

# Integrating Multimodal Very-High-Resolution Data for Ecosystem Intelligence and Natural Capital Monitoring

Supervisors: Yves Plancherel ([y.plancherel@imperial.ac.uk](mailto:y.plancherel@imperial.ac.uk)), Matt Piggott ([m.piggott@imperial.ac.uk](mailto:m.piggott@imperial.ac.uk))

Emerging UAV, aerial, and satellite technologies now make it possible to collect **multimodal, very-high-resolution (VHR) environmental data** that combine LiDAR, multispectral, hyperspectral, and thermal imaging. Yet, the potential of these rich datasets remains underexploited due to the absence of integrated processing frameworks capable of converting raw data into ecological and decision-relevant information. This project will develop and test a new generation of **bespoke multimodal data-processing pipelines** to extract, quantify, and attribute changes in ecosystem structure, function, and value.

The research will focus on designing computational workflows that fuse 3D geometric data with spectral and temporal observations, allowing fine-scale estimation of indicators such as vegetation biomass, canopy health, soil moisture, and habitat condition. A key objective is to create adaptable algorithms that operate across spatial and temporal scales—linking UAV-level precision with airborne and satellite observations—to produce **consistent, traceable metrics for natural capital accounting**.

Novelty arises from the project's holistic integration of multimodal sensing, advanced machine learning, and ecological modelling into a single analytical framework optimized for **change detection, attribution, and ecosystem service valuation**. The developed pipelines will enable robust monitoring of biodiversity and landscape dynamics, providing a scalable foundation for assessing environmental resilience and guiding climate adaptation strategies. By uniting sensor innovation with data intelligence, this project aims to redefine how VHR geospatial data are transformed into actionable insight for science, policy, and natural capital management.

*We are looking for pro-active and scientifically curious applicants with an excellent background in the appropriate subject, e.g. geospatial analysis, data science, earth or environmental science, physics, mathematics, or engineering, and with the willingness to learn computational methods as needed. Interaction with industry and incorporation of field studies are also possible (and encouraged) within the scope of the research.*

*Applicants with a strong academic record and who can demonstrate aptitude for an independent and creative approach to scientific research (or other activities relevant to their background) are more likely to be successful. Students will be strongly encouraged to make projects their own and will be supported through that growth process so do not hesitate to also propose your vision when contacting us.*