Modelled decay of BSE prion infectivity buried in landfills 30 years ago.

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Introduction

- In the 1980s and 1990s there was an outbreak of bovine spongiform encephalopathy (BSE), also known as mad cow disease, in cattle in the UK
  - Abattoir capacity was overwhelmed
  - ~6,000 carcasses buried in 59 landfill sites
  - Max carcass in a landfill = 1,200
- Some of these landfill sites have now been closed and repurposed for other uses
- Prion decay in soil is slow, mostly driven by freeze-thaw and wet-dry cycles
- Could buried carcasses still pose a risk to cattle today?

Risk Questions

- What is the BSE infectivity remaining today in these landfills?
- What is the likelihood of cattle being exposed to BSE infectivity from these buried BSE prions?

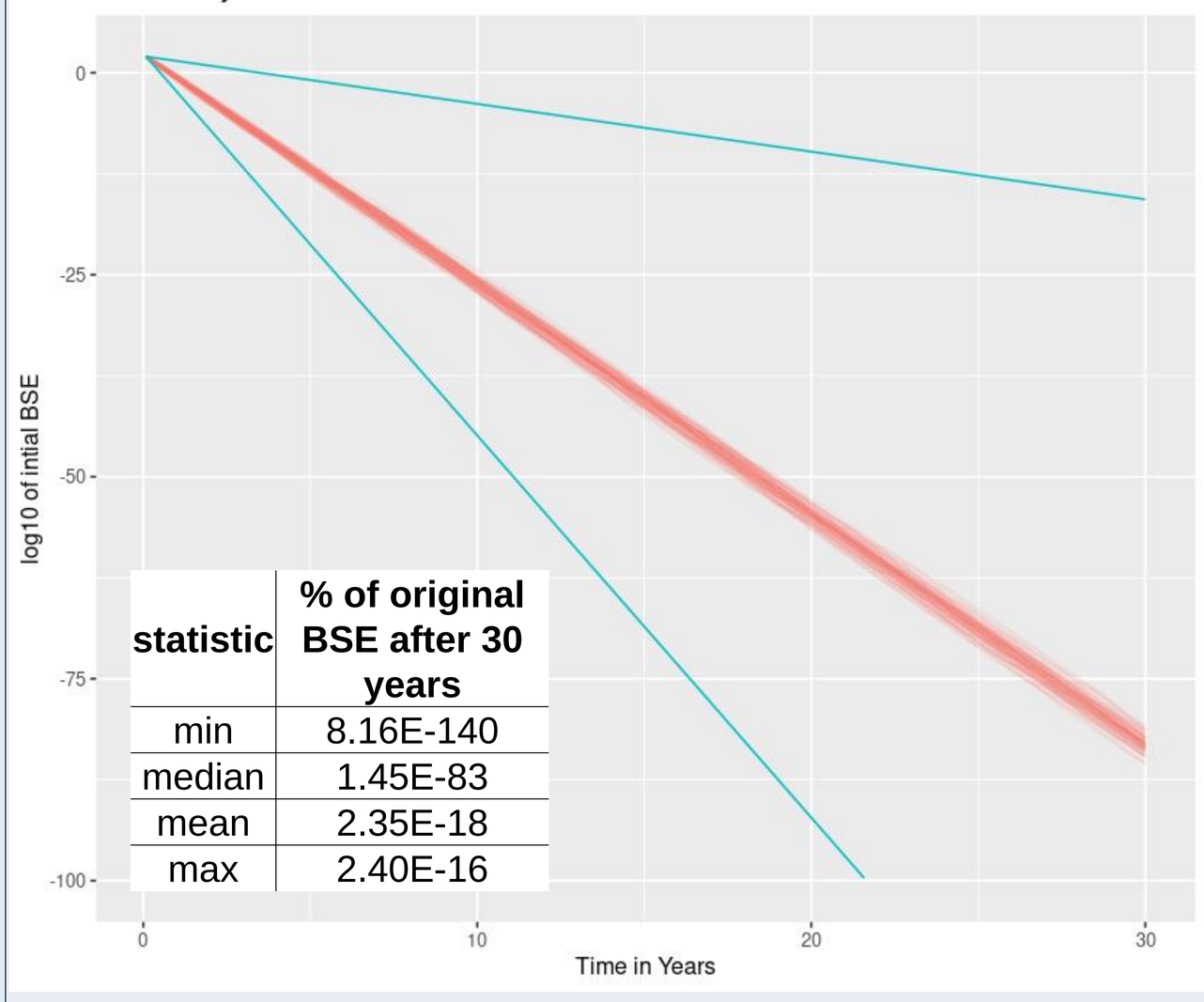
Methods

- Infectivity starts at 1 unit (100% of initial value)
- Scrapie decay rate in soil (fold reduction per month), *D_soilSc* ~ Uniform(1.12,1.18)
- Ratio of scrapie decay to BSE decay, *R_comp ~ Betapert(1,1.5,2.1)*
- BSE decay rate in soil for each month, *D_soilBSE=D_SoilSc*R_comp*
- Min and max decay rates also calculated
- Output = % of initial BSE remaining after X years

Assumptions

- All carcasses deposited at the same time
- Prions instantly enter the soil at burial
- No uptake of prions by vegetation
- Groundwater leachate within safe bounds for dissolved organic carbon

Results



statistic	% of original BSE after 30 years
min	8.16E-140
median	1.45E-83
mean	2.35E-18
max	2.40E-16

Modelled decay of BSE infectivity in landfills over a time frame of two years, with the transformation log10{infectivity} applied to the infectivity output

Conclusions

- *Worst Case scenario*: 1,200 contaminated carcasses with the BSE prion decaying at the median rate
  - Model estimates 5.22 * 10^{-78} bovine oral ID50 units would remain after 30 years
- The likelihood of cattle being exposed to BSE infectivity arising from these buried prions is **very low** with **medium** uncertainty.
- The very low risk is driven by the estimated BSE infectivity decay rate in soil.
- The largest source of uncertainty is whether the decay rate in a landfill environment is the same as in soil; waterlogging and anaerobic conditions may interfere with normal decay

Key References:
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We would like to thank DEFRA for funding this project. Also big thanks to our team members, Verity Horigan, Mark Arnold, and Brenda Rajanayagam.

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