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# TICKS AND TICK-BORNE DISEASES IN SCOTLAND

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## WHY IS THIS A CONCERN?

- Ticks and tick-borne diseases can affect human, livestock (especially sheep) and wildlife (red grouse) health.
- There is a growing and widespread perception that abundance of the main tick species, the sheep tick *Ixodes ricinus*, is increasing and its distribution expanding in Scotland.
- At the same time there has been an increase in reported cases of human Lyme disease, and louping ill, in both sheep and red grouse.
- These diseases have significant economic implications for rural communities and may have wider impacts on biodiversity, yet solutions depend on knowing more about the ecology of ticks, the interaction with hosts, and the epidemiology of tick-borne diseases.

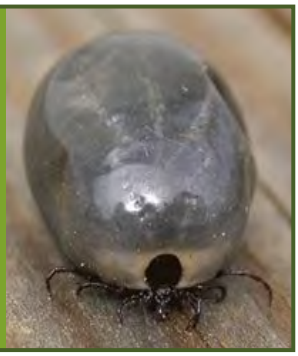
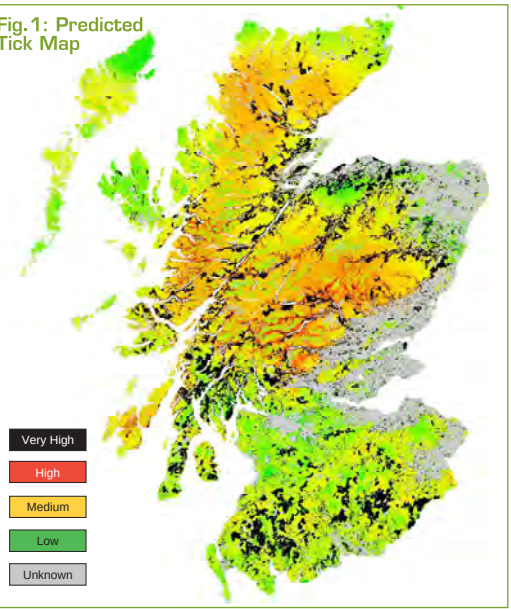


Fig.1: Predicted Tick Map




## PRESSING QUESTIONS - A) TICK ECOLOGY & HOST INTERACTIONS?

Our research aims to get better predictions of the abundance of ticks across Scotland (Fig. 1) by addressing the following questions:

- What is the role of *climate warming* on the tick life cycle, in particular tick questing dynamics?
- How do changes in *sheep management* (not 'dipping') influence ticks.
- How do *reductions in sheep* and *increasing red deer* on unenclosed land influence ticks.
- Are apparent differences between *habitats*, woodland vs. heather moors (Fig. 2), due to *differences in densities* of hosts, especially red deer (Fig. 3).

**Climate measurements/experiments:**
(a) Altitude as surrogate for climate.
(b) Mesocosms in climate controlled chambers.

**Observation of ticks in relation to land use/hosts**
(a) Effects of land use/grazing regime
(b) Effects of host densities within/between habitats
(c) Effects of movements of deer between habitats.

**Network of deer larders:**
Linking tick burden to environmental variables, deer health & demography.

Fig.2: Significant differences between habitats

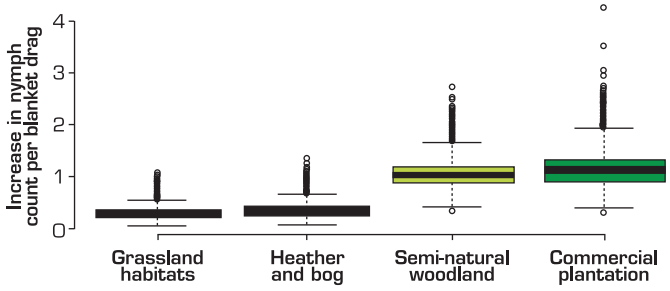
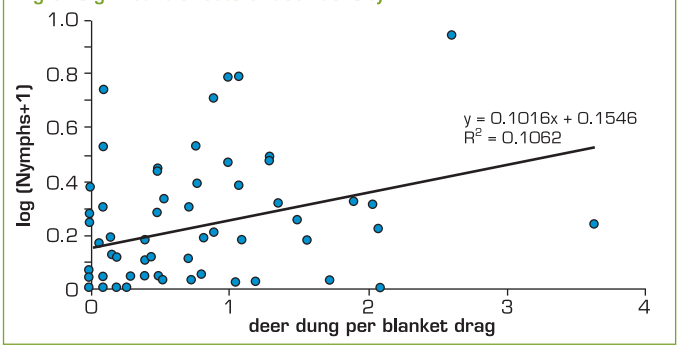



Fig.3: Significant effects of deer density




## PRESSING QUESTIONS - B) EPIDEMIOLOGY OF TICK-BORNE DISEASES?

With collaborators partly facilitated by the EPIC – Centre of Excellence, the Macaulay Institute is now developing spatial models (SIR) of disease risk with both Ben McCormick (SAC, Inverness) and Rachel Norman (Stirling) based on both improved knowledge of tick distribution (as described above) and louping-ill and lyme disease incidence to address the following questions:

- What aspects of environmental variation, tick and host behaviour influence spatial and temporal variation in disease risk?
- How will scenarios of climate change and policy reform driving land use change influence disease risk across Scotland?
- How can refined predictions of risk and spread of disease help inform policy to manage habitats and/or hosts to control disease.

DISEASE INCIDENCE DATA

**Louping-ill virus sero-survey on 125 sheep farms:**
In collaboration with Chris Cousens (Moredun) and George Gunn (Scottish Agricultural College, Inverness) investigate:
(a) management, and
(b) environmental variables.

**Lyme *Borrelia* prevalence in ticks:**
In collaboration with Alan Bowman (Aberdeen Univ) investigate:
(a) Role of small mammals & deer,
(b) Environmental correlates and
(c) *Borrelia* genospecies, region & symptoms.

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