Fully-funded PhD opportunity: Optimising surveillance approaches for jewel beetle threats to forestry by modelling insect perception

Supervisors: Roger Santer (Department of Life Sciences, Aberystwyth University); Dave Williams (Forest Research); Joe Francese (USDA); Otar Akanyeti (Department of Computer Science, Aberystwyth University)

To apply: Application via CV plus covering letter expressing why you wish to undertake this project, and how your skill set is suited to it, by email to rds5@aber.ac.uk before **Monday 30th June 2025**.

Project description:

Jewel beetles (Family Buprestidae) are a threat to trees and forests due to their long-lived, wood-boring larvae (which are readily transported within nursery plants, firewood, and wood packaging material), and strongly flying adults. Consequently, jewel beetles of various species have become devastating invasive pests after accidental introduction to new geographic areas, causing wide-ranging environmental, economic, and social impacts. There is growing concern that many invasive Buprestid species (particularly *Agrilus* species), along with other wood-boring insects, could be introduced into the UK, leading to significant impacts on UK trees, woodlands and forests. As such, effective surveillance protocols are needed so that introductions can quickly be detected and tackled, and forests protected. This project will take an innovative approach to meeting this need: by understanding the way in which jewel beetles perceive the world, and engineering trapping approaches that exploit those perceptions to more effectively lure beetles and protect forestry.

The project will combine field experimentation with sensory ecological modelling incorporating AI approaches, and will be supported by a supervisory team highly skilled in each area. The student will conduct field experimentation in the UK, investigating the attraction of beetles to different trap designs. The supervisory team includes extensive expertise in such experimentation (Dave Williams, Forest Research), with the potential to replicate experiments in the USA (Joe Francese, USDA). The student will also quantify the appearance of traps, and natural stimuli of various kinds, by reflectance spectrometry and calibrated photography, and will model how the tetrachromatic visual system of a jewel beetle would respond to such stimuli. Those calculated sensations will then be used to predict beetle behaviour using AI techniques, and the resulting models used as a guide for the optimisation of traps. The main supervisor (Roger Santer, Aberystwyth University) has proven expertise in such approaches and has successfully applied them to a range of pest insect species.

The project presents a unique opportunity to engage in both pure and applied, as well as practical and theoretical research, integrated within an international research team providing opportunities to understand and contribute to the surveillance and management of invasive insects on a global scale. The project is fully funded, including UK student fees, stipend, and a research budget.

Applicants should have/expect a II(1) or greater at BSc level, and/or a Masters-level qualification, in Zoology, Entomology, or a related discipline. It is desirable for applicants to have (i) experience of biological (and particularly entomological) field work, (ii) experience of insect identification, (iii) competence in using R statistical software, (iv) an interest in the applications of AI/machine learning, and (v) competence in scientific report writing. The applicant should hold a UK driving license and be willing to travel for fieldwork.

Expressions of interest and informal queries by email to Roger Santer (rds5@aber.ac.uk).

References:

Santer, R.D. and Akanyeti, O. (2025), Using artificial neural networks to explain the attraction of jewel beetles (Coleoptera: Buprestidae) to colored traps. Insect Science. https://doi.org/10.1111/1744-7917.13496

Santer, R.D. and Allen, W.L. (2024), Optimising the colour of traps requires an insect's eye view. Pest Manag Sci, 80: 931-934. https://doi.org/10.1002/ps.7790

Santoiemma, G., Williams, D., Booth, E.G. et al. Efficacy of trapping protocols for Agrilus jewel beetles: a multi-country assessment. J Pest Sci 97, 1795–1810 (2024). https://doi.org/10.1007/s10340-023-01728-z