

# An On-going Investigation in to the Ecological Determinants of Lyme Disease in the South Downs National Park, South East England: The potential for 'One Health' Interventions'

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## Introduction to Lyme Borreliosis

Lyme borreliosis (LB) is a tick-borne infection transmitted by *Ixodes* sp. ticks, which if untreated can cause skin, cardiac, nervous system, and musculoskeletal disease. Ticks acquire the bacterium, *Borrelia burgdorferi* s.l. (Bb), upon taking a blood meal from an infected host animal, and transmit the organisms to a susceptible host upon taking a subsequent blood meal. In Western Europe, Bb is known to be endemic in a wide range of small wild animals, including rodents and birds. Large mammals, such as deer and sheep, may also support tick populations by providing adult female ticks the blood meals required to produce eggs.

In the UK, annual diagnoses of LB have trebled over the last two decades. The widening UK distribution of the main LB tick vector (*Ixodes ricinus*) has been linked to deer population expansion. However, the wider ecological determinants that affect the density of infected ticks are poorly understood.

## Sampling Activity & Results to Date

To date, six sites have been drag-sampled across the SDNP; with ticks being successfully obtained from all sites (at densities of 0-11 per 50m drag). Ticks have also been collected from sixteen sites where individual or multiple deer were sampled. In total, around 700 ticks have been collected, and are undergoing genetic analysis to determine first the presence of *Borrelia*, and then the host animals involved in the disease cycle. Individual ticks are being speciated according to taxonomic morphology. It is anticipated that the results from this study will be published in early 2018.

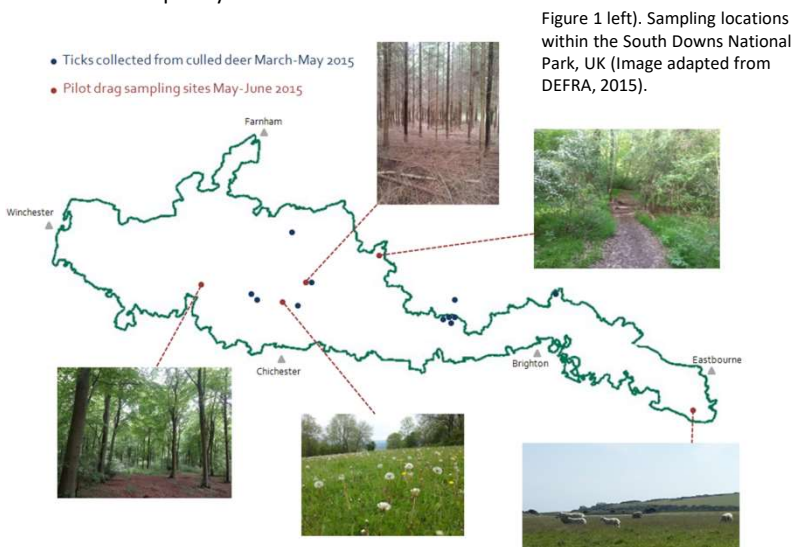


Figure 2 (above). Drag sampling in the South Downs National Park, UK. Tick sampling with woollen (a) blanket (b) chaps and (c) flags.

## Study Overview

This ongoing research is (i) mapping the Lyme borreliosis vector and pathogen distribution across the South Downs National Park (SDNP) by field sampling, and (ii) systematically reviewing proposed interventions based on One Health (an integrated approach to wildlife, livestock and human health). The study aims to link causal factors of LB hazard within the SDNP, and suggest policies to reduce LB risk to humans, so as to minimise conflicts between land use and environmental / human health.

Prior to this project, the specific habitat determinants of LB hazard in the SDNP have not been studied. Elsewhere woodlands are associated with LB. However, in addition it has been recognised that animal grazing can support vector populations, and in some cases pathogen transmission (Ogden et al., 1997). Given that large parts of the SDNP are used for sheep grazing, this could suggest links between animal husbandry and LB hazard, in addition to those normally associated with wildlife.



## References

- Ogden N., et al (1997) Natural Lyme disease cycles maintained via sheep by co-feeding ticks. *Parasitology*, 115(6):591-599.
- Middleton J., et al (2016) Can interventions that aim to decrease Lyme disease hazard at non-domestic sites be effective without negatively affecting ecosystem health? A systematic review protocol. *Environmental Evidence*, DOI: 10.1186/s13750-016-0074-7.

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