PROJECT TITLE: Thirsty Forests: How Trees Use Water to Survive Extreme Summer

Project Science Theme: Climate Change and Risk
Project keywords: Climate, forests, ecophysiology, carbon, modelling

Lead Institution: University Bristol
Lead Supervisor: Prof. Martin De Kauwe, Bristol, Biological Sciences
Co-Supervisor: Prof. Lina Mercado, University of Exeter, Geography
Co-Supervisor: Dr. Mike Bell, Forest Research
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Project description:

Climate change is reshaping UK forests, with record-breaking summers bringing more frequent, intense, and prolonged heatwaves and droughts. These extremes threaten forest carbon uptake, water use, and ecosystem resilience. To predict future changes in carbon and water cycling, and ultimately species distributions, we must understand how trees use, store, and regulate water use under stress.

The project will address three key questions: (1) how tree water status varies from daily to seasonal timescales and influences ecosystem water use during heatwaves and droughts; (2) how internal water storage buffers trees against extreme heat and water stress; and (3) how stress-induced changes in canopy architecture and leaf area affect forest carbon and water exchange in subsequent summers. Depending on the student, there is scope to lead a leaf-warming experiment.

Working at Forest Research's Alice Holt Research Station, an 80-year-old oak woodland, the student will combine field measurements of gas exchange, plant hydraulics, stem dynamics, terrestrial laser scanning, and eddy-covariance fluxes with modelling across scales from leaves to whole ecosystems. The student will shape the research direction by refining hypotheses, designing field campaigns, and developing approaches for integrating observations with modelling.

Training will be delivered jointly by the University of Bristol, Forest Research, and the University of Exeter. Forest Research will provide hands-on training in forest monitoring, dendrometry, and access to long-term datasets, while Bristol and Exeter will provide training in plant ecophysiology, statistical data analysis, and development of the Joint UK Land Environment Simulator (JULES), the UK's flagship land-surface model for Earth system and climate prediction. Through close supervision during fieldwork, analysis, code development, manuscript preparation, and conference presentations, the Doctoral Researcher will develop independence while receiving mentorship from supervisors and partners. The Doctoral Researcher will develop coding,

statistical, scientific writing, and communication skills within a collaborative ecology, physiology, and modelling team.

CASE partner:

Forest Research will provide substantial in-kind support through co-supervision of the PhD project, access to expertise in greenhouse gas and water flux measurements, and use of field and research facilities. The student will have opportunities to undertake study visits at Forest Research and work closely with researchers involved in long-term forest monitoring and flux observations, including activities linked to the Alice Holt oak forest flux tower site. Forest Research estimates that the value of supervisory input, hosting, training, and access to facilities will exceed £20,000 over the duration of the project. Forest Research will provide the standard CASE partner financial contribution of up to £1,500 per year for 3.5 years (total contribution up to £5,250). These funds will support activities associated with the studentship, including project-related research, training, and engagement with the CASE partner.

Useful recruitment links:

For information relating to the research project please contact the lead Supervisor via: m.dekauwe@bristol.ac.uk

Bristol NERC GW4+ DTP Prospectus:
https://www.bristol.ac.uk/study/postgraduate/research/great-western-four-doctoral-training-partnership-nerc/

How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

The application deadline is Thursday 7 January 2027 at 2359 GMT