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Inside front cover photograph: True-colour satellite image of Cornwall, UK
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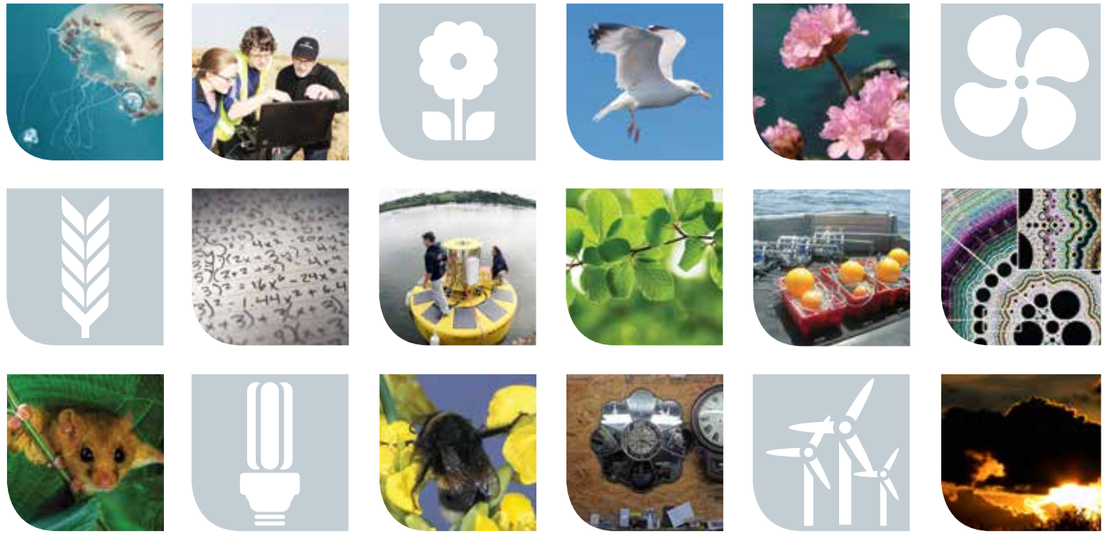

Working together

A guide to research at the **Environment and Sustainability Institute**

"At the Environment and Sustainability Institute we're using Cornwall and the Isles of Scilly as a living laboratory to explore issues with a wider global impact. The region's peninsular nature, the interactions between marine and terrestrial environments, local expertise in renewables, and the population dynamic make it an incredibly rich location for research."

Professor Kevin J Gaston

Director of the Environment and Sustainability Institute

True-colour satellite image of the county of Cornwall in southwest England, Great Britain. North is at top. Land's End (at lower left) and Lizard Point (at bottom left) are respectively the westernmost and southernmost parts of the English mainland. Cornwall is largely rural and has a patchwork of fields, upper centre is Bodmin Moor (dark green). At upper left is the Celtic Sea, whilst at lower right the English Channel. Image taken by the Landsat-5 satellite.
PLANETOBSERVER/SCIENCE PHOTO LIBRARY

Welcome

Professor Kevin J Gaston

Director of the Environment and Sustainability Institute, University of Exeter

At the University of Exeter Penryn Campus, we have built a world-class research institute dedicated to finding cutting-edge solutions to complex problems of environmental change – the Environment and Sustainability Institute (ESI). Much of our work is embedded within Cornwall and the Isles of Scilly but its impact is far wider and of practical, national and international application.

The difficulties faced by humankind are so diverse and deep-seated that they require a collaborative and groundbreaking approach involving experts from a wide range of backgrounds. Some of the solutions we envisage will be technological or related to land use, and others will depend on a change in human behaviour. Most will involve varying combinations of all three. This is why, at the ESI, our research is interdisciplinary across three interrelated themes: Clean technologies, Natural environment, and Social science and sustainability.

Our interests may be varied, and expertise broad but everything we do is linked by a common thread of working together and thinking differently. The calibre of our researchers and value of our approach are already recognised.

To date we have attracted external research funding in excess of £7 million.

This brochure provides not only an introduction to our impressive international team and their different backgrounds but also describes how we're actively working in partnership. We are collaborating with businesses, stakeholders, commercial investors, and local, national, and regional support providers to help translate research and expertise into innovative business practices, products and services. The ESI Business Network currently has over 400 members and we have assisted more than 300 businesses.

Of course, a publication like this can only ever hope to be a snapshot in time. We are growing quickly so by the time you read this there will no doubt be additional new faces and innovative research projects. Our website will better reflect these changes. See: www.exeter.ac.uk/esi

We are a dedicated and passionate team and I am proud to work alongside my colleagues to undertake research of critical importance in a spirit of creativity, collaboration, and rigour.

Interdisciplinary research

Interdisciplinary research is at the core of the Environment and Sustainability Institute. We know that by working together, researchers from different backgrounds and with different perspectives can solve problems where the solutions are beyond the scope of a single subject.

Our researchers, when collaborating with businesses, international research partners and knowledgeable practitioners, are uniquely placed to deliver creative solutions to problems of environmental change. The challenges being addressed within the ESI are global in scale and the solutions relevant across the world. However, we are developing them in partnership with Cornish businesses and for the direct benefit of the regional economy.

Here we feature a selection of our researchers from a wide range of academic backgrounds who collectively demonstrate the type of interdisciplinary research we are proud to lead.

Matt and Kirsten discuss remote data collection technologies at Porthleven Harbour, Cornwall.

"The issues we research in fisheries and sustainability are complex and contextual, but are nearly always a mix of the social and ecological. To find solutions, scientists need to have a problem-focused and interdisciplinary approach which fundamentally requires collaboration between natural and social sciences."

Dr Kirsten Abernethy
Lecturer in Environmental Social Science

Dr Matthew Witt and **Dr Kirsten Abernethy** understand the high expectations we place on our ocean resources and the tensions these can create.

In the summer months, **Dr Matthew Witt** may be found in the waters around the UK tracking basking sharks, along with collaborators from Scottish Natural Heritage. He is developing research expertise in remote data collection technologies and is currently working with external partners to plan for the sustainable management of the sea, particularly in light of the human pressures from commercial fishing and renewable energy extraction.

Dr Kirsten Abernethy studies marine fisheries and coastal communities, and is interested in understanding how fishing-dependent communities adapt to environmental, economic and social change, and the incentives behind moving towards more sustainable fishing practices. Her work has included research in the Cornish fishing industry and community-based resource governance in the Solomon Islands.

Matthew and Kirsten are mutually interested in understanding not only the benefits we derive from the oceans but also what we need to do to manage this important resource for the future. Matthew's technical expertise in remote data collection and Kirsten's in community decision making and co-management are both essential to solving problems such as the design of cross-boundary marine protected areas and effective site placement of sometimes conflicting human activities. They aim to reconcile ecological, economic and social objectives.

Interdisciplinary research

CONTINUED

"It will be great for us to work with companies to develop win-wins, where operational efficiency is increased, costs are equivalent, or even reduced, but biodiversity can be enhanced. The Environment and Sustainability Institute's unique interdisciplinary approach means that ecologists sit alongside engineers, sitting alongside a business liaison team, all designed to enhance the impact of our research."

Professor Robbie McDonald
Chair in Natural Environment

Tapas and Robbie consider the impact of vegetation at the base of photovoltaic solar panels on the University of Exeter Penryn Campus, Cornwall.

Professors Robbie McDonald and **Tapas Mallick** share an interest in identifying win-wins for cost effective management and biodiversity enhancement of solar parks.

Professor Tapas Mallick leads solar energy activities within the Environment and Sustainability Institute. Alongside his research team, he is currently developing an innovative and highly efficient, semi-transparent photovoltaic solar panel.

Professor Robbie McDonald is interested in wildlife ecology and in resolving human-wildlife conflict. His current research projects are varied, ranging from the science, policy and practical implications of bovine tuberculosis (TB) in badgers to the impacts and management of invasive species.

In recent years, planning permission for hundreds of ground-based solar parks has been granted with many awaiting construction. Commercial operators require solar parks which are secure and where vegetation can be prevented from shading panels, while regulators require that negative impacts on the environment are minimised and/or mitigated. Such needs may appear to be in conflict.

Robbie and Tapas are combining their interests and expertise to explore win-win practices for the cost effective management and biodiversity enhancement of solar parks, and to provide guidance to commercial operators and regulators. Their research will include determining current best practice and creating a demonstration project to show how cost effective site management options could address the need for reducing shade and maintaining security of solar parks while increasing biodiversity.

Interdisciplinary research

CONTINUED

"Study of people's attachments to specific places and the value they attribute to different landscapes is highly relevant for an understanding of cultural ecosystem services. It can be challenging, however, for qualitative social scientists to find common ground with researchers who focus primarily on quantitative measures.

In the Environment and Sustainability Institute, we have an exciting opportunity to bring together different disciplinary perspectives and develop collaborative research methods that can respond to this challenge."

Dr Caitlin DeSilvey
Senior Lecturer in Environmental Social Science

Kevin and Caitlin discuss the landscape at Enys Gardens, Penryn, Cornwall.

Professor Kevin J Gaston and **Dr Caitlin DeSilvey** are working together to better understand and measure the cultural benefits humans derive from nature.

The measurement and valuation techniques applied to many ecosystem goods and services, including water, food, and physical resources, are already well established. However, ways to quantitatively value cultural ecosystem services, such as the wellbeing humans derive from spending time in beautiful natural spaces, are less well understood.

Professor Kevin J Gaston is highly experienced at applying quantitative methods to study ecosystem goods and services, land-use strategies, the scaling of biodiversity and the ecology of urban environments.

Dr Caitlin DeSilvey, a member of the Expert Panel informing the ongoing work of the UK National Ecosystem Assessment (UK NEA), brings to this research a humanities perspective grounded in qualitative approaches. Caitlin is interested in the cultural aspects of environmental change and uses creative methods to understand and interpret how people value different landscapes.

Together, Kevin and Caitlin are bridging the divide between traditionally different research approaches. This innovative work has the potential to inform and solve diverse problems associated with subjects ranging from urban planning and design of the built environment to conservation and land-use. The first research paper produced as a result of this collaboration has been published.

Interdisciplinary research

CONTINUED

"The complex natural world around us is the life support system upon which humans depend. There are many threats to this system, and to alleviate these we need to know the causes, symptoms and cures.

This can only be achieved by bridging traditional disciplines and by combining empirical and modelling work, and a range of qualitative and quantitative approaches."

Dr Ilya Maclean
Lecturer in Natural Environment

Stuart and Ilya watch a seal swimming in Housel Bay, The Lizard Peninsular, Cornwall.

Professor Stuart Townley and **Dr Ilya Maclean** share an interest in using dynamic mathematical and predictive models to map biodiversity, and to explore species population and evolution.

Dr Ilya Maclean is an ecologist and uses The Lizard Peninsular in Cornwall as an outdoor laboratory for his work, exploring the effects of environmental threats such as climate change on wetland species. His research is applied and enables him to advise organisations such as Natural England on priorities for conservation action.

Professor Stuart Townley is a mathematician and researches the relationships which exist between things. While his interests span biological and engineering systems, his expertise is of significant value to the study of ecosystems, and understanding how these might change in the future.

By providing a physical space (with outstanding facilities and resources) within which researchers from different disciplines can work together, and in partnership with local business, the Environment and Sustainability Institute is maximising the potential for our team to achieve genuinely innovative research outcomes.

Meet our researchers

Dr Kirsten Abernethy

Lecturer in Environmental Social Science

I am an interdisciplinary scientist looking at marine fisheries and coastal communities. I am broadly interested in understanding the incentives behind sustainable practices, particularly given the social and economic contexts, and global challenges such as climate change. My research combines multiple perspectives to understand patterns of marine resource use and decision-making at different levels. Most recently, I have been investigating the community co-management of marine resources in the Solomon Islands.

Discipline Geography, College of Life and Environmental Sciences

Dr Karen Anderson

Senior Lecturer in Natural Environment

My research centres on using remote sensing as a tool for assessing landscapes, particularly soils, vegetation and peatlands. As a way of understanding ecological structures I develop special analysis techniques – including unmanned aerial vehicles – to model land surface processes and to monitor soil structure for land degradation assessment. This also means developing 3D virtual models both to engage local communities and to help visualise future change.

Discipline Geography, College of Life and Environmental Sciences

Professor Katrina Brown

Chair in Social Science

I am an environmental social scientist, specialising in environmental change, development, vulnerability and resilience. My research focuses on how individuals and societies understand and respond to change, and their different capacities for adaptation and transformation. I am committed to interdisciplinary research on sustainability and have led international research teams to examine environmental change and poverty alleviation in developing countries.

Discipline Geography, College of Life and Environmental Sciences

Dr Chris Bryan

Lecturer in Sustainable Mining and Minerals Resourcing

I study the world's smallest miners. As a microbiologist, I investigate microbial populations which bio-mine for valuable metals. My research looks at these populations' structures and interactions, and at how to influence their actions. Other projects have focused on e-waste bio-treatment and groundwater recovery.

Discipline Camborne School of Mines, College of Engineering, Mathematics and Physical Sciences

Dr Caitlin DeSilvey

Senior Lecturer in Environmental Social Science

I am a geographer whose research explores the cultural significance of material change. I use visual imagery and story-telling to engage people in imagining changing environments and places, and look to patterns from the past to try to understand what the future might bring. I am also interested in how things age over time, and in the value of repair and mending skills to extend the lives of worn objects and encourage more sustainable use of resources.

Discipline Geography, College of Life and Environmental Sciences

Professor Kevin J Gaston

Chair in Biodiversity and Conservation

I lead basic, strategic and applied research in environmental science, with particular emphases at present including common ecology, ecosystem goods and services, land use strategies, and urban ecology. I am interested in exploiting technological advances to improve environmental monitoring and in identifying win-win opportunities for reducing environmental pressures and improving regional economies.

Discipline Biosciences, College of Life and Environmental Sciences

Meet our researchers CONTINUED

Professor Bernd Lottermoser

Chair in Environmental Geochemistry

My research looks at the consequences of growing resource use and investigates disturbances due to unnatural pollutants. I work as part of the Environment and Sustainability Institute's interdisciplinary team on trace metal transfer processes in terrestrial landscapes. I am the lead for a joint research project with the University of Tasmania to improve understanding of the environmental liabilities and risks associated with mining operations.

Discipline Geology, College of Engineering, Mathematics and Physical Sciences

Dr Ilya Maclean

Lecturer in Natural Environment

I am an applied ecologist whose research explores how species threatened by water shortage respond to environmental threats, for example climate change and habitat loss. My work aims to predict and understand the effects of climate change on wetland species on Cornwall's Lizard Peninsula. I am particularly interested in using my research results to identify priorities for conservation action and help species cope with changes to their habitats.

Discipline Biosciences, College of Life and Environmental Sciences

Professor Robbie McDonald

Chair in Natural Environment

I am interested in mammal ecology and small carnivores in particular, having previously studied the biology of the weasel family. My research has included looking at the science, policy and practical implications of bovine tuberculosis (TB) in badgers, and the impacts and management of invasive species. I hope to develop a programme of applied, interdisciplinary work that will help Cornwall, the South West, and the UK to develop in a sustainable way. I lead the University's partnership with the National Wildlife Management Centre as part of a Wildlife Research Co-operative.

Discipline Biosciences, College of Life and Environmental Sciences

Dr Markus Mueller

Lecturer in Applied Mathematics

My research addresses mathematical systems and control theory and their applications within marine engineering, renewable energy and systems biology. My academic work includes developing the Applied Mathematics programmes for both undergraduate and postgraduate taught students at the Penryn Campus, with a focus on interdisciplinary applications and in close liaison with my colleagues.

Discipline Mathematics, College of Engineering, Mathematics and Physical Sciences

Professor Tapas Mallick

Chair in Clean Technologies (Renewable Energy)

I lead solar energy activities within the Environment and Sustainability Institute. My research focus is applied solar energy and, with my research team, I look at bridging the urban and rural energy divide through solar energy implementation. I am particularly interested in teaching advanced solar energy engineering and heat transfer for renewable energy systems.

Discipline Renewable Energy, College of Engineering, Mathematics and Physical Sciences

Dr Juliet Osborne

Senior Lecturer in Natural Environment

My research looks at how insects and plants interact within the environment, and their role in the provision of ecosystem services. My work includes the study of pollination and pest regulation in crops. I am particularly interested in conserving and promoting bee populations, and protecting and promoting wild flower and crop pollination. To achieve this, I work closely with beekeepers and conservation organisations.

Discipline Biosciences, College of Life and Environmental Sciences

Meet our researchers CONTINUED

Dr Clare Saunders

Senior Lecturer in Environmental Politics

My areas of research expertise are social movements and protest, climate and energy politics, and social networks. I am involved with several interdisciplinary projects, ranging from exploring why protesters take to the streets, to investigating whether local energy saving initiatives can help householders reduce their energy demand. I measure the extent to which a variety of organisations, including industry lobby groups, influence climate change policies.

Discipline Politics, College of Social Sciences and International Studies

Professor Stuart Townley

Chair in Applied Mathematics

I am particularly interested in dynamical systems and control: the study of things (biological and engineering) which interact and evolve in time and can be managed and optimised. I've been the Chair in Applied Mathematics at the ESI since June 2011 and have led the introduction of the Mathematics and the Environment programme, which addresses questions relating to climate change and our – and the natural world's – response and reaction to it.

Discipline Mathematics, College of Engineering, Mathematics and Physical Sciences

Dr Amber Teacher

Research Fellow

I am a biologist who sees research as a way to solve problems. I am particularly interested in the biology of wildlife, and I look closely at genes to gain an understanding of how animals adapt to their changing environment. My research helps make biologically-informed wildlife management decisions. Much of my work centres on the impacts of climate change, disease and overfishing on wild populations, and establishes how wild populations adapt to these pressures. I collaborate with policy makers to ensure that my research is used to directly address problems for conservation and sustainability.

Discipline Biosciences, College of Life and Environmental Sciences

Dr Stephen Votier

Senior Lecturer in Natural Environment

I am an ornithologist, focusing largely on marine birds. My research revolves around trying to understand how global change impacts upon seabirds, and use these results to inform conservation priorities and solutions. To achieve this requires research at the individual, population and ecosystem level, involving a wide variety of analytical tools and approaches.

Discipline Biosciences, College of Life and Environmental Sciences

Dr Matthew Witt

Lecturer in Natural Environment

My research focuses on marine ecology, looking specifically at the distribution and behaviour of turtles, sharks and other mobile marine species. Acquiring this knowledge is often challenging so my work uses a wide range of technologies, including satellite tracking and acoustic detection. I am especially interested in using large sets of data to assess the effects of human activities on marine ecosystems.

Discipline Biosciences, College of Life and Environmental Sciences

Dr Xiaoyu Yan

Lecturer in Clean Technology/ Renewable Energy

I am an engineer whose research looks at joining up sustainable energy systems and low carbon transport technologies, such as electric vehicles. I plan for current and future energy supply and analyse the environmental and economical viability of these technologies. I am particularly interested in the potential use of alternative fuels.

Discipline Renewable Energy, College of Engineering, Mathematics and Physical Sciences

Meet our researchers CONTINUED

Dr Gabriel Yvon-Durocher

Lecturer in Natural Environment

I explore the effects of environmental change on the structure of ecological communities (which are groups of actually or potentially interacting species living in the same place).
I am mainly interested in understanding how structure and variables interact to determine changes at the ecosystem scale. I have developed a predictive 'tool box' to forecast how these ecological communities may be disrupted in a world increasingly dominated by humans.

Discipline Biosciences, College of Life and Environmental Sciences

Latest appointment

Dr David Benson

Lecturer in Environmental Social Science

I am an interdisciplinary social scientist with a background in environmental studies. I have a particular interest in how society and the environment can be governed to achieve greater sustainability. I conduct comparative national research into: the integration of environmental concerns into government fiscal cycles; the development of the green economy in EU states; collaboration between stakeholders in catchment management; UK climate policy; and also the potential environmental impacts of algal bio-fuels production and their regulation.

Discipline Politics, College of Social Sciences and International Studies

Working with businesses

Working in partnership with business in Cornwall and the Isles of Scilly, the Environment and Sustainability Institute (ESI) is enabling the necessary transition from resource-intensive economic growth to a more resilient, environmentally-sustainable economy.

We have an experienced and knowledgeable business-facing team facilitating this change. Our Knowledge Exchange Managers are enabling research collaborations between ESI academic experts and businesses. Alongside them, our specialist Business Mentors are supporting enterprises in the environmental goods and services sector that have potential to grow into new markets. Together, the team are forming partnerships with businesses, stakeholders, commercial investors, and local, national and regional support providers to help translate research and expertise into innovative business practices, products and services.

Our Business Network already consists of over 400 businesses.

Working with the ESI can help businesses to:

- gain access to the latest research and thinking to build a competitive edge;
- receive support to develop collaborative research projects;
- develop new products, processes, strategies or patents;
- utilise specialist business mentoring and start-up assistance;
- access our business networks and networking opportunities;
- facilitate collaborations with other organisations;
- access research facilities and equipment;
- benefit from student and graduate placements.

Projects can be:

- long or short-term;
- developed with bespoke objectives in mind.

The ESI supports and works with a range of organisations including businesses, charities, social enterprises and community groups with a direct interest in our research themes, and which wish to inform and be a part of a developing and relevant research agenda.

Please contact the Knowledge Exchange Team at: esibusinessenquiries@exeter.ac.uk