



# ESI DroneLab

The University of Exeter's Environment and Sustainability Institute (ESI) is a £30 million interdisciplinary centre leading cutting-edge research into solutions to problems of environmental change; in so doing we are enhancing people's lives by improving their relationships with the environment. We are based on the University's Penryn Campus, near Falmouth.



European Regional Development Fund  
Investing in your Future



[www.exeter.ac.uk/esi](http://www.exeter.ac.uk/esi)

## What is a drone?

As far as environmental research is concerned, a drone is a lightweight airborne platform from which we can collect research data. At ESI DroneLab, we mount a range of sensors such as optical and thermal cameras on drones for remote sensing research. Remote sensing is the science of collecting imaging data for environmental analysis. From drones we can achieve very fine-grained data.

## What can drones do?

Our drones fly low and slow, to give them the best possible chance of capturing images with unrivalled spatial resolution. Drones are a game-changing remote sensing platform – they are flexible and can be used in a self-service mode. Capturing remote sensing data this way is much more responsive than, for example, via satellites or piloted aircraft.

## How do we use them?

Drone data are an incredibly rich source of information for mapping land surface and coastal zone processes. We capture fine-scale imaging data that can be used to describe landscape structure in two and three dimensions. State-of-the-art data capture and analysis approaches turn single images into structure-from-motion derived topographic models and geo-referenced ortho-mosaics (specially-rectified images for environmental mapping that are corrected for terrain relief variation, lens distortion and camera angle).



## For what purpose?

This wealth of rich information helps to inform a more sustainable way to manage landscapes, to improve functional understanding of hydrological and ecological processes and to guide interventions to improve the management of natural or semi-natural systems.

We currently use drones to support:

- Ecological mapping
- Topographic modelling
- Coastal zone surveys
- Wildlife monitoring
- Vegetation structural analysis
- Soil erosion survey
- Restoration monitoring
- Catchment management

Environment and Sustainability Institute  
Penryn Campus  
Penryn TR10 9FE  
[www.exeter.ac.uk/esi](http://www.exeter.ac.uk/esi)

Contact: [karen.anderson@exeter.ac.uk](mailto:karen.anderson@exeter.ac.uk)



World-class answers to environmental questions



European Regional Development Fund  
Investing in your Future



Photos by: James P Duffy, Leon DeBell, Karen Anderson

## What's new about ESI DroneLab?

The novelty and creativity of our approach to drone-based environmental monitoring lie in our use of very lightweight, low-cost and open-source drone systems for generating high quality spatial data. Many groups rely on closed-source systems which are expensive to buy, difficult to repair and modify, and far less flexible for creating bespoke surveying solutions for specialist applications.



## Designed and built here

We design, build and fly our own lightweight, easily repairable systems, and we rely on globally trusted control systems to power our fixed wing and multi-rotor aircraft. We also use design tools – like the 3D printing of drone parts – to modify and customise our aircraft. All of this is crucial in providing flexible, bespoke ways to answer specific research questions.



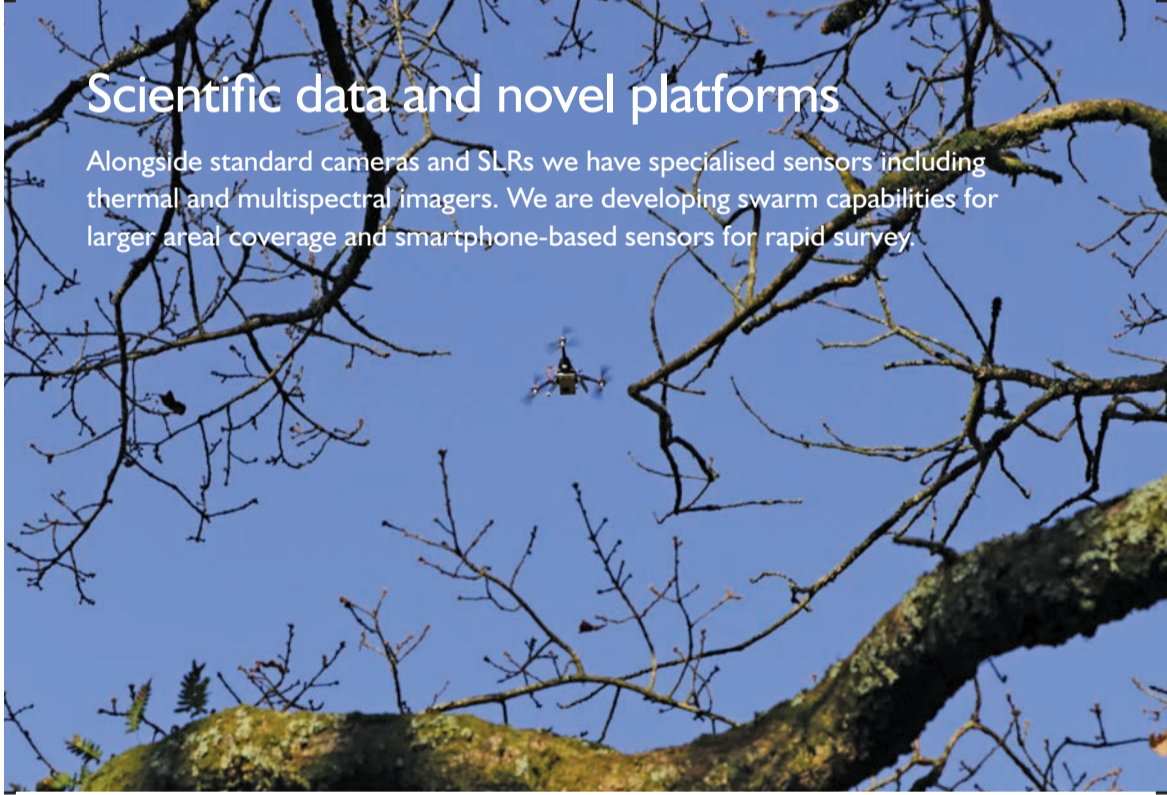
## A better outcome

At the data delivery end, we have developed a unique approach for improving the accuracy of end products. Our state-of-the-art approaches turn single images into high resolution, precise, three dimensional models.



## Scientific data and novel platforms

Alongside standard cameras and SLRs we have specialised sensors including thermal and multispectral imagers. We are developing swarm capabilities for larger areal coverage and smartphone-based sensors for rapid survey.



## Our laboratory

We have a dedicated drone laboratory and a range of systems, including a heavy-lifting delta wing aircraft, heavy-lifting octocopter, lightweight powered gliders and lightweight multi-rotor aircraft. We combine drone survey flights with expert ground support using field validation methodologies which we have developed and refined. We have a high accuracy differential GPS to support registration of data and access to a high performance computing cluster with bespoke software for rapid data processing.



## Group and expertise



ESI DroneLab is led by Dr Karen Anderson. The research group comprises a range of existing PhD and post-doctoral researchers with a wealth of operational experience. We work with a wide range of stakeholders, industry figures and peer researchers worldwide, and have been building our expertise and experience in this area since 2010. Our group is growing and we're keen to hear from you if you'd like to collaborate with us.