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Is climate change increasing viral disease in farm animals?

Since 1998, there have been increasing outbreaks of the viral disease Bluetongue among European livestock. Using a newly developed climate-based model that accurately predicts past outbreaks, researchers have provided evidence that climate change is a major driver of these outbreaks.

Bluetongue (BT) is a viral disease of ruminants (which include sheep and cattle) spread by biting midges. For some time it has been widely distributed in Africa, Asia, Australia, South America and North America. Until recently, it was very rare in Europe, but in 1998, an unprecedented series of outbreaks began, causing the deaths of millions of animals and serious economic impacts. Scientists have proposed that changes in climate may be partly responsible. Furthermore, since it has emerged only recently, scientists believe BT provides a good example for the development of models to describe how climate change may influence diseases in the future.

The study, partly supported by the EU CIRCE project[1], developed a framework to evaluate the effects of past and future climate on the risk of the emergence of BT. The framework integrated climate data into a disease transmission model and evaluated whether the model could reproduce accurately past outbreaks of BT. Good correspondence between the model and historic records suggests that climate was influencing the increase in outbreaks. Sheep and cattle were considered as these are present in large numbers; data on midge abundance was provided by the Spanish BT national surveillance programme. Past climate data from 1961-2008 was derived from a dataset of observed temperature and rainfall, and future climate data from model simulations provided by ENSEMBLES[2] data.

The climate-driven model explained both spatial and temporal variations in the recent emergence and spread of BT in Europe. This included the 2006 BT outbreak in northwest Europe, which occurred in the year that the model predicted the highest risk since at least 1960. The model also provided insight into the role of drivers in different parts of Europe. For example, in northwest Europe temperature is a major driver of disease risk, whereas in southwest Europe the situation is more complex. In southwest Europe, if rainfall is low then increases in temperature will lead to a decrease in risk of BT outbreaks, and if rainfall increases, higher temperatures will lead to an increase in risk.

The model also quantified the effects of future changes of climate on the risk of BT transmission. Results suggest that by 2050 the number of secondary cases arising from the introduction of one infected animal will increase by 30% in northwest Europe and by 10% in southwest Europe.

The researchers highlighted some weaknesses in the model, such as the lack of species-specific data of the different types of midges, including biting rate, incubation period and mortality rate. They also suggested the data on midge abundance was questionable as it relied on midges caught in light traps, which might not represent the population. Lastly, there was no accounting for lags in the model which presumes a near-instant impact of changes in climate. Nevertheless, the framework successfully describes past outbreaks of BT in Europe, provides predictions for the future and could be applied to other diseases.

1. CIRCE (Climate Change and Impact Research: The Mediterranean environment) was supported by the European Commission under the Sixth Framework Programme. See: www.circeproject.eu
2. ENSEMBLES was supported by the European Commission under the Sixth Framework Programme. See: www.ensembles-eu.org

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