2021_03: Improving abundance estimation methods to support control of bovine tuberculosis in wildlife

Supervisor: Dr Marcus Rowcliffe (marcus.rowcliffe@ioz.ac.uk)

Department: ZSL Institute of Zoology / Imperial College School of Public Health

a) Motivation for the project

Bovine tuberculosis (BTb) is a persistent and devastating problem for cattle farmers in England and Wales. Because the disease can be transmitted by badgers, current UK government policy supports culling to reduce badger populations, with knock-on effects on biodiversity. This policy is controversial, and the government is now exploring vaccination of badgers as an alternative, although little strong evidence as yet exists on the efficacy of this approach. Understanding the effectiveness of either intervention requires robust methods for estimating badger abundance, to quantify either the impact of culling, or vaccination coverage achieved. However, there is currently no widely accepted and credible method for estimating badger numbers accurately and precisely.

Analytical methods applied to data from camera trapping have recently developed a long way, presenting an opportunity to fill these knowledge gaps and provide a crucial monitoring tool.

The REP student would join efforts to develop and evaluate the use of camera trap-based abundance estimation in the context of managing BTb risks from badgers. The work is a collaboration between ZSL (applicant plus Rosie Woodroffe), Imperial College (Christl Donnelly) and Natural England (Pete Brotherton), led by current Imperial NERC SSCP DTP student Verity Miles.

b) Context and background

This project falls within NERC's terrestrial sciences remit under the conservation and population ecology research areas, aiming to shed light on an important set of biological processes in an applied setting. The work is strategic in that it addresses a key societal challenge, aiming to generate evidence in acute demand by UK government (DEFRA) and its agencies (Natural England). The work is heavily quantitative, involving the application of machine learning for the processing of imagery, and advanced statistical models for data analysis.

This provides an excellent opportunity to meet REP goals by giving a student with a quantitative background the opportunity to experience the application of their skills in the context of an important current environmental issue.

c) Objectives and methodology

The REP student's core objective will be to lead on efforts to introduce machine learning for image classification into the data pipeline. Efforts on this are underway, and the necessary expertise and support exists within the applicant's research group at ZSL, although we currently have no one specifically dedicated to this task.

The aim would therefore be to give the student freedom to research the existing options for image classification, to apply and test one of these, and to report on its effectiveness and the workflow required to use the approach in our context. With strong guidance from relevant experts within the ZSL research group, I expect this to be achievable within the 10 week timeframe suggested.

The student will also participate in field trips to deploy camera traps in England, giving them first-hand experience of how the imagery that feeds their primary objective is generated. In addition, depending on skills and interest, they will have the opportunity to participate in and learn about a range of other tasks involved in the generation and analysis of camera trap data:

- efficient management and storage of large image sets;

- manual processing of images to generate data for training of machine learning models;

- manipulation, visualising and analysing data to understand patterns using statistical programming software.

The student will also be fully embedded in a research group with long experience of research and policy on badgers and bovine Tb, giving them a great opportunity to understand the overarching socio-political context motivating their project.

Project Length: 10 Weeks