Project Title: Artificial Intelligence for managing ancient woodlands in the UK sustainably to meet net-zero climate targets

Lead Institution/Department: University of Bristol, School of Geographical Sciences

Primary Supervisor. Dr Ce Zhang, School of Geographical Sciences

Co-supervisor. Dr Richard Timmerman, School of Geographical Sciences

Co-Supervisor: Prof Jane Memmott, School of Biological Sciences

Co-supervisor. Dr Simon Smart, UK Centre for Ecology and Hydrology

Scholarship: The Bristol Postgraduate Research Scholarship covers full fees, a stipend at UKRI (UK Research and Innovation) rates (£20,780 for 25/26) for living expenses, and up to £2,100 per year for research expenses, for a registration period of 4 years. Study will begin in September 2026**.**

The deadline for applications is 19th January 2026.

https://www.bristol.ac.uk/science-engineering/postgraduate-research/pgr-scholarships/

Project aims and methods

Sustainable management of woodlands is essential for increasing the resilience to pressures from global climate change, greenhouse gas emissions, and competing land-use demands. Recent COP27 further strengthened the commitments to "net zero emissions" and "green economy" to hold global temperature increase below 2°C and prevent disastrous climate change. Many nations have included nature-based solutions in their efforts to reduce emissions and prevent climate change. The UK Committee on Climate Change has advised that to reach net-zero emissions by 2050, the UK must create 30,000 – 50,000 hectares of forest per year (UK CCC, 2021). However, a number of challenges remain, relating to the knowledge of existing tree stocks in the UK and how much carbon can be removed from the atmosphere. In particular, almost all the focus has been on small woodland and conifer plantations that are easier to harvest and weigh, whereas the large and mature ancient woodlands are under-studied, which present the richest biodiversity and culture value, and could make an important contribution to UK targets under climate emergency. This is largely due to current carbon biomass estimations rely on simplifying assumptions that have remained largely unchanged and unchallenged for many decades. This project is, therefore, designed to bring together Environmental Science, Data Science and Statistics to address this challenge, by developing novel machine learning and deep learning techniques to predict carbon storage and sequestration from sensor data itself, and to drive a step-change in our understanding of the contribution of ancient woodland to environmental sustainability and changing climates.

This project will exploit Artificial Intelligence (AI), digital signal processing, digital humanity and statistical reasoning to develop fundamental new methods for processing massive aerial photos and ancient woodland survey datasets over the past 70 years. New unmanned aerial vehicles (UAV) data will be acquired to update and calibrate the AI model for carbon uptake and storage of UK ancient woodlands. The studentship will provide opportunities to conduct extensive fieldwork across the UK to assess carbon storage across a range of ancient woodland sites with different historical and cultural value. The student will collaborate with a number of key partners, including the Avon Needs Trees, Woodland Trust, Forestry Research, Forestry England. Through these partnerships we have permissions to conduct fieldwork across ancient woodlands of various ages and different landscapes. By advancing AI and sensor techniques, this project will establish an accurate calculation of carbon trapped in UK ancient woodlands and provide a modelling framework to inform policy decisions about how to manage sustainably to reach UK's net zero targets in 2050.

The student will be based on the School of Geographical Sciences and the UK Centre for Ecology and Hydrology through Centre of Excellence in Environmental Data Science (CEEDS). This setting provides a unique and stimulating environment, with series of research seminars, workshops and training opportunities provided across Geographical Sciences and CEEDS to support AI-based environmental innovations in which the student will be encouraged to participate actively. Additionally, the student will be trained to become a licensed drone pilot and have a free place at the drone image processing course run by UKCEH.

Candidate Requirements

Good conceptual and practical knowledge of AI and sensor technology is desirable. Programming (ideally in Python) and machine learning skills are assets. However, enthusiasm for ancient woodlands and curiosity about the best ways to conserve it sustainably under climate change using geospatial science are by far the most important requirements.

Further Information

Please contact ce.zhang@bristol.ac.uk for informal enquiries.

- https://www.bristol.ac.uk/geography/courses/postgraduate
- https://www.bristol.ac.uk/geography/courses/postgraduate/physphd.html

How to Apply: Please apply to the "Geography (PhD)" programme at https://www.bristol.ac.uk/study/postgraduate/apply/