Individual and collective response to parasite risk in an extensive grazing system

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Project description

Differential grazing in heterogeneous environments is known to be important for the transmission of vector-borne diseases such as liver fluke (snail vector), anaplasmosis, babesiosis and louping-ill (tick vectors) (Medlock et al. 2008). Soil water content and vegetation play a significant role in creating suitable micro-climates for vector development and parasite persistence, factors that are currently being impacted by changes in climate, land use, and drainage patterns. To understand the potential effects of environmental changes on parasite-host interactions it is necessary to investigate how grazing correlates with parasite distribution, and to study the behavioural responses to spatial variations in parasite risk. This project aims to investigate these questions in an extensive grazing system, free-ranging sheep on the moorlands of Exmoor and Dartmoor. The project will leverage recent technological advances to relate parasite risk to fine-scale environmental variables. The second stage of the research will assess the ability of animals to mitigate risk through a quantitative analysis of movement patterns. A key focus will be on understanding the role of social interaction and collective movement in parasite avoidance.

The technology employed will consist of lightweight Unmanned Aerial Vehicles, multi-spectral imaging techniques, and automated computer vision for animal tracking. Unmanned Aerial Vehicles (UAVs) are radio-controlled aircraft that can carry imaging payloads, capable of flying under the command of a remote pilot. Low-cost avionics systems have recently put UAVs within reach of the general public and these aircraft are emerging as valuable scientific tools for environmental monitoring applications (Anderson and Gaston, 2013). UAVs are uniquely placed to assist in the study of in situ animal behaviour as they can record high resolution spatial information, are extremely mobile, and are able to capture stable footage of animal movement within a large study area. At the University of Exeter's Environment and Sustainability Institute (ESI) there is a new facility for low-cost, lightweight UAVs a nationally unique facility, to which the successful student will have access.

Data acquisition via the in-house UAV capability will permit characterisation of spatial distribution of soil water (thermal wavelengths) and vegetation spatial structure (structure-from-motion approaches) in grazed regions of Dartmoor and Exmoor. Transect sampling and laboratory analysis will relate these variables to parasite risk levels. UAVs alongside existing automated animal detection software will then be employed to study movement

patterns of extensively grazing sheep. The ability of animals to respond to variable levels of parasite risk will be assessed.

Anderson and Gaston (2013) Lightweight unmanned aerial vehicles will revolutionize spatial ecology. Frontiers in Ecology and the Environment 11: 138146
Medlock JM, Pietzsch ME et al. (2008) Investigation of ecological and environmental determinants for the presence of questing Ixodes ricinus (Acari: Ixodidae) on Gower, South Wales. Journal of Medical Entomology 45, 314-325