Continuing Professional Development

Environment courses
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The courses detailed in this brochure are just a selection of our most popular Environment short courses, and provide an overview of the topics covered. For a complete list of our range of courses, please visit: www.cranfield.ac.uk/enviroshortcourses
Welcome to Cranfield’s Environment short courses

Environment is a key strategic theme at Cranfield. We have been contributing to the green economy for over 40 years and making tangible impacts on the environment, society and the growing economy.

We support Government and business in the ongoing move to a low carbon future. Our expertise covers many aspects of this diverse field; from the circular economy to climate change, spatial modelling to environmental governance, and land management to environmental engineering.

Our courses span environmental analytics, management and resource recovery.

• Analytics courses - teach you to derive information from data measured on the ground, in the air, or from space, to monitor, model, and visualise complex environmental processes.
• Management courses - show you how to evaluate risk and formulate economic policy and societal options to inform sustainable environmental decision-making for government and business.
• Resource recovery courses - help you to develop solutions to remediate, recover, and restore precious environmental resources.

Work with some of the leading minds in the environment industry

With our experience in research-informed teaching, no other organisation in the UK and perhaps Europe, knows more to help you address the environment challenges you face than Cranfield University.

You will benefit from:

• Industry relevant courses.
• Learning and collaborating with our industry renowned faculty.
• Practical exercises that hone your new skills using our outstanding industry grade facilities.
• Application of the latest technologies into your organisation.

Upgrade

Many of our five day courses are part of an MSc and you can accumulate credits towards a postgraduate qualification. Look out for the upgrade icon on the course pages.
Aerial Photography and Digital Photogrammetry

Deriving digital elevation models and ortho imagery is an important application of remote sensing data. Image interpretation is a vital skill required in many image-based mapping projects. The concepts and techniques of image interpretation will be introduced and practised.

What you will learn

On successful completion of this course you will be able to:

• Summarise the geometry and spectral properties of vertical aerial photographs and evaluate their importance in the use of aerial photography for deriving mapping products.
• Apply the basic principles of softcopy photogrammetry to a range of remotely sensed datasets.
• Interpret aerial photographs in the context of the physical and human environments.
• Evaluate elevation data products derived from stereo image pairs and assess their use for a range of applications.
• Prepare orthophotography from standard frame aerial photography and assess the quality of the output.

Core content

• Topographic maps and remote sensing images: map scale and content, image sources and interpretation methods, accuracy issues.
• Aerial photography in the context of other remote sensing systems.
• Physics of light: principles of recording the image. Stereoscopy and parallax.
• Geometry: scale variation, relief displacement, tilts.
• Geometry of vertical aerial photographs: geometry, co-ordinate axes, scale, measurement.
• Softcopy photogrammetry. Digital elevation models.
• Satellite photogrammetry.
• Air photo mosaics and orthophotos.
• Interpretation: principles and factors.
• Applied interpretation: geology, geomorphology, vegetation, soils, urban structures.
• Flight planning. API project management and implementation.
• Recent developments - digital aerial photographs, scanning existing photography.

Who should attend?

Attendees should have some familiarity with imagery and would like to gain skills of interpretation and orth-rectification.

Course duration

Five days

Upgrade this course

This course is part of an MSc module. Participants can accumulate credits towards a postgraduate qualification.

Book online

www.cranfield.ac.uk/adpd

or call an advisor on:
T: +44 (0)1234 754189
This short course will provide you with an understanding of the waste anaerobic digestion process and design, a technical overview of the processing and recovery of energy from organic materials, and the organic fraction of municipal solid waste by anaerobic digestion.

**What you will learn**

On completion of the course, you should be able to:

- Understand the biochemistry of anaerobic digestion.
- Scope and evaluate the requirements of anaerobic digestion of waste.
- Identify and evaluate energy requirements of anaerobic digestion process.
- Critically evaluate factors that influence anaerobic digestion and approaches to optimise anaerobic digestion process.
- Describe the key requirements of quality protocols.

You will learn the importance of controlling and understanding variables such as:

- VFA (Volatile Fatty Acid).
- Ripley ratio.
- Carbon-to-nitrogen ratio.
- pH.
- Gas flow rate.
- Temperature.
- Acidity.
- Mixing.

**Core content**

- Fundamentals of anaerobic digestion.
- Anaerobic digestion operation and design.
- Controlling parameters.
- PAS110 and quality protocols.
- Pre-treatment of waste - why and how?
- Tutorial anaerobic digestion process.
- Anaerobic digestion gas - optimisation and clean up.
- Energy requirement.
- Anaerobic digestion case studies.

**Who should attend?**

Plant operatives who want to be able to contribute more to improving and optimising methane yields and profitability.

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**Course duration**

One day

**Book online**

[www.cranfield.ac.uk/adw](http://www.cranfield.ac.uk/adw)

or call an advisor on:

T: +44 (0)1234 754189

www.cranfield.ac.uk/enviroshortcourses
Ecological Restoration

This course covers the breadth of considerations required for ecological restoration and gives the opportunity to undertake management planning at both site and landscape scales.

What you will learn
On successful completion of this course, you will be able to:

- Understand the principles underlying restoration ecology and ecological restoration in local, national and global contexts.
- Identify the environmental and biological controls on plant community composition and ecosystem structure.
- Describe the mechanisms underlying natural successional patterns in vegetation communities, as well as human-induced changes in habitat-type.
- Evaluate suitable technologies for the remediation of different types of contaminated land.
- Relate habitat management to ecosystem function.
- At different scales, plan ecosystem creation or restoration based on the biotic and abiotic context of the area.
- Design and assess the feasibility and appropriateness of a habitat restoration scheme.

Core content
- The principles of ecological restoration.
- Abiotic and biotic controls on community composition.
- Practical techniques for effective habitat creation and restoration.
- Habitat management for faunal conservation.
- Effects of changes in climate and land use on conservation practices.
- Habitat case studies; for example wetland, grassland, woodland, heathland, riparian buffer strips.
- Contaminated land and remediation technologies.
- Contaminated land issues and market size.
- Monitoring and modelling contaminants.
- Hazard appraisal and risk assessment.
- Importance of scale for reconstruction of habitats.

Who should attend?
This course is aimed at those interested in the wider context, theories and issues surrounding the restoration of ecosystems. The course is suitable for people from a wide range of disciplines from ecologists through to engineers.

Course duration

Five days

Upgrade this course

This course is part of an MSc module. Participants can accumulate credits towards a postgraduate qualification.

Book online

www.cranfield.ac.uk/er

or call an advisor on:
T: +44 (0)1234 754189
Evaluating Sustainability Through Life Cycle Approaches

This course provides specialist understanding of the frameworks and techniques available to evaluate process performance of an organisation or cohesive system in terms of sustainability.

What you will learn
On successful completion of this course you will be able to:

• Select and evaluate accepted frameworks to assess the performance of processes and/or systems in terms of sustainability.
• Identify and implement appropriate techniques to assess the environmental performance of an organisation or product or process.
• Critically evaluate the outcomes of environmental assessment techniques.

Core content
• Sustainability performance evaluators; definitions, indicators, indicator selection and analysis assessing information against performance criteria.
• Frameworks and techniques; environmental management systems, lifecycle assessment, strategic and environmental impact assessments, carbon and water foot-printing.

Who should attend?
The course is aimed at those who need to understand how to analyse the sustainability of products or services. These include sustainability managers, technical managers, technical specialists, PhD students from other disciplines and policy makers who need to understand the methods critically. The main method is Life Cycle Assessment (including the carbon footprint and water footprint). Additional insights into social and economic aspects of sustainability are provided.
Image Processing and Analysis

Image processing and analysis is one of the fundamental tools of applied remote sensing. It is the means by which information can be extracted from raw digital data to produce and manipulate images from airborne and space sensors.

What you will learn
On successful completion of this course you will be able to:

• Identify a wide range of image processing techniques.
• Explain the purpose of each process and the underlying mathematical principles.
• Operate and manage an image processing system.
• Select appropriate image processing sequences to achieve predetermined objectives.
• Integrate image processing techniques into applications of remote sensing.

Core content

• The remote sensing process: data management and planning.
• Physics of light: principles of recording the image, plant, soil and water spectral properties in the optical wavelengths, influence of plant structure, moisture content, phenology and growth cycle on reflectance patterns, effect of organic matter, mineral content, texture and moisture content on soil reflectance.
• Satellite image processing: digital image enhancement and classification, indices.
• Geometric correction: map projections, selection of ground control points, transform equations, resampling methods (nearest neighbour, bilinear interpolation, cubic convolution, sinc x).
• Image enhancement: contrast stretching (linear, bilinear, gaussian, histogram equalisation and manual), digital filtering in the spatial domain (low-pass, high-pass, high-boost, median and directional).
• Classification: density slice, box classification, maximum likelihood and minimum distance algorithms. Supervised and unsupervised training techniques. Spectral coincident plots and decision tree classification.
• Current classification methods.

Who should attend?
Anyone interested in image processing for career or research purposes, such as GIS/software engineer, remote sensing specialist, environmental engineer, precision agriculture technologist.

Course duration

Five days

Upgrade this course

This course is part of an MSc module. Participants can accumulate credits towards a postgraduate qualification.

Book online

www.cranfield.ac.uk/ipa

or call an advisor on:
T: +44 (0)1234 754189
Natural Resource Economics

This course uses economic theory to explore the relationship between the stocks of natural capital and the flows of services that emanate from them.

Economic models are used to analyse current resource management challenges, distinguishing between renewable and nonrenewable resources. The course is delivered mainly through case studies focusing on major types of natural resources, and integrates strongly with those dealing in welfare economics and policy.

What you will learn
On successful completion of this course you will:

• Demonstrate a conceptual understanding of stocks and flows applied to natural resources and related ecosystems and the role of economic theory in resource allocation decisions.
• Demonstrate a systematic understanding of and apply methods of economic analysis to support practical decision making for the management of natural resources, consistent with the concept of sustainable development.

Core content
• Introduction: sustainable development, natural capital and ecosystems services.
• Theoretical frameworks for economically optimal use of non-renewable and renewable resources.
• Theory into practice: Economic dimensions of the management of natural resources: land and soils, energy, minerals, water, biodiversity, marine fisheries, forestry.
• Implications for natural resource and environmental policy.

Who should attend?
Those wishing to take an introductory course in the theory and application of natural resource economics should apply. More specifically, those who need to make decisions over natural resources and the environment, that are informed by economic theory, will find this course useful. This for example could include researchers, consultants, and employees in non-government organisations, working in a UK, European, or global context.
Physical Principles of Remote Sensing

The appropriate application of remote sensing to the monitoring of earth resources requires an understanding of basic physics and imaging technology. This subject introduces the basic radiometric concepts and physical relations required for remotely sensed data to be analysed quantitatively.

What you will learn
On successful completion delegates should be able to:

- List the primary physical quantities that are directly related to measured radiance.
- Define the basic radiation quantities.
- Explain the nature of surface and atmospheric interactions with electromagnetic radiation.
- List the major types of detectors and describe how satellite images are formed.
- Describe the complete remote sensing process from data reception to information extraction.
- Apply calibration and atmospheric correction methods to image data.
- Explain the physical relations underlying the retrieval of satellite measured reflectance, temperature and backscattering coefficients.

Core content

- Introduction to the physical principles remote sensing.
- Electromagnetic radiation: radiometric units and terms, radiation laws, radiation sources optical, thermal and microwave.
- Surface interactions.
- Plant, soil and water spectral properties.
- Atmospheric interactions and correction.
- Spatial resolution and geometry.
- Orbits and platforms.
- Review of satellite and airborne systems.
- Image formation: passive systems (detectors, opto-mechanical line scanners, waveband separation, linear and area arrays) and active systems (Lidar, RAR and SAR concepts).
- Data reception: data transfer rates, telemetry, ground segment.
- Data distribution: data suppliers, product levels, internet.

Who should attend?
Anyone coming from education or industry, or seeking a challenging career in one of the growing range of industrial and research sectors that now routinely make use of the GI technologies.

Course duration
Five days

Upgrade this course
This course is part of an MSc module. Participants can accumulate credits towards a postgraduate qualification.

Book online
www.cranfield.ac.uk/pprs
or call an advisor on:
T: +44 (0)1234 754189
**Principles of Sustainability**

This course introduces and critiques three approaches to improving sustainability: ecosystem services, the circular economy, and per capita energy use. It examines their application to resolve real-world problems and create commercial opportunities.

**What you will learn**

On successful completion of this course you will be able to:

- Explain how an ecosystem service approach can help society to identify and make decisions regarding the use of ecological resources, with a focus on biodiversity, greenhouse gases, nutrient loss, and water use.
- Critique terms like “sustainability”, “ecosystem services”, and “circular economy”.
- Explain how the “circular economy” provides commercial opportunities, and the role of design and manufacturing.
- Explain how we can enhance the stability, resistance and resilience of natural systems.
- Use a per capita approach to explore the synergies between food, feed, wood, and renewable energy production to guide decision making and identify opportunities in the context of a case-study.

**Core content**

- Moving from an “Empty World” to a “Full World”.
- The Ecosystem Service Approach (Millennium Ecosystem Assessment and UK National Ecosystem Assessment).
- Ecosystem processes and succession; the role of energy; feedback systems; biodiversity and system restoration.
- Using an ecosystem approach: quantifying trade-offs and synergies; improving water and nutrient management, reducing greenhouse gases emissions, enhancing stability, resistance and resilience.
- Introduction to the circular economy: opportunities for businesses; opportunities for consumers.
- How design, manufacturing practice and management can contribute to a circular economy.
- Case study: trade-offs, synergies, and opportunities to enhance well-being and ecosystem service provision in terms of energy, food, feed and wood for a case study area.

**Who should attend?**

Those looking to develop a range of knowledge and skills including environmental principles (such as the ecosystem services framework), economic and financial methods, and social, policy and governance viewpoints.
Unmanned Aerial Vehicles (UAVs) are emerging as a key engineering tool for future environmental survey tasks. UAV aerial imagery offers both timely (on-demand) and more detailed (higher resolution) information than comparable satellite imagery. This course will introduce the main principles behind UAV flight control, data capture, image processing and interpretation.

What you will learn
This five day course will cover the principles of UAV flight control (theory, practice and practical demo), image processing (data capture and analysis) and data interpretation (using data from different case studies). The course will strengthen current knowledge of UAVs for environmental science whilst also addressing wider relevant key elements on data capture, analysis and interpretation.

Overall, this course consolidates the application of UAV technology by introducing environmental professionals and researchers to state-of-the art technology for environmental monitoring - a key skill gap identified by the environment sector.

Core content
Day one - Principles of UAV flight control
- UAV flight control - review of the main operational features of UAVs (eg quadrotor dynamics, aerodynamic lifting surface and vehicle design parameters).

Day two - Image processing principles
- Data capture and survey design - this will focus on the design of monitoring programmes for UAV data collection (eg number and location of ground control points, flight height, image resolution and image footprint).
- Data analysis - image processing considerations will be discussed within this session.

Days three and four - Environmental applications
- Case study one: UAVs for freshwater ecosystem monitoring.
- Case study two: UAVs for landscape monitoring.

Day five - Policy applications
- Civil Aviation Authority legislation.
- Practical session - hands on session on UAV flight operation. Expected drones to be showcased are Quadcopters, Octocopters and Fix Wing platforms.
- Case study three: UAVs for environmental policy implementation.

Who should attend?
Anyone interested in environmental monitoring, and those looking to expand UAV based applications into the “environmental domain”. Governmental organisations, researchers and environmental consultants, as well as insurance companies interested in mapping the effect of damage caused by environmental catastrophic events will also be interested.

Course duration
Five days

Book online

www.cranfield.ac.uk/enviro-uavs

or call an advisor on:
T: +44 (0)1234 754189
Organisations that have attended Cranfield environment courses

- Anglian Water.
- ADHB.
- Environment Agency.
- Mott MacDonald.
- National Trust.
- Natural England.
- Ordnance Survey.
- Raytheon UK.
- R&D Trials Agronomist.
- Tarmac.
- United Nations.
Location

How to find us
Cranfield University is located about halfway between London and Birmingham, and on the outskirts of Milton Keynes. Junctions 13 and 14 of the M1 are five minutes away and Milton Keynes railway station is 20 minutes by taxi. London Luton, Stansted and Heathrow airports are 30, 90 and 90 minutes respectively by car, offering superb connections.

If accommodation is required, please make your own arrangements at Mitchell Hall or the Cranfield Management Development Centre.

More information can be found at www.venuecranfield.co.uk

Executive Education Services
Cranfield University
Cranfield, Bedford, MK43 0AL, England
E: professionaldevelopment@cranfield.ac.uk
T: +44 (0)1234 754189
www.cranfield.ac.uk/enviroshortcourses