

The role of competition and disease on the replacement of red squirrels by greys

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Since its introduction into the UK, the grey squirrel has ‘replaced’ the red squirrel throughout most of England and Wales, and in parts of Scotland and Ireland. The traditional explanation is that competition with the grey squirrel (principally over food resources) is the primary cause of decline (although theoretical studies have failed to verify this being unable to account for the rate and pattern of red squirrel decline observed). New evidence suggests that a squirrel parapoxvirus may also be important in causing the red squirrel replacement. It has been shown that this virus can cause a deleterious disease in the red squirrel while having no detectable effect on grey squirrel health. Thus the grey squirrel may be acting as a reservoir host for the parapoxvirus and this may provide the missing element from our understanding of the UK red squirrel decline and its ecological replacement by the introduced grey squirrel.

To investigate the role of parapoxvirus in the red squirrel decline the two-host/shared microparasite differential equation model of Bowers & Turner (1997) was modified to make it specifically applicable to the squirrel/virus system. We focus on the time taken to transform the disease-free red squirrel population equilibrium to either the disease-free grey squirrel population equilibrium (when considering competition-mediated replacement) or the grey squirrel population equilibrium with endemic infection (when considering competition/infection-mediated replacement). We also

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develop a spatial model of the squirrel/virus system by linking a grid of patches containing the temporal model equations by dispersal. We use the best available parameters for the squirrel/virus system and examine whether the spatial model with or without the disease could replicate the dynamics of the well documented expansion of grey squirrels and decline of red squirrels that occurred in Norfolk (England) from 1960-1982, for which data is available (Reynolds 1985).

References

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