

PhD Opportunity

Using Unmanned Aerial Vehicles (UAVs) for Mapping Hydromorphology and Hydraulic Habitat

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Director of Studies: Dr Fleur Visser

Research Group: [Sustainable Environments Research Group \(SERG\)](#)

The PhD Opportunity

Hydromorphology is synonymous with physical habitat in rivers and describes the combination of the morphological and hydrological / hydraulic components of river channels. It is one of the key drivers influencing the structure and function of aquatic communities. However, due to a long history and widespread extent of humans altering channel morphology for flood mitigation and weir creation and altering flows for abstraction and dam construction, hydromorphology is often in a degraded state.

In order to assess current river health, often driven by legislative needs, e.g. the EU Water Framework Directive, and also to assess the impact of remedial works through river restoration, hydromorphological assessment is required. Traditional methods of assessing the morphology and hydraulics of rivers has often used either rapid subjective visual assessment from the bankside which is prone to surveyor variability or detailed and intensive manual data collection of water depths and velocities with instruments in direct contact with the river, including dGPS, total stations, current meters and Acoustic Doppler Current Profilers.

In recent years, drones or Unmanned Aerial Vehicles (UAVs) have gained increasing use as a noncontact and rapid means to assess river hydromorphology and surface flow velocities. Their benefits include access to parts of the channel that may be inaccessible on foot and the ultra-high-resolution data they can create through the collection of overlapping imagery and the use of Structure-from Motion (SfM) photogrammetry. This has been used by River Science researchers within the Sustainable Environments Research Group at the University of Worcester with success in shallow clear water streams to map channel bed topography or bathymetry. UAV video is also now being used to map surface flow velocities using Image Velocimetry (IV). Rarely however have these two items been combined in one study to assess hydromorphological diversity and hydraulic habitat.

This PhD aims to utilise both methods, i.e. SfM for channel bathymetry and IV for surface flow velocity measurement to test the ability of using UAVs for assessing hydromorphology and hydraulic habitat under a range of scenarios, including natural, engineered and restored reaches.

Additional fieldwork costs are likely to be in the region of £1000 to cover transport to and from field sites and field equipment (e.g. survey markers).

Please note, our previous PhD students have sometimes been able to secure additional external funds to cover some fieldwork costs and/or financial assistance towards conference attendance from sources such as the British Society for Geomorphology and the British Hydrological Society.

References

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Rivas-Casado, M., Maddock, I.P. & Woodget, A.S. (2020) Using Unmanned Aerial Systems for riverine environments. In, Green, D. (ed.) *Unmanned Aerial Remote Sensing: UAS for Environmental Applications*. CRC Press. pp. 55-75.

Woodget, A.S., Carbonneau, P.E., Visser F. & Maddock I.P. (2015) Quantifying submerged fluvial topography at hyperspatial resolutions with UAS imagery and SfM-photogrammetry. *Earth Surface Processes and Landforms*. 40: 47-64.

Woodget, A.S., Visser F., Maddock I.P. and Carbonneau, P.E., (2016) The accuracy and reliability of traditional surface flow type mapping: Is it time for a new method of characterising physical river habitat? *River Research and Applications*. 32: pp.1902-1914.

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Application Process

To begin the application process please go to

<https://www.worc.ac.uk/research/research-degrees/applying-for-a-phd/>.

The Interview

All successful applicants will be offered an interview with the proposed Supervisory Team. You will be contacted by a member of the Doctoral School Team to find a suitable date. Interviews can be conducted in person or over Microsoft Teams.

Funding your PhD

For information about Doctoral Loans please visit: <https://www.worc.ac.uk/study/fees-and-finance/doctoral-loans.aspx>

During your PhD you can access the Research Conference Support Scheme to support the costs of presenting your research at an external conference.

Research at the University of Worcester

Research is central to the University's mission to make a difference in everything that we do. We are committed to delivering excellent research which extends the boundaries of human knowledge but which also improves people's lives by enabling better health outcomes, improving food security, developing environmentally sustainable solutions for crop production and socially sustainable solutions to our ageing population, enhancing public knowledge and understanding of the past and present.

The University hence focuses its research around five high-level challenges facing society, locally, nationally and globally:

- [Human Health and Wellbeing](#)
- [Sustainable Futures](#)
- [Digital Innovation](#)
- [Culture, Identity and Social Exclusion](#)
- [Professional Education](#)

The success of our research is reflected in our continuous improvement in external research assessment processes. In the most recent Research Excellence Framework, REF 2021, the University saw a near 50% increase in the scale of its research and 12% increase in quality, building on its performance in REF 2014 when it was the UK's most improved university in terms of Research Power, a combination of scale and quality.

Research Degrees at Worcester

Our research students are central to our overall mission for research. They are working at the cutting edge of their disciplines and driving forward the quality of our research whilst enriching our research culture. We are looking to increase our research student numbers as a strategic imperative.

Our commitment to our students is reflected in the results of the Postgraduate Research Experience Survey 2023 in which we ranked 3rd for overall research student satisfaction nationally. Key to our success in this area is the Doctoral School, a focal point for all our research students.

It provides:

- day-to-day support for our students, both administrative and practical, through our dedicated team.
- a Research Student Study Space with both PCs and laptop docking station.
- a comprehensive Researcher Development Programme for students and their supervisors.
- a programme of student-led conferences and seminars.

Research Group

The Sustainable Environments Research Group (SERG) supports and promotes transdisciplinary research at the environment-society interface, and contributes to the University of Worcester's [Sustainable Futures](#) strategic area of challenge and more widely the UN's Sustainable Development Goals (SDGs). SERG's research draws upon expertise from a range of disciplines including ecology, conservation, natural resource management, river science, rural and urban development, health and wellbeing, climate change, and sustainable development itself. Our impact-driven research in recent years has addressed many of the key challenges facing society and the environment, such as climate change adaptation and mitigation, flood management, air quality, enhancing biodiversity in vulnerable environments, developing climate-smart sustainable agriculture, and delivering sustainable development in the global south.

Widening Participation

As part of its mission statement the University is committed to widening participation for its higher degrees. Although most candidates will have an undergraduate and/or a Masters degree, the University is happy to accept applications from candidates with relevant professional qualifications and work related experience.

For further information or an informal discussion on this project, please contact Professor Ian Maddock: i.maddock@worc.ac.uk

