Climate change influences on the potential geographic distribution of the disease vector tick *Ixodes ricinus*

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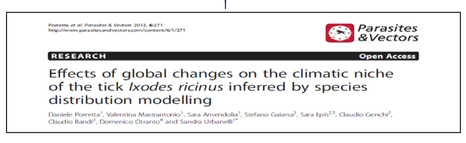
Background

- *Ixodes ricinus* is a species of hard tick that transmits several important diseases in Europe and North Africa, including Lyme borreliosis and tick-borne encephalitis.
- Climate change is affecting the geographic distributions and abundances of arthropod vectors, which in turn influence the geographic distribution and epidemiology of associated vector-borne diseases.
- To date, few studies have investigated effects of climate change on the spatial distribution of *I. ricinus* at continental extents.
- We assessed the potential distribution of *I. ricinus* under current and future climate conditions to understand how climate change may influence the geographic distribution of this important tick vector and associated tick-borne pathogens in coming decades.

MATERIALS & METHODS

Ixodes ricinus records



GBIF Global Biodiversity Information Facility

VectorMap
Spatial
Temporal
Vector MosquitoMap TickMap SandflyMap MiteMap FleaMap
Host/Reservoir HostMap
Vector VectorSurv

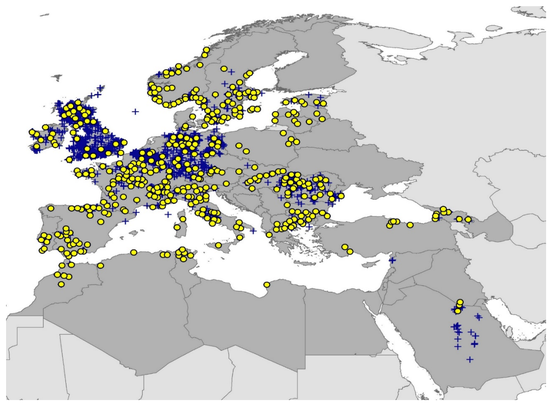
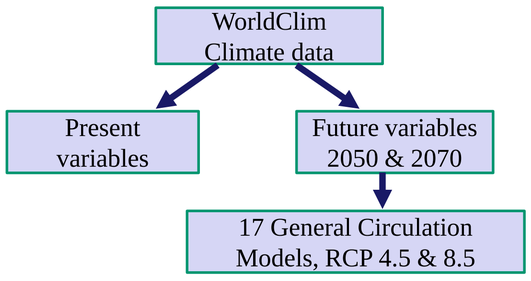
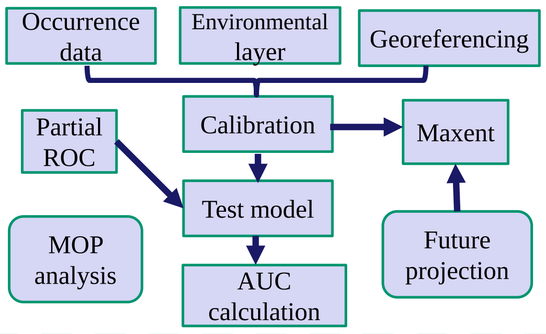


Fig1. Map showing occurrence points of *Ixodes ricinus* derived from various sources. Yellow circles indicate points retained after distance filtering.

Environmental data



Ecological Niche Modeling



Results

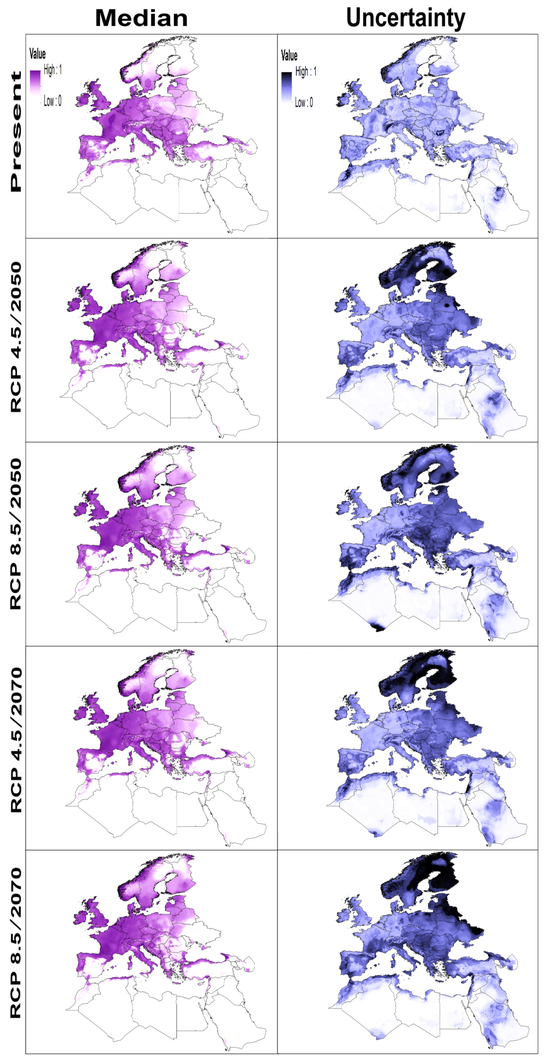


Fig 2. Current and future potential distribution of *Ixodes ricinus* based on present-day and future climatic conditions. Left-hand maps show potential distributions, whereas right-hand maps indicate the uncertainty.

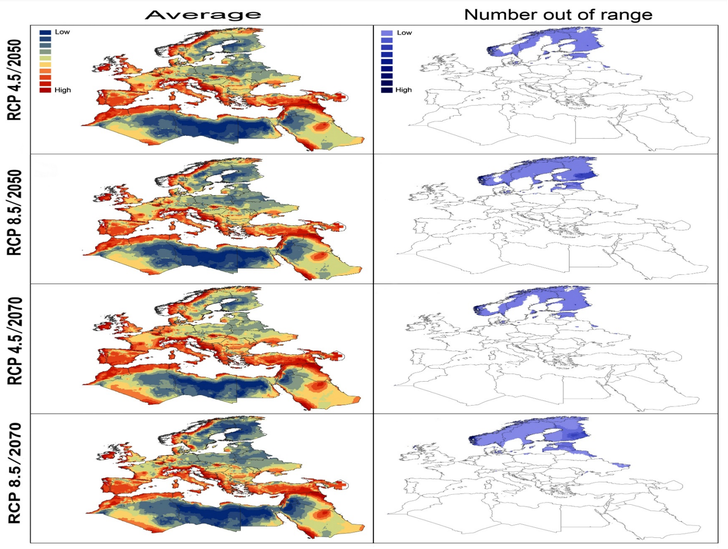


Fig 4. MOP calculations for model transfers from present to future climate scenarios for 17 GCMs (RCP 4.5 and RCP 8.5) in 2050 and 2070. Left-hand panels show the average MOP distance among models (dark red represents high average and dark blue represents low average). Right-hand panels show the number of models out of range (dark blue represents areas with most frequent strict extrapolation).

Discussion

- Our models anticipated potential range expansions more broadly in northern Europe, with milder winter conditions as temperature increases.
- In Sweden, for example, the climate has changed to be significantly warmer in the last 3 decades: the 8 warmest Novembers on record were between 2000 and 2009.
- Given that various tick-borne diseases cause serious health problems, predicting future suitable areas for *I. ricinus* can help to guide plans to manage and mitigate effects of these health threats.

Acknowledgment

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