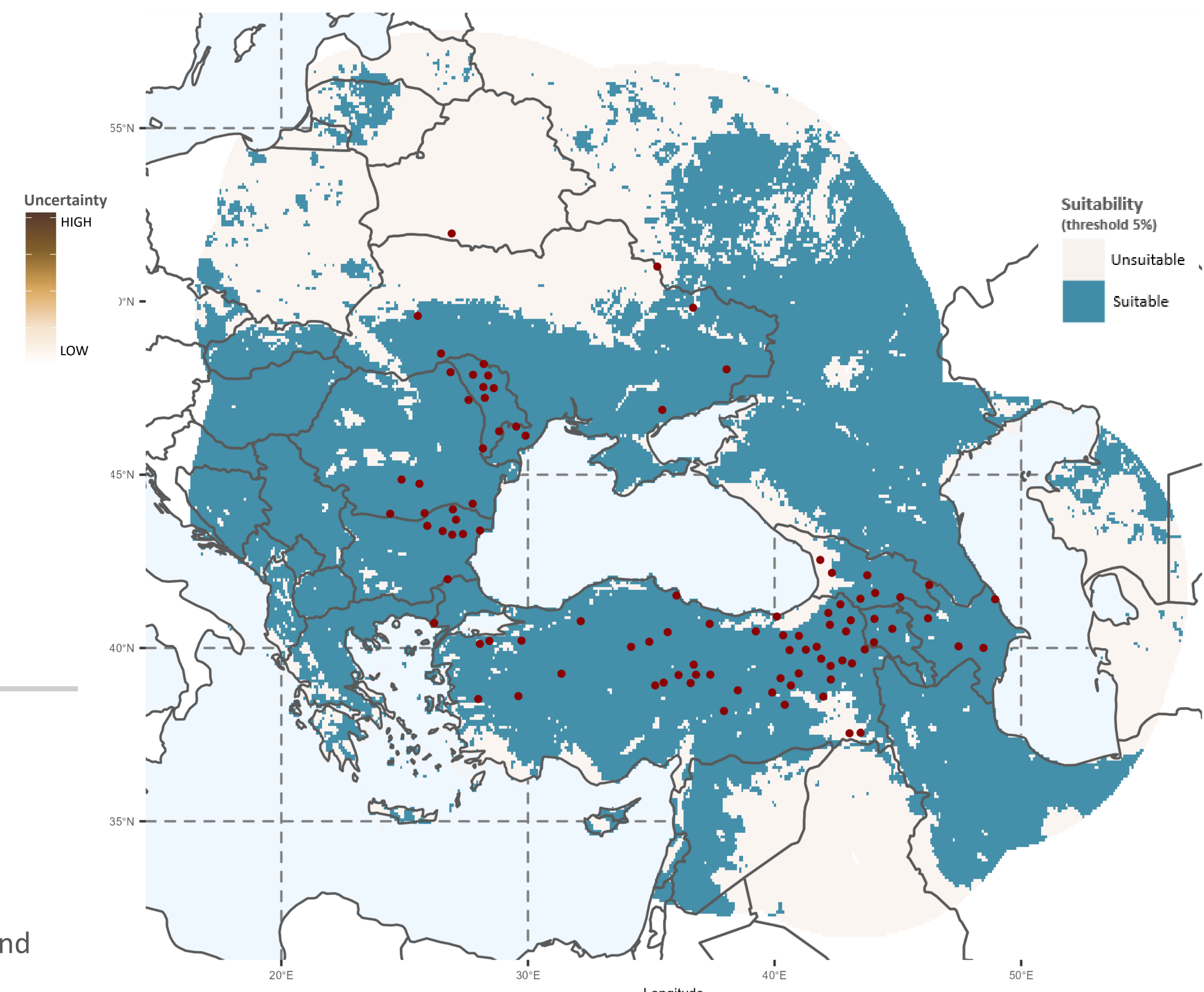
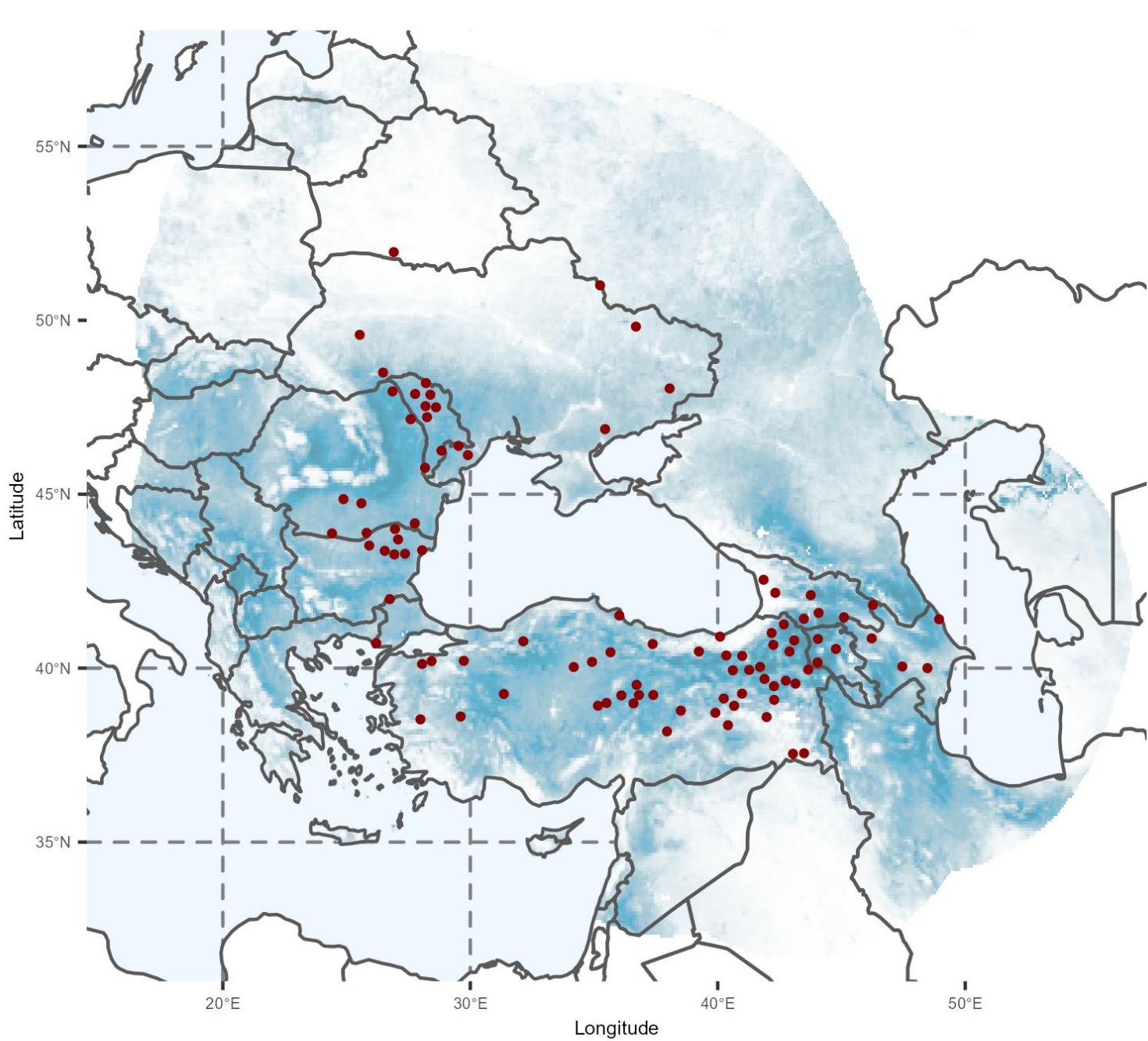
Domain	Variables
SOIL	Soil Organic Carbon Nitrogen Cation exchange pH
ENV	Environment Temperature Moisture BIO1 to BIO7 BIO10 to BIO17
VEG	Vegetation Enhanced vegetation index
RUMs	Ruminant abundance Number of cattle km ² Number of sheep km ² Number of goats km ²

Results

Continuous model

Model Uncertainty

Threshold model



Discussion & Conclusion

- The selected model includes No. of RUMs plus ENV, SOIL and VEG, which suggests the importance of ruminants for the anthrax cycle in the studied region.
- Suitable areas for anthrax can be found across all the countries surrounding the Black Sea.
- Regions depicting suitability with low uncertainty include the east and west areas of the studied region encompassing some Balkan countries (east Bulgaria, North Macedonia, Kosovo, west Serbia), Hungary and the studied areas of Iran and Russian Federation.