TBE RISK MODELLING AT NATIONAL SCALE, GREAT BRITAIN

Background:

Since the first detection of tick-borne encephalitis (TBE) virus in ticks in the United Kingdom in 2019, several autochthonous human cases have been reported (see, e.g., the February 2025 Newsletter). To effectively target preventive measures, particularly public health awareness, an improved understanding and mapping of environmental conditions that favor the formation of TBE virus foci is essential. A recent study aimed to develop risk maps to support public health authorities in tailoring surveillance, identifying potential risk areas for human exposure, and guiding awareness-raising efforts and vaccination policies.

Method & Results:

In Europe, natural TBE virus cycles occur within forested areas and adjacent meadow biotopes, where small mammals such as bank voles (*Myodes glareolus*) and yellow-necked mice (*Apodemus flavicollis*) play a role in virus maintenance. Additionally, deer species are thought to contribute significantly to the TBE virus cycle by serving as key reproduction hosts for *Ixodes ricinus* ticks.

Between 2018 and 2021, a total of 3,348 blood samples from deer across 1,307 sites in England and Scotland were analyzed using ELISA testing. Four deer species were included: fallow deer (*Dama dama*), red deer (*Cervus elaphus*), muntjac deer (*Muntiacus reevesi*), and roe deer (*Capreolus capreolus*). TBE-ELISA results were mapped at a 1 x 1 km resolution and summarized by species.

Of the samples received:

- 52 of 361 fallow deer samples tested positive
- 38 of 228 muntjac deer samples tested positive
- 56 of 822 roe deer samples tested positive
- 38 of 352 red deer samples tested positive

Positive cases were detected in both England and Scotland, with 66% of the positives concentrated in Norfolk, Hampshire, and Suffolk.

Environmental predictors such as mean annual surface temperature and the rate of spring warming (measured from February to April) had the greatest influence on the likelihood of TBE virus exposure in deer. The percentage of coniferous woodland in a given area was also found to be a significant factor. For roe and fallow deer in particular, deer occupancy—defined as the likelihood of multiple species co-occurring—also played an important role.

Overall, deer were more likely to test positive for TBE-ELISA in areas with a high proportion of coniferous woodland, faster spring warming, higher mean annual temperatures, and in regions where multiple deer species are likely to coexist.

The predicted probability of TBE virus occurrence based on deer exposure was overlaid with data on recreational demand (e.g., estimated weekly or annual visits to natural areas for holidays) across Great Britain. This allowed the identification of locations where both TBE virus exposure risk and human recreational activity are high. Based on this model, high-risk areas were found primarily in the south and east of England, as well as in South Wales.

Discussion:

This study combined serological surveillance of four ecologically distinct wild deer species with spatial risk modeling that incorporated a wide range of climatic, ecological, and land-use variables. The findings provide new insights into the conditions that support the emergence of TBE virus foci in Great Britain and help identify potential hotspots of human exposure. emerging TBE risk areas.

SEROPREVALENCE AND INFECTION INCIDENCE OF TBE VIRUS IN SWITZERLAND

The resulting TBE virus suitability maps offer a valuable tool for public health authorities to prioritize surveillance, enhance public awareness, and inform vaccination policy in areas of elevated risk.

Literature:

Hassall et al.
Identifying hotspots and risk factors for tick-borne encephalitis virus emergence at its range margins to guide interventions, Great Britain. *Euro Surveill.* 2025;30(13):pii=2400441. doi:10.2807/1560-7917.ES.2025.30.13.2400441.

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