Ticking time bomb: New modeling predicts huge increase in ticks across Scotland

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Credit: Erik Karits from Pexels

The prevalence of ticks in Scotland will increase by a quarter under the most optimistic climate change scenario, according to new modeling by mathematicians at the University of Stirling.

The paper "GIS-ODE: linking dynamic population models with GIS to predict pathogen vector abundance across a country under climate change scenarios" was published in the *Journal of The Royal Society Interface*.

Ticks are tiny spider-like creatures usually found in grassy and wooded areas that can spread viral and bacterial infections, including Lyme disease.

If global temperatures are limited to 1°C by 2080, the prevalence of ticks will increase by 26%, but under the 4°C temperature rise scenario, the number of ticks will almost double—a 99% increase—by 2080.

Only the highest peaks in Scotland will remain too cold for maintaining tick populations if temperatures rise by 4°C, according to the research.

World leaders promised in 2015 to try to limit the long-term temperature rise to 1.5°C to help avoid the most damaging impacts.

Mathematicians in the University of Stirling's Faculty of Natural Sciences developed a new model which predicts tick density under varying climate change scenarios and produced maps which show which areas of Scotland will be worst affected.

Professor Rachel Norman, who led the study, said, "The model predicted an increase in tick densities and a spread of tick distribution over Scotland for all climate warming scenarios by 2080.

"The strength of these predicted increases in tick density varied depending on the habitat. While woodland habitats were predicted to experience the highest absolute increases, the largest proportional increases were predicted for the slopes of mountains, known as montane habitats.

"Many of these areas that were predicted to be tick-free under recent climatic conditions were predicted to become warm enough to allow sustained tick populations by 2080."

Pioneering approach

Professor Norman and her team developed a powerful tool that is dynamic and mechanistic, yet mathematically relatively simple, so it can be adopted by non-specialists. In the future, it could be adapted to predict disease risk.

Professor Norman said, "Scotland is an ideal country for pioneering this approach as the issue of ticks and tick-borne disease risk is of increasing concern with reported increases in tick abundance and Lyme disease incidence.

"This modeling has allowed us to identify which geographic areas and habitats might be particularly vulnerable to increased tick densities owing to climate warming.

"While we developed the approach to predict tick densities over Scotland, it could be easily used for other areas and other vector species, and pathogens could be added to the model, enabling predictions of disease risk.

"Indeed, this methodology could be used more broadly to understand the dynamic response of populations over time to a variety of environmental changes and provides a neat new method in the modeling toolbox for researchers to choose from."

More information: A. J. Worton et al, GIS-ODE: linking dynamic population models with GIS to predict pathogen vector abundance across a country under climate change scenarios, *Journal of The Royal Society*

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