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Title: Do woodland patch size and connectivity influence tick density, nymph infection prevalence and Lyme Disease hazard through impacts on key tick hosts?

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Zoonotic tick-borne diseases are a rising concern in the UK, with Lyme disease incidence increasing over the last two decades. Changing land use across UK through government policies to expand woodlands and green spaces may affect human risk of exposure to tick-borne diseases by creating more suitable habitats for *Ixodes ricinus* as well as by impacting abundance and movement of key tick hosts such as rodents and deer. We used a systems approach to investigate how changing landscape structure, specifically woodland size and patch connectivity will impact *I. ricinus* densities, pathogen infection prevalence as well as Lyme disease hazard in two contrasting landscapes endemic for Lyme disease pathogens (*Borrelia burgdorferi sensu lato*). We expected larger and more connected woodland patches to have higher tick densities and *B. burgdorferi s.l.* prevalence due to higher host habitat use by tick and pathogen transmission hosts. We also predicted that woodlands would have higher densities of infected ticks than adjacent open habitat due to more suitable habitat and abiotic conditions.

To test this, we sampled *I. ricinus* nymphs from 60 woodlands and 30 adjacent open habitats, across a gradient of woodland patch size and connectivity in Aberdeenshire, Scotland and Dorset, Wiltshire and Hampshire (collectively referred to as Wessex), England and tested the nymphs for infection with *B. burgdorferi s.l.* In addition, we deployed 180 trail cameras in the woodland and open habitats, to measure habitat use of important tick hosts specifically roe, fallow, red and muntjac deer as well as livestock. We used a set of general linear mixed models, to address how woodland size and connectivity affects nymph densities, *Borrelia* infection prevalence and the density of infected nymphs (Lyme disease hazard), while accounting for other variables such as climate, vegetation and host habitat use.

Consistent with our predictions, we found significantly higher densities of infected ticks in woodland patches compared to adjacent open habitats. In contrast to our predictions, we found that woodland size did not have an impact on nymph densities, infection prevalence or Lyme Disease hazard. Patch connectivity on the other hand had opposite effects on nymph densities in the two landscapes. More connected patches had significantly higher nymph densities in Aberdeenshire, whereas the more connected patches in Wessex had significantly lower nymph densities. These opposing effects could be driven by the differing landscape features and host habitat use within the two landscapes. Specifically, the matrix between woodland patches in Aberdeenshire is dominated by fenced pastureland and arable crops while the Wessex landscape matrix comprises large, open grazing commons with livestock freely roaming between and within woodland patches. Our study illustrates the possible impacts of large-scale woodland management policies, specifically those resulting in increased woodland area and more connected woodlands, on the distribution and density of *I. ricinus* as well as the Lyme disease pathogens. Importantly, we show that these impacts can be context-dependent, driven by the specific features of the landscape.