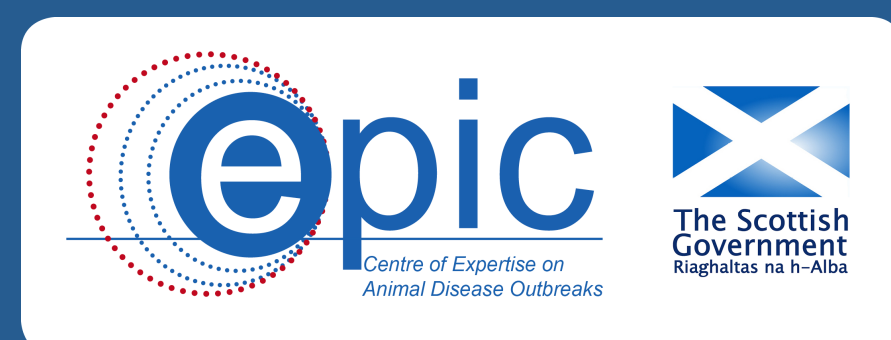


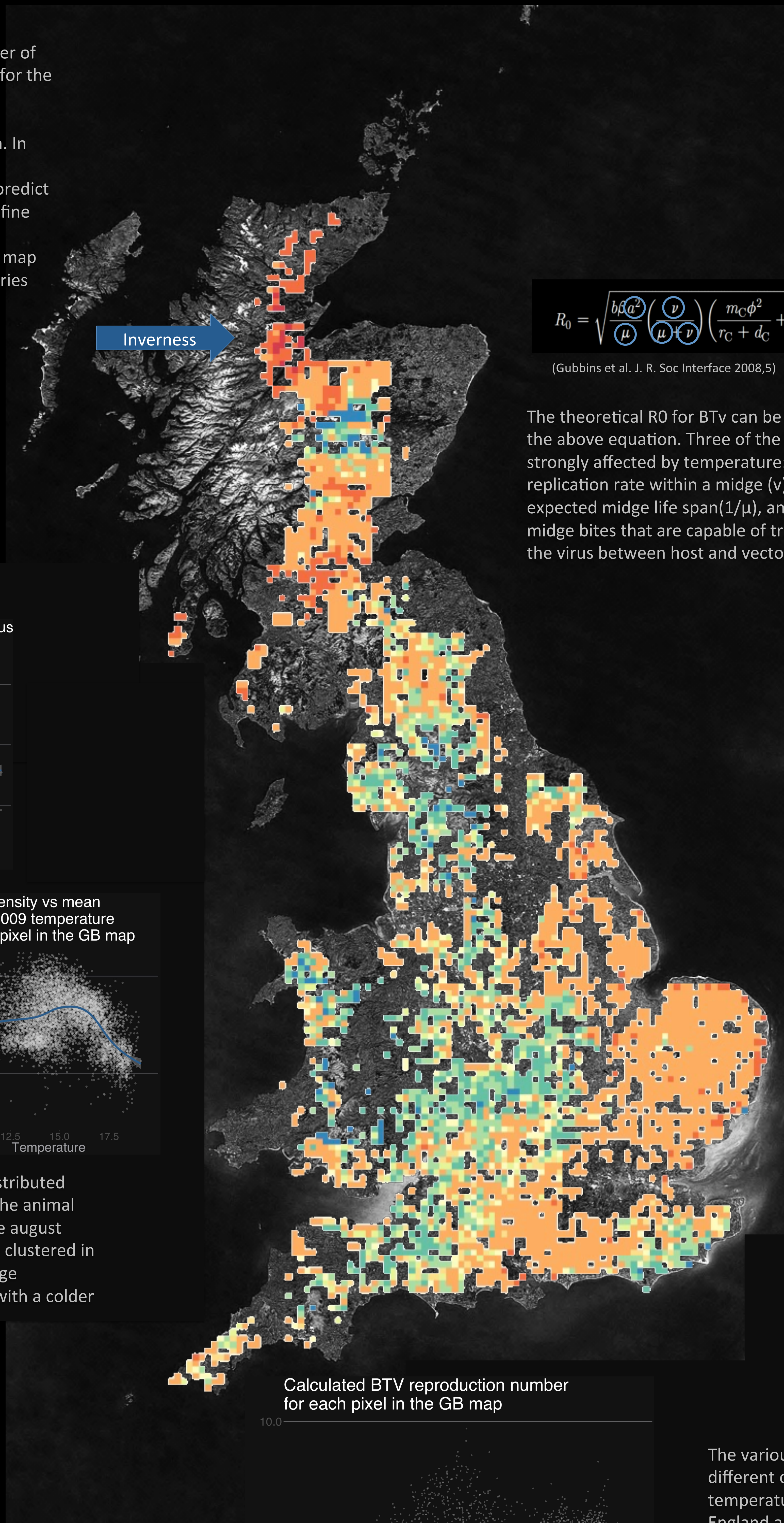
What is the potential for BTV spread in GB and how is it affected by temperature and midge abundance?

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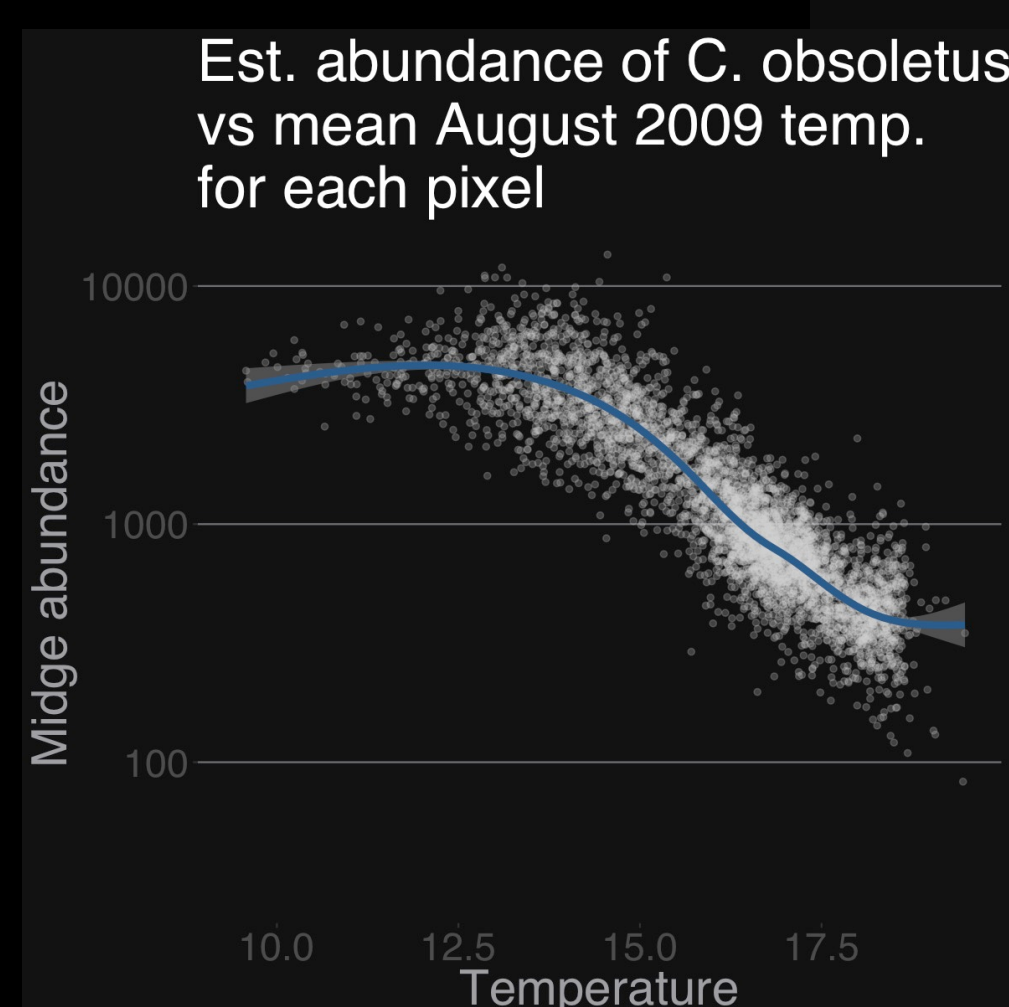
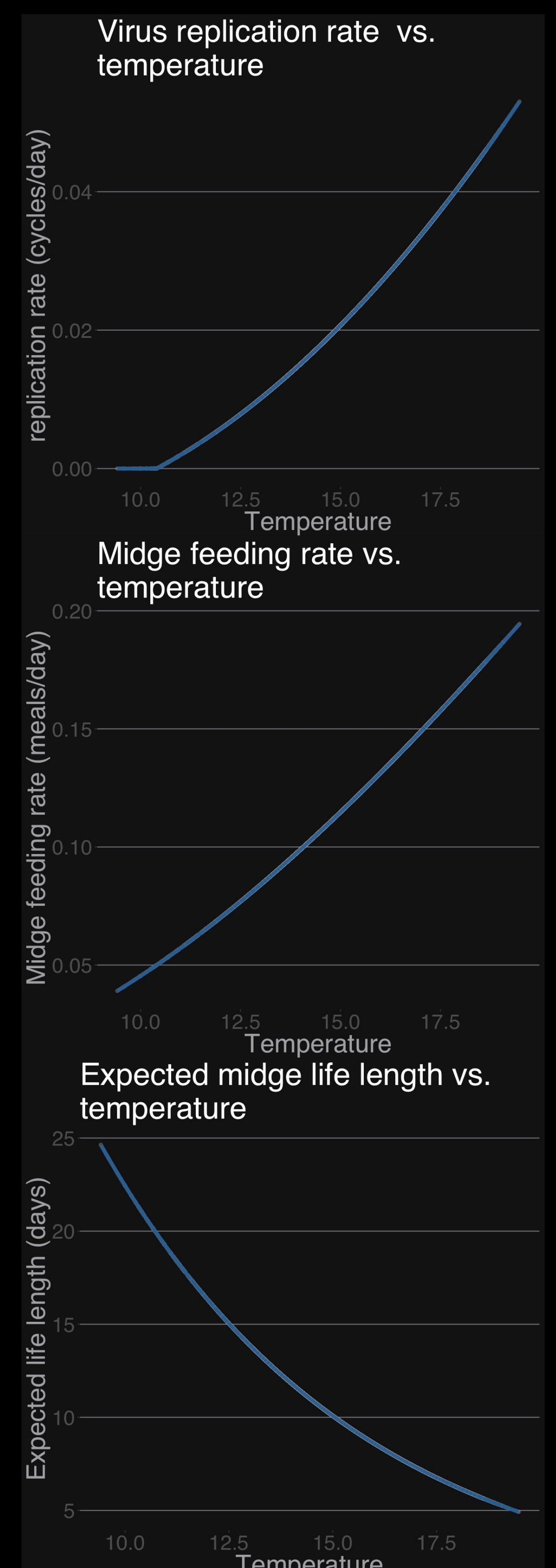
In the last few years, there has been a number of outbreaks of BTV in France, causing concern for the potential of a new UK introduction. Previous models of BTV spread have often assumed a constant midge density, due to a lack of data. In this work, we used environmental data and surveillance data of *Culicoides obsoletus* to predict the maximum annual midge abundance at a fine spatial scale. Model predictions were then combined with climate and livestock data to map how the reproductive number (R_0) of BTV varies across Great Britain.



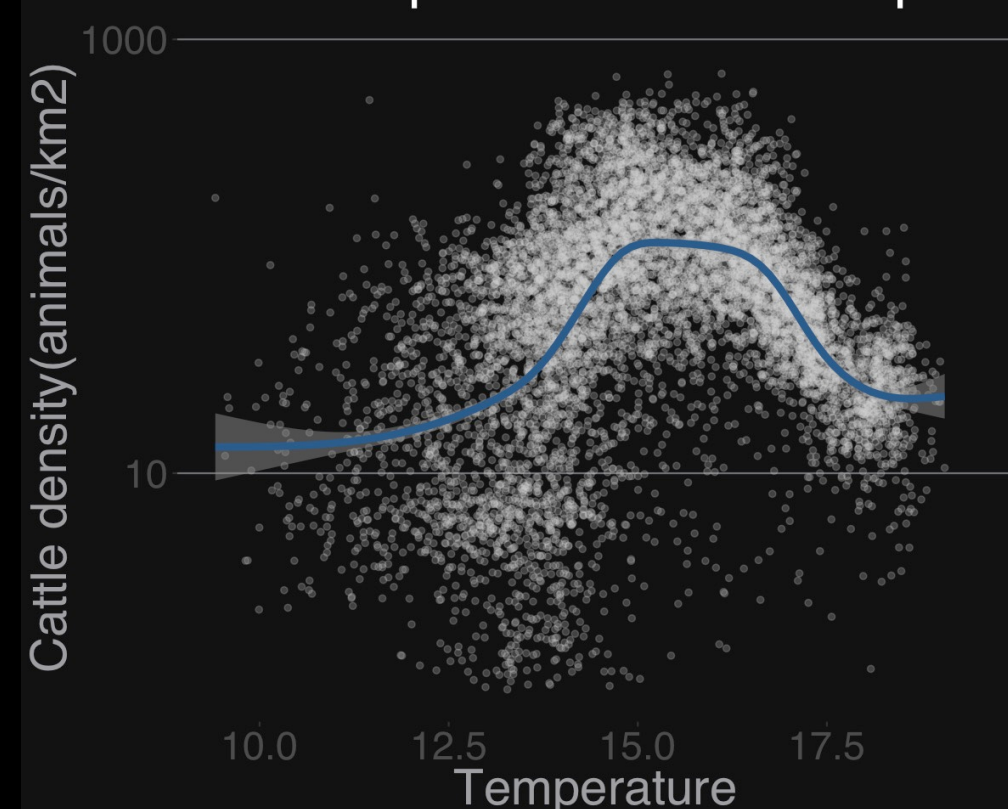
$$R_0 = \sqrt{\frac{b\phi a^2}{\mu}} \left(\frac{v}{\mu} \right) \left(\frac{m_C \phi^2}{r_C + d_C} + \frac{m_S (1 - \phi)^2}{r_S + d_S} \right)$$

(Gubbins et al. J. R. Soc Interface 2008,5)

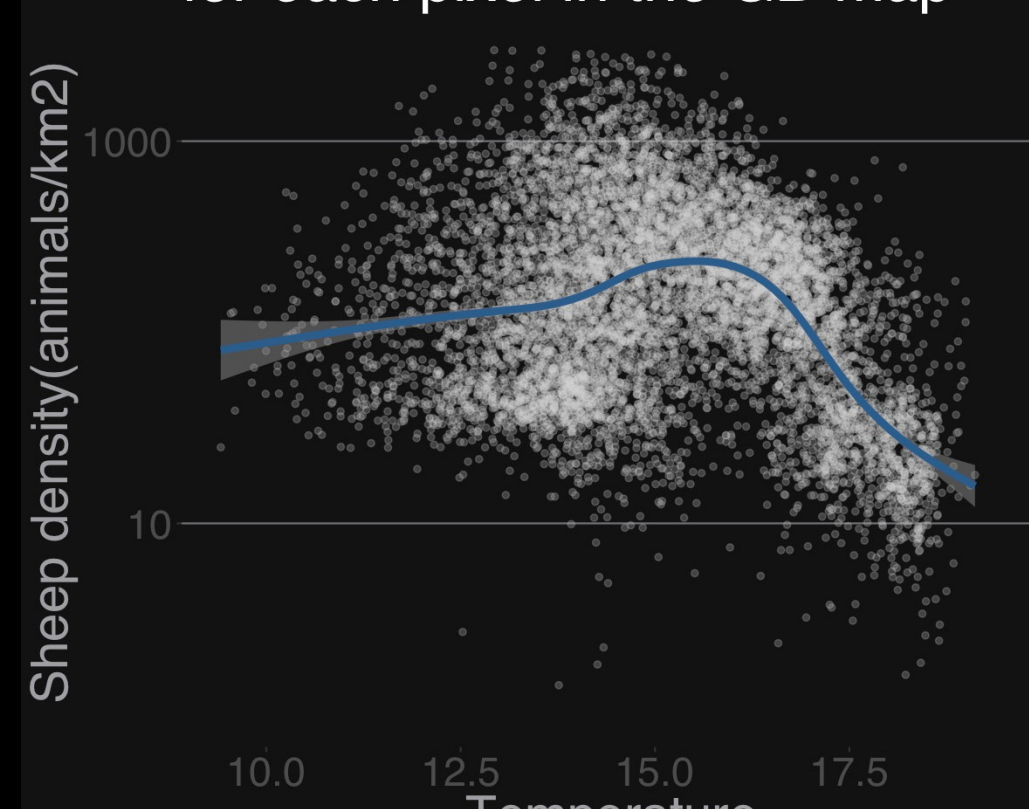
The theoretical R_0 for BTV can be calculated by the above equation. Three of the variables are strongly affected by temperature: the virus replication rate within a midge (v), the expected midge life span ($1/\mu$), and the rate of midge bites that are capable of transmitting the virus between host and vector (a).



Cattle density vs mean August 2009 temperature for each pixel in the GB map

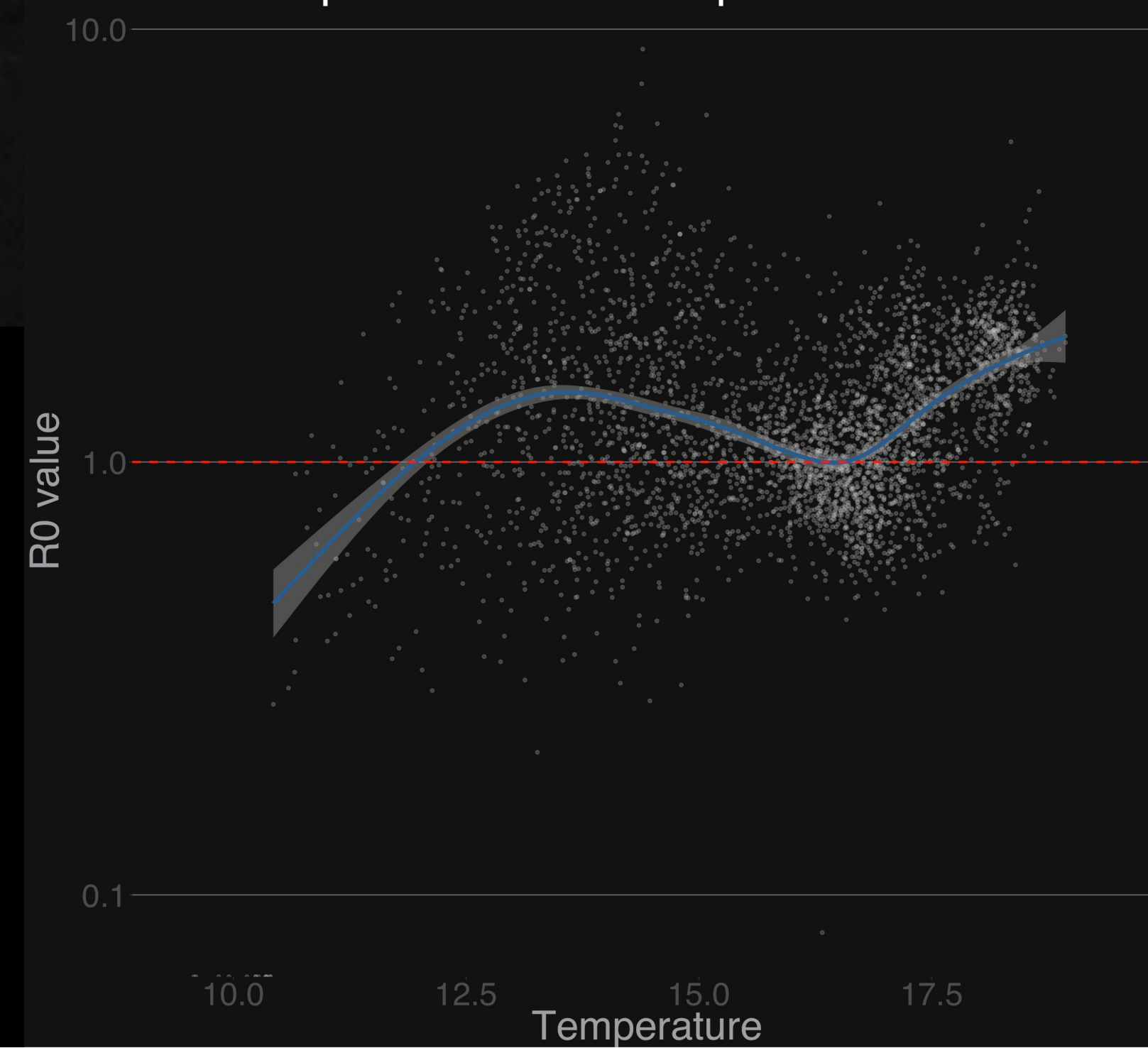


Sheep density vs mean August 2009 temperature for each pixel in the GB map

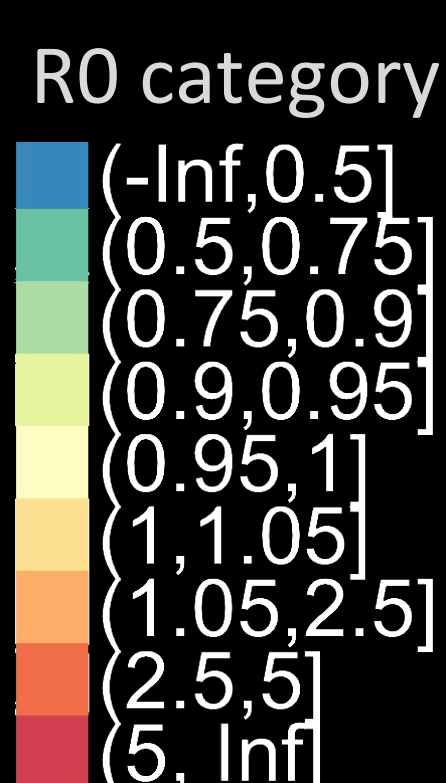


Cattle and Sheep herds are unevenly distributed across the country. The above plots of the animal density in each pixel against the average August temperature, indicate that livestock are clustered in regions with medium climate while midge abundance tend to be highest in areas with a colder climate.

Calculated BTV reproduction number for each pixel in the GB map



The various factors affecting BTV spread are pulling in different directions, causing a bimodal curve of R_0 vs. temperature. The results indicates that both Southeast England and Northern Scotland are highly suitable for BTV spread, and that the intermediate region is less suitable. BTV has never been introduced in Scotland, so these model results cannot be fully evaluated, but they nevertheless could have implications for the management of future BTV epidemics.



(Map showing estimated R_0 in August 2009)