



ANNUAL REPORT 2023

Begin



Vision

To enable a transition to a zero carbon, resource efficient and sustainable society

Mission

To generate new research knowledge for the understanding and protection of our natural environment, and develop technologies, tools, services and policy knowledge to facilitate a transformation to a zero carbon, resource efficient, and sustainable society

THE ENVIRONMENTAL RESEARCH INSTITUTE IS COMMITTED TO THE FOLLOWING FIVE CORE PRINCIPLES

Research excellence

Interdisciplinary collaboration

Research with impact – Environmental, Societal & Economic

High quality postgraduate and postdoctoral education and training

Diversity and Equality

Photography credits:

Tomas Tyner, Claire Keogh and Marcin Lewandowski

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Message from ERI Director

The year 2023 was a very successful year for UCC's Environmental Research Institute as evidenced by this annual report. We have grown significantly over the past year and the ERI is now home to nearly 600 researchers, marking a significant growth that was leveraged by the significant UCC Futures recruitment programme across ten indicative areas of strategic importance including sustainability. We secured an additional €14 million in research funding, supplementing the existing 300 active projects with a collective value of €88 million in 2023. We use this funding to further deliver on our mission, namely to generate new research knowledge for the understanding and protection of our natural environment, and develop technologies, tools, services and policy knowledge to facilitate a transformation to a zero carbon, resource efficient, and sustainable society.

The ERI demonstrated significant scientific excellence in sustainability 2023, as evidenced by the 388 internationally peer reviewed publications, the awards, elected positions and national and international committee appointments our researchers achieved and our rankings amongst the top engineers and scientists in Ireland and globally.

Translating our research results into significant societal impact was also very evident in 2023. Amongst the many examples in this report, this included empowering children and young people aged 8-16 about biodiversity, underpinning the Department of Transport 'Your Journey Counts' campaign to encourage active travel, participating in working groups for different chapters of the Government's

Climate Action Plan, 2024, informing Cork City's Climate Action Plan through a baseline emissions analysis and mapping, empowering and encouraging consumers to transition to more sustainable eating patterns and informing a just transition in agriculture and land use.

The year 2023 also marks a significant milestone as we evolve from UCC's Environmental Research Institute into UCC Futures Sustainability Institute. This evolution builds on the strengths of UCC's sustainability research that have been developed over nearly a quarter of a century since the establishment of the ERI. It also reflects the University's strong commitment to sustainability across sustainability research, sustainability practice and sustainability teaching that is reflected in UCC's Securing Our Future Strategic Plan. I warmly welcome the 30 new UCC Futures - Sustainability academics recruited in 2023 from across the disciplines of Science, Engineering, Food, Business and Law, who will provide a major additional contribution to sustainability research in UCC and to the new UCC Futures Sustainability Institute.

A handwritten signature in blue ink that reads "Brian Ó Gallachóir".

PROFESSOR BRIAN Ó GALLACHÓIR
Incoming Director,
Environmental Research Institute

ERI Management 2023



- | | |
|--|---|
| 1. PROFESSOR BRIAN Ó GALLACHÓIR | ERI Director (April – Dec 2023), Director of the SFI MaREI Centre, Associate Vice-President of Sustainability |
| 2. PROFESSOR SARAH CULLOTY | ERI Director (Jan – March 2023), Head of College of SEFS |
| 3. PROFESSOR JERRY MURPHY | Director of the SFI MaREI Centre, Vice-Director of the ERI |
| 4. DR PAUL BOLGER | ERI Manager |
| 5. DR GILLIAN BRUTON | SFI MaREI Centre Manager |
| 6. DR JIMMY MURPHY | LIR NOTF Manager |

ERI Operations Team 2023

ELAINE BURNS
Doctoral Training Co-Ordinator

DR AOIFE CORCORAN
Communications and Research Impact Officer

AOIFE DEANE
Communications & Public Engagement

PETER HOURIHANE
MaREI Senior Programme Manager

GRAINNE LYNCH
Research Support Officer

ANNETTE MATTHYS
EU Funding Coordinator

HELEN MCMAHON
Research Support Officer

DR SONIA MONTEIRO
Research Grants Coordinator

KAREN O'CALLAGHAN
Marketing & Multimedia Research Assistant

DEE O'CONNOR
Marketing & Communications Manager

CATHAL O'MAHONY
EU Grant Manager

ANNETTE O'SULLIVAN
Research Assistant Admin

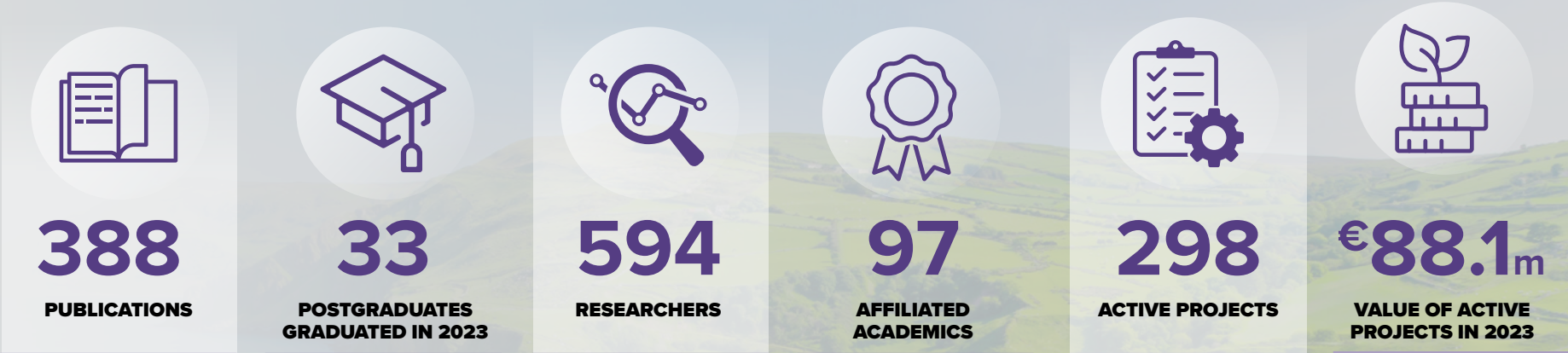
ANGELA POPE
Finance Manager

IAN POWER
LIR NOTF Operations Co-Ordinator

TARA REDDINGTON
Research Support Officer

DR CHRIS ROGERS
Lab Manager

Snapshot of ERI in Numbers for 2023



Funding Source



1 | UCC Futures – Sustainability Institute



2023 saw the launch of the UCC Futures programme at the University. UCC Futures combines research prioritisation with an innovative academic recruitment strategy across ten strategic research areas that have been prioritised within the UCC Strategic Plan 2023-2028. The University has the ambition to lead in these ten areas and place UCC on the international map for research excellence.

Sustainability is a core value of UCC. The University is leading globally in creating a sustainable future through our practice, research and education. In line with this ambition, UCC Futures - Sustainability Institute was selected as one of the UCC Futures ten strategic research areas.

The UCC Futures – Sustainability Institute will build on the solid foundations and substantial achievements of the Environmental Research Institute (ERI) which was established almost 25 years ago. The complexity of global sustainability challenges requires experts from multiple disciplines and sectors to collaborate in new and reimagined ways. At the ERI we have always believed that solving sustainability challenges requires creative, inter-disciplinary solutions, driven by an innovative and holistic approach. Through the Institute's programmes of inter- and trans-

disciplinary research, we have successfully generated new knowledge and developed technologies and tools that have facilitated a just transition that is economically prosperous and socially inclusive, while protecting our natural environment. The UCC Futures – Sustainability Institute represents the next phase of the important and impactful journey of discovery for the ERI.

The recruitment and commencement of 30 new academics across the University's four Colleges under UCC Futures in 2023 and 2024 adds significantly to the breadth and depth of sustainability research at UCC and provides the opportunity to deepen existing research strengths and develop new areas of excellence such as clean energy transition, sustainable business, sustainable materials, marine and coastal resilience, low carbon agriculture, and circular bioeconomy. These new appointments and new strategic research areas will enhance UCC scientific excellence and impact in the area of sustainability research, and further catalyse the development of an Institute of international standing.

The UCC Futures – Sustainability Institute is being led by the Director of the ERI and Associate VP of Sustainability, Prof Brian Ó Gallachóir.

A WARM WELCOME TO OUR 30 NEW UCC FUTURES – SUSTAINABILITY ACADEMICS

Applications were sought for 30 positions in the Sustainability area across the schools and disciplines of Science, Engineering, Food, Business and Law. These academic posts are a key part of the second phase of the UCC Futures recruitment programme. This programme led a creative, inclusive, and interdisciplinary approach to this area and provide transformative leadership that will further enhance UCC's outstanding research and research-informed teaching.



**DR ALIA
ASHERALIEVA**
School of Computer
Science & Information
Technology



**PROF VALERIA
ANDREONI**
Cork University
Business School



**PROF FEMI
AMAO**
School of Law



**DR TRACY
BRADFELD**
Cork University
Business School



**DR BRENDAN
BULFIN**
School of Chemistry



**DR WILLIAM
BURCHILL**
School of BEES



**PROF MICHELLE
CARR**
Cork University
Business School



**DR GILLIAN
COLLINS**
School of Chemistry



**DR JOHN
CONDON**
School of
Mathematical Sciences



**DR MARA VAN
TWUIJVER**
Cork University
Business School



**DR RAMIRO
CREGO**
School
of BEES



**DR FRANCISCO
VITOR SANTOS
DA SILVA**
School of Engineering



**DR PAUL
DEANE**
School of Engineering



**DR LOUISE
FIRTH**
School of BEES



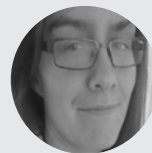
**DR DEIRDRE
HENNESSY**
School of BEES



**DR ANTONY
KNIGHTS**
School of BEES



**DR SERHIY
YANCHUK**
School of
Mathematical
Sciences



**DR LAURA
MAYE**
School of Computer
Science & Information
Technology



**DR STEPHEN
MCCARTHY**
Cork University
Business School



**DR CILLIAN
WILLIAMSON**
School of
Mathematical
Sciences



**DR VIJAYAKUMAR
NANJAPPAN**
School of Computer
Science & Information
Technology



**PROF BRIAN
O'GALLACHOIR**
Associate VP
Sustainability/
Director ERI



**DR JAMIE
O'NEILL**
Cork University
Business School



**DR BER
POWER**
Cork University
Business School



**DR GAURAV
RAJAURIA**
School of Microbiology
/Food and Nutritional
Science



**DR ORLAGH
REYNOLDS**
Cork University
Business School



**DR WENDY
ROWAN**
Cork University
Business School



**PROF STEWART
SMYTH**
Cork University
Business School



**DR KLAS
JAN STOL**
School of Computer
Science & Information
Technology



**DR HUANHUAN
XIONG**
Cork University
Business School

2 | ERI Research Highlights 2023

2.1 CLIMATE ACTION

Climate change is one of the greatest threats facing humanity. The transition to a zero carbon and climate resilient society as committed to in the 2015 Paris Agreement is now underway. The ERI Climate Action challenge is focused on understanding, responding, adapting, and living with climate change.



SOCIETAL IMPACT: DEPARTMENT OF TRANSPORT USES UCC RESEARCH IN PUBLIC AWARENESS CAMPAIGN

The Department of Transport launched a public awareness campaign in 2023 called ‘Your Journey Counts’ to encourage active travel, highlighting that ‘By choosing to walk, cycle or take public transport, you are part of the national effort to reduce transport emissions by 50% by 2030.’

The Government increasingly recognises that reducing transport emissions cannot be delivered by technology alone. Increasing active modes of travel (walking and cycling) and increased switching from car transport to public transport form a key part of the solution space but have been too often neglected, partly due to an absence of evidence. Published research results from MaREI on passenger transport trends in Ireland has addressed this evidence gap and these results are now being used directly by the Department of Transport in their campaign. In the section on the DoT Your Journey Counts website on ‘Benefits of sustainable travel’ DoT draws on MaREI research results:

“By walking and cycling where possible, you can save even more carbon emissions. For example: if you switch a four-kilometre typical car school trip with cycling a bike to school you could save 200kg of CO₂ each year. If we replaced all car trips less than 4km with cycling trips, we could cut national emissions from passenger transport by 9%. If we replace all car trips of less than 6km with cycling trips, we could cut national emissions from passenger transport by 21%.

MAREI RESEARCH INFORMS GOVERNMENT CLIMATE ACTION PLAN

The Climate Action and Low Carbon Development Act 2021 placed the annual production of a Climate Action Plan on a statutory footing. Climate Action Plan 2024 is the key climate policy document nationally that sets out the all-of Government response to the challenges posed by climate change and specifies pathways to delivering the required emissions reductions to comply with Ireland’s ambitious carbon budgets and sectoral emissions ceilings. The purpose of the Climate Action Plan is to enable Ireland to meet 2030 targets and be well placed to meet mid-century decarbonisation objectives. In 2023, UCC researchers participated in six working groups developing different chapters for the Government’s Climate Action Plan 2024.

The Department of the Environment, Climate and Communications is funding MaREI’s energy modelling team at the ERI to make their unique energy systems modelling expertise available to Government Departments and is used to underpin the Climate Action Plan.

“MaREI is one of the standout success stories in Ireland’s efforts to achieve excellence and impact in research. It is positioned at an important intersection in the vital effort that is needed to address Ireland’s climate and energy challenges. Through building talented, diverse and multi-disciplinary research teams MaREI has generated a high-quality research output and a European and global reputation amongst the research community. Perhaps most impressively, MaREI has implemented a sophisticated and persistent engagement strategy to ensure the policy relevance and impact of this research. As a result, MaREI is highly respected and trusted by policy makers and is providing crucial expertise to successfully guide Ireland’s transition to net zero.

Jim Breslin, Former Secretary General, Department of Further and Higher Education, Research, Innovation and Science



SUPPORTING LEADERSHIP IN SUSTAINABILITY

In March 2023, the Sustainability Leadership programme was launched at the Irish Management Institute (IMI) in Dublin. This programme for senior leaders is a collaboration between the UCC Sustainable Futures Project and the Irish Management Institute. The IMI, in association with the ERI identified the key challenges and obstacles facing leaders and organisations seeking to implement a sustainability agenda. Grounded in best practice, this highly practical programme will equip participants with the

transformational leadership capabilities needed to successfully embed change and achieve sustainability goals. Project lead Dr Marguerite Nyhan (ERI, MaREI, School of Engineering and Architecture) officially launched the programme and delivered the first lecture to participants from some of Ireland's largest companies.



THE NET EFFECT

When developing and deploying negative emissions technologies (NETs), little attention has been paid to where. Should negative emissions technologies be deployed in Western countries for most climate action or Asia where they are needed for development? In a 2023 publication in the Global Sustainability journal, Dr Kian Mintz-Woo (ERI, Dept of Philosophy) argues that this point raises morally and legally important implications by identifying a trade-off between 'efficiency' and 'need'. On the one

hand, one might develop NETs where they are likely to contribute most to global mitigation targets, contributing to a global climate solution. On the other hand, one might develop NETs where they can help support development on a regional basis, justified by regional demands. Dr Mintz-Woo defends these arguments and suggests that they reflect the values of efficiency and responding to need, respectively. To the extent that these values conflict, they introduce what Dr Mintz-Woo calls the Need-Efficiency Trade-off Effect ('NET Effect').

TRANSDISCIPLINARY APPROACHES TO SUSTAINABILITY RESEARCH

A 2023 research paper led by Dr Evan Boyle and Dr Connor McGookin (both of ERI and MaREI) analyses the transdisciplinary approaches academics use to engage with stakeholders on sustainability challenges. The researchers looked at how academics work with different groups, like businesses, government, and communities, to study big environmental issues, especially climate change, and highlight how the rules and systems in universities and research institutions affect this kind of teamwork. The researchers conducted interviews with 10 experts to understand the challenges and also the reasons why academics team up with others to study complex problems. The research provides two significant contributions: it adds to what we know about why researchers collaborate with different groups, and it talks about the rules and systems that affect this kind of research, suggesting ways to improve. The authors, who are early in their careers and come from sociology and energy engineering backgrounds, wrote this based on their experiences working on the Dingle 2030 project – which focused on a community's switch to cleaner energy.



SOCIAL ACCEPTANCE OF WIND ENERGY

Wind energy has a pivotal role to play in the transition to renewable energy. However, social opposition to developer-owned wind farms is a key barrier to its deployment. Two 2023 publications exploring citizen engagement in Irish wind energy from ERI/CUBS authors Dr John Eakins, Dr Ber Power, Dr Ellen O'Connor, Dr Geraldine Ryan, Dr Gordon Sirr and Julia le Maitre, featured in a special issue of Energy Policy on the dynamics of social acceptance.

The authors explored the issue of market acceptance of citizen investment opportunities in wind farms by examining citizens' willingness to invest in projects. Based on a survey of 2,023 Irish citizens, they found that 56% of citizens would invest in a local project, 41% would invest in a portfolio of projects, and 29% would invest in a non-local project. The analysis reveals a number of socio-demographic, locational, community and attitudinal variables that affect both the decisions of citizens to invest in projects and the monetary amount that they are willing to invest. The findings of the paper provide insights into policy measures that could help to strengthen the market acceptance of citizen investment opportunities and will be useful for policymakers who are seeking to mobilise citizen investment with a view to enhancing the deployment of wind energy.

In addition, the multidisciplinary wind energy research team led by Dr Paul Leahy (ERI, MaREI) made multiple advances in 2023 with Dr Angela Nagle of the Re-Wind team established a startup company BladeBridge which is delivering sustainable repurposed infrastructure and products from wind turbine blades decommissioned in Ireland. BladeBridge was selected for the ESB 2050 Accelerator run by Dogpatch Labs; in parallel H-Wind PhD Student Quang Vu Dinh winning "Best Presentation" for his talk on "A method to map the levelised cost of hydrogen from offshore wind farms coupled to onshore electrolyzers via HVDC" at the 6th International Conference on Clean Energy & Technology held in Penang, Malaysia.



SOCIETAL IMPACT: INFORMING CORK CITY'S CLIMATE ACTION PLAN

Home energy usage and road transport emissions are responsible for two-thirds of greenhouse gasses being generated in Cork City, according to important new ERI research commissioned by Cork City Council's Climate Action Unit. The 'Modelling and Spatial Mapping of Cork City Baseline Emissions' study, completed by UCC's School of Engineering and Architecture, MaREI and ERI, gathered data on emissions from homes, vehicles and businesses. It calculated energy demand and modelled CO₂ emissions across transport, residential, commercial/industry, public, agriculture & fishing and waste while mapping energy and CO₂ emissions and comparing them against national emissions models.

The research, led by Dr Marguerite Nyhan (ERI, MaREI, School of Engineering and Architecture) with colleagues Anna O'Regan and Lily Purcell from the Nyhan Future Sustainability Research Group and Dr Conor McGookin (ERI, MaREI) found that Cork City is releasing nearly 1 million tonnes of greenhouse gases into the air every year. Our 78,856 homes alone contribute 34% of total emissions. Road transport, especially cars, account for another 29%. Our most congested roads, including the South Ring, N8 and Anglesea Street, among others, are emissions blackspots. The remaining balance of the City's greenhouse gas emissions are from commercial and industrial buildings, which contribute 22%, public services contribute 7%, agriculture and fisheries 6% and waste 2%.

To further understand and advance the science of sustainable cities, Dr Nyhan and her team also published new research in Environmental Science & Technology in 2023 which harnessed Google Air View-air pollution levels and Google Street View-derived urban greenspace metrics along the entire road network of Dublin City.



SUSTAINABLE DEVELOPMENT GOALS

In a 2023 correspondence to Nature, Dr Marguerite Nyhan (ERI, MaREI, School of Engineering and Architecture) and UCC's Vice President for Research and Innovation, Prof John Cryan wrote that while global efforts in science, technology and innovation could accelerate achievement of the United Nations Sustainable Development Goals (SDGs) by 2030, scientists need to be incentivised to contribute to these goals with new reward and evaluation systems which capture both scientific excellence and SDG impact.

“ So far, only 15% of SDG targets are on track for 2030, 48% are off-track and 37% have either stagnated or regressed below the 2015 benchmark. Action to rectify the situation is becoming increasingly urgent. To encourage SDG-relevant research, reward and evaluation systems need to be reformulated to capture both scientific excellence and SDG impact. Many universities, including ours (University College Cork, Ireland), are already mapping their research against the SDGs. A new vision for research quality includes broadening metrics-based evaluation and assessment approaches to factor in SDG alignment and progress...

Dr Marguerite Nyhan
and Prof John Cryan

Dr Nyhan was also amongst the experts invited to the 2023 UN Multi-stakeholder Forum on Science, Technology & Innovation for the SDGs, to discuss her paper 'Harnessing Emerging Technologies for Scalable, Global, Ethical & Equitable Education for Sustainability' which was published with co-authors in Microsoft.

Additionally, to analyse the Sustainable Development Goals in a global framework, a newly published textbook authored by Dr Paul Holloway (ERI, Dept of Geography) applies the lens of the Sustainable Development Goals to the study of Geographical Information Systems (GIS) using 16 real world SDG case studies from 11 different countries. By using open source software, the book provides a novel enhancement to 2nd and 3rd level GIS curricula.



SCIENTIFIC EXCELLENCE

ERI Director Professor Brian Ó Gallachóir's scientific publications have now been cited more than 10,000 times. Citations are one of many metrics for scientific excellence, they provide an important indication of how useful your peers globally value your research.



10,000+
CITATIONS FOR
HIS SCIENTIFIC
PUBLICATIONS

CAN WE ADAPT TO GLOBAL WARMING?

A 2023 paper by mathematicians at UCC and the University of Exeter in England, has found that our ability to adapt to global warming will be impaired if the rate of change is too rapid. Approaching critical levels at too fast rate of change will create new rate-induced tipping points, researchers have found. This, in turn, will impact our capacity to meet the challenges posed by tipping points since tipping will occur earlier than expected. Until now, critical levels have been assumed to be a point of no return, but the new study concludes that dangerous rates of change could trigger irreversible shifts in human and natural systems even before these critical levels are reached. The new study highlights the dangers associated with rate-induced tipping, which is triggered not by a critical level of change but instead by how quickly that level is approached.

For example, a slower or more gradual approach towards a critical level of climate change will allow humans, animals, and ecological systems more time to adapt and survive the outcomes once this level is reached. However, a more disruptive rapid approach risks the survival of species even before a critical level is reached. This disruption to ecosystems will, in turn,

create new challenges and new tipping points in socio-ecological networks through so-called domino effect.

“

Rate-induced tipping captures a ubiquitous and potentially dangerous instability -- failure to adapt to changing external conditions thus requires deeper understanding and recognition by climate policy makers.

Author Professor Sebastian Wieczorek from the School of Mathematical Sciences and the ERI



UCC @COP28

As the only Irish University with observer status, UCC once again sent a delegation of students, academics, and researchers to the COP 28 global summit in Expo City, Dubai in November 2023.

COP 28 brought together nations to assess global efforts to limit the levels climate change against targets set by the UN Framework Convention on Climate Change, the Kyoto Protocol, the Paris Agreement, and other international accords.

The delegation was composed of academics, researchers, post- and under-graduate students; including Niamh Guiry, Dearbhla Richardson, Claudia Hihetah, Dr Kian Mintz-Woo, Dr Marie Aronsson-Storrier, Dr Archishman Bose, John Barimo. For the first time, this year UCC allocated 3 of its badges to climate activists from the global south to ensure representation for those most impacted by climate change.

“

UCC was the first Irish University to secure official observer status at COP meetings, and we believe it is important for universities to maintain a presence at the talks. We need observers to stand witness to these important international negotiations and to critically assess the decisions made, in order to ensure the outcomes shape a better future for us all.

Associate Vice-President of Sustainability at UCC and Director of the Environmental Research Institute
Prof Brian Ó Gallachóir

“

Sustainability is core to UCC's ethos – it is one of the five key goals outlined in our five-year strategic plan launched this year. Whether it be through day-to-day initiatives such as our Plastic Free UCC policy, or at a macro level by attending COP28, we will not be found wanting in our relentless efforts to address the single greatest challenge of our age.

UCC President Prof John O'Halloran

UCC also hosted a mock COP28 to understand COP's challenges and to see if a global agreement can be reached, organised by UCC Green Campus and the ERI, and supported by UCC Sustainable Futures Lab, with thanks also to UCC Students Union, UCC BEES Society, UCC Environmental Society and UCC Global Justice Society. The Mock COP28 was organised by Dr Fionn Rogan and Irene Ní Shúilleabháin.

In addition, to coincide with COP28 UCC collaborated with the University of Plymouth and the University of Massachusetts, Lowell to host an online lunchtime discussion to provide a local perspective and opportunity to engage with COP28 themes. Guest speakers were:

Prof Brian O'Gallachoir, UCC Associate VP for Sustainability and ERI Director, University College Cork, Ireland

- Dr Munira Raji, Sustainable Geoscience and Natural Capital Research Fellow, University of Plymouth and member of the United Nations Economic Commission for Europe (UNECE) Task Force on Just Energy Transition, Plymouth, UK
- Professor Juliette Nicole Rooney-Varga, Professor of Environmental Science, Director - Climate Change Initiative, UMass Lowell, USA



UNCOVERING THE HIDDEN FORCE GOVERNING THE SURVIVAL OF DEEP-SEA LIFE

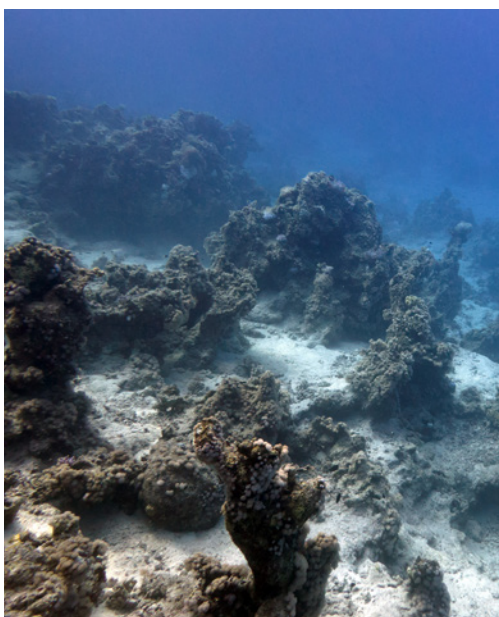
Our ocean biodiversity is dependent on the strong circulation system of our oceans. Water near the ocean surface moves towards the poles, where it becomes cold and dense. When the dense water sinks, it brings oxygen with it from the atmosphere to the ocean floor. This oxygen is vital for the survival of deep-sea creatures. Similarly, nutrients from sunken organic matter are delivered back to the surface, providing plankton with the sustenance to grow and support the wonderful biodiversity of our oceans. However, this was not always the case throughout the Earth's history, and research from Dr Andrew Keane (ERI, School of Mathematical Sciences) published in *Nature* in 2022, has found that this circulation can suddenly disappear with the gradual shifting of the continents.

Decades of modelling and analysis show that if precipitation in certain parts of the Atlantic Ocean pass a certain threshold, or if atmospheric CO₂ passes a critical level, then the ocean would quickly find itself in a state of reduced circulation. This new study uses a complex computer model of the Earth with a 3D representation of the ocean dynamics and reconstructed continental configurations from across the past 540 million years. The simulations of this model show that even small adjustments to the positions of the continents can 'tip' us into a completely different distribution of oxygen in the deep ocean.

“

The Earth's climate system is so complex that it is possible for a seemingly tiny change to result in a relatively sudden and often drastic response. The critical threshold that is overcome by this tiny change is often referred to as a climate 'tipping point'. It's clear from many recent studies that a tipping of the modern Atlantic Ocean circulation would change life as we know it in western European countries because our climate would become drastically colder. Some of these studies even suggest that we are approaching a tipping point. Our study highlights the threat to ocean biodiversity, especially to creatures of the deeper and darker parts of the ocean

Dr Andrew Keane



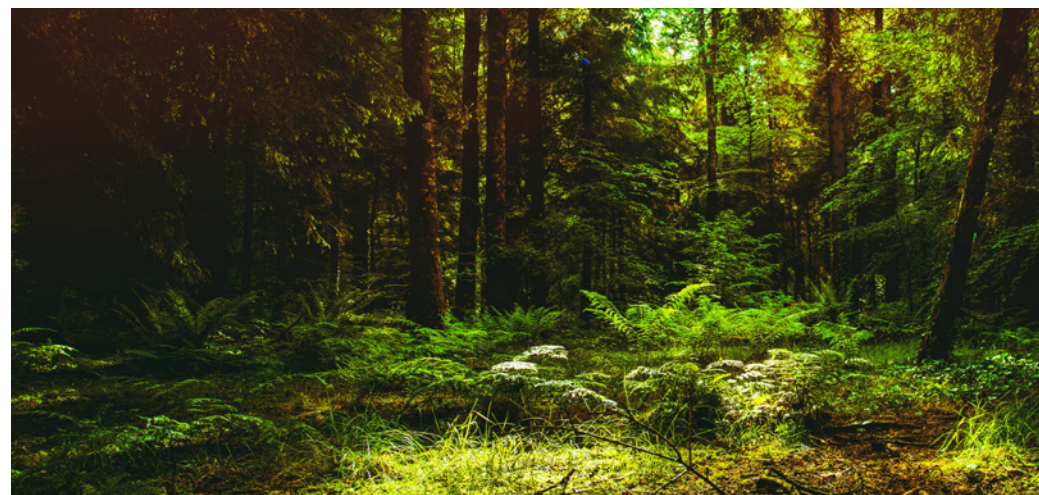
USING NOVEL TECHNOLOGIES TO HELP OUR FORESTS ADAPT TO CLIMATE CHANGE

It is crucial to make forest ecosystems more resistant to face the challenges presented by climate change, through resilience strengthening and close-to-nature forestry. However, implementing such approaches and monitoring their progress requires accurate knowledge about forest ecosystems that rely on forest *in situ* data at high spatial and temporal resolution.

Novel, terrestrial-based technologies will play an important part and such technologies have experienced a fast development in recent years. The forests can now be observed and monitored in a very high spatial and temporal resolution that was not possible even a few years ago. Researchers and practitioners are facing a unique opportunity to deepen the understanding of forest ecosystems and to change the forestry to adapt to the climate, environment and industrial changes. Various research groups across EU and beyond are testing such technologies or developing

processing algorithms for precision forestry and forest ecology. But further cooperation is urgently required and Dr Markus Eichhorn (ERI, School of BEES) is currently leading on communication and dissemination in a COST Action which aims to promote such collaboration.

3DForEcotech (Three-dimensional Forest Ecosystem Monitoring and Better Understanding by Terrestrial-based Technologies) will establish a strong network of scientists, stakeholders and sensor manufacturers to synchronise the knowledge, to develop general protocols and algorithms for forest ecosystem state survey and forest functioning, and to make these novel technologies available to a broad audience. Specifically, 3DForEcoTech will develop protocols for data acquisition, processing, fusion for forest inventory and ecological applications, and will establish open-data and open-source algorithm databases.



2.2 HEALTHY ENVIRONMENT

Our economic prosperity and well-being are underpinned by the quality of our environment and natural capital. The ERI Healthy Environment challenge is focused on protecting our natural ecosystems and providing a healthy environment for humans, animals and plants to live in.

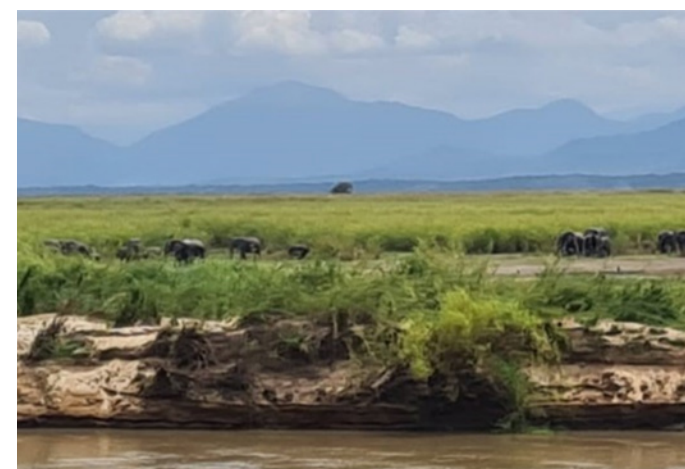


PROMOTING DEVOLVED CONSERVATION INITIATIVES IN TANZANIA THROUGH COLLABORATION WITH LOCAL STAKEHOLDER COMMUNITIES

The collaboration between Professor Ger Killeen's research group (School of BEES, ERI) and a community-run Wildlife Management Area (WMA) in Tanzania has led to enhanced effectiveness of this decentralized rural development organization, so that it now has clearly improved governance and management and has begun to accrue sustainable income by regularly hosting tourists.

In particular, twinned Irish and Tanzanian students working together across the WMA have not only accumulated invaluable formal research data, they have also seeded a long term ecological monitoring platform and a modest but steady flow of income from local and international ecotourism visitors. Indeed, the governing villages have already benefited through employment opportunities and some modest financial support for grass roots development initiatives.

The ongoing project now supports and documents the evolution of the WMA into a fully sustainable, well-managed local initiative that successfully protects this beautiful hardwood forest, maximizes its carbon sequestration value, maximizes stakeholder community benefit and minimizes human exposure to malaria, zoonoses and emerging infections. Encouragingly, some parts of the WMA that had been illegally converted to farmland are already recovering with rebounding forest cover. As a result of all these small steps in the right direction, animals are now returning to some that had been badly encroached, the most obvious of which are the elephants.



SCIENTIFIC EXCELLENCE



**5 SCHOOL OF
BEES/ERI
SCIENTISTS**

Ranked In The Elsevier
TOP 100,000
SCIENTISTS GLOBALLY
Based on career citations.

- 1. Professor John Davenport – Emeritus Professor
- 2. Professor Gerry Killeen
- 3. Professor Astrid Wingler
- 4. Professor Marcel Jansen
- 5. Professor Tom Cross – Emeritus Professor

BUILDING SUSTAINABILITY INTO
HEALTHY EATING GUIDELINES

The Lancet Global Syndemic Report and the EAT-Lancet Commission call for comprehensive measures and a shift to more sustainable, plant-based diets to address obesity, undernutrition, and climate change. With international commitments to reduce greenhouse gas emissions and growing concerns about health and environmental impacts, promoting sustainable diets is becoming a central policy concern globally and in Ireland.

The Safefood project recently published a review of international practice on building sustainability into national healthy eating guidelines and the practical implications for policy. Recommendations from the research team, which included Dr Janas Harrington (ERI/ School of Public Health), included guidance

specific to empowering and encouraging consumers to transition to more sustainable eating patterns.

This 18-month project aimed to find the best ways to promote healthy and sustainable eating habits, focusing on the island of Ireland. It used a mix of methods to gather information from various sources, including research and real-life experiences. Key findings and recommendations include the need for clearer guidelines on sustainable eating, addressing misconceptions about certain foods, and promoting awareness of the environmental impact of dietary choices. Participants expressed concerns about the cost, accessibility, and practicality of sustainable diets, highlighting the importance of education and support in making healthier and more eco-friendly food choices.



CHALLENGES IN WATER
TREATMENT

Disinfecting drinking water can create challenging byproducts. The PRODOM project led by Dr John Weatherill has been investigating the use of a method called EEM-PARAFAC (Fluorescence excitation–emission matrices parallel factor analysis) to study these byproducts, exploring the relationships between fluorescence and the byproducts. This method could be a cheaper way to predict DBP formation in treated water, but it hasn't been widely studied yet. In a 2023 review Dr Weatherill and colleagues examined data from 45 scientific articles to find patterns between certain substances in water (identified by PARAFAC) and the amount of DBPs produced during disinfection. They found strong connections between certain types of DBPs, like trihalomethanes (THMs) and haloacetic acids (HAAs), and substances like humic/fulvic-like components in water. However, the links between nitrogen-based DBPs and PARAFAC substances were less clear. Overall, while this method shows promise for predicting DBP formation, more research is needed to create a global model that works for all water sources.



SOCIETAL IMPACT: STRIVING FOR A JUST TRANSITION IN AGRICULTURE

National Economic and Social Council (NESC) has released a new report in 2023 chaired by Prof Thia Hennessy (ERI, CUBS), "Just Transition in Agriculture and Land Use" as part of its 50th-year work programme. The report suggests that by adopting a fair and inclusive approach, the agriculture and land use sector can play a significant role in tackling climate change and biodiversity loss. The recommendations focus on four key areas: coordinating and governing the transition, ensuring socially inclusive participation, seizing opportunities for change, and distributing efforts fairly. The report outlines twenty recommendations, including enhancing farm advisory services, increasing financial support for farmers, and establishing a Just Transition Commission and Fund. The authors emphasise that a just transition within agriculture can address environmental challenges while supporting rural communities and livelihoods. They highlight the importance of collaboration with various stakeholders to achieve a fair transition that balances economic, social, and environmental goals.

ENABLING IRISH YOUTH TO ADVOCATE FOR NATURE

On Earth Day 2023, Saturday 22 April, Ireland's first Children and Young People's Assembly on Biodiversity Loss published its final report, calling for greater respect for the rights of nature and for biodiversity to be at the centre of decision-making. The report also calls for children and young people to be included in how we respond to biodiversity loss. ERI researchers Dr Clodagh Harris (Dept of Government & Politics), Dr Aoife Daly (School of Law) and Aoife Deane (MaREI) were members of the research team which designed and implemented the Assembly.

The Assembly met over two weekends in October 2022 and aimed to ensure Ireland's youngest citizens have their say in how Ireland responds to the challenge of biodiversity loss. Over 500 children and young people aged 7-17 years from across Ireland applied to be part of the assembly, of which 35 were selected representing a diverse cross-section of society. The Assembly's report charts in beautiful and vivid detail the journey that participants in the Assembly went on over the course of their work together. It details their activities over the two weekends and captures their key

recommendations, including a vision of the future they would like to see.

The Assembly's legacy is now being developed through a follow-on project called Teaching Resources for Youth-informed Biodiversity Education (TRYBE) led by Aoife Deane of MaREI and the ERI, which addresses some of the Assembly's calls to action around education and raising awareness.



SUPPORTING BIODIVERSITY ON IRISH FARMS



Cllr Danny Collins, Lord Mayor of Cork County Council; Cllr Deirdre Forde, Lord Mayor of Cork City Council; Prof. Frank Buckley (Professor of Agricultural Science & Head of Discipline of Agricultural Science Degree at UCC); Tánaiste Micheál Martin; Robert Harkin (President of the Munster Agricultural Society); Saba Loftus (Head of Development, College of Science, Engineering and Food Science at UCC)

Tánaiste Micheál Martin announced an exciting collaboration between the Munster Agricultural Society (MAS) and UCC at the official opening of the Cork Summer Show in 2023.

The Munster Agricultural Society are generously providing a philanthropic gift of €375,000 to the Cork University Foundation for the development of a Farmland Biodiversity Education and Research Programme within Agricultural Science at UCC. MAS will also loan a two-acre research site to UCC for plot-based research in soil and grassland science. This builds on the strong legacy of agricultural education and collaboration between UCC and MAS in the region.

The objective of the MAS supported Farmland Biodiversity Education and Research

Programme at UCC, in conjunction with the ERI is to develop and deliver a comprehensive programme of Farmland Biodiversity education, demonstration, research and extension initiatives. This will provide leadership to the industry, guidance for future policy and incentive schemes, and share with the public the positive actions being taken at farm level.

Separately, Dr Rossana Henriques and Dr Fidelma Butler (ERI, School of BEES) are addressing plant/pollinator interactions in Irish farmlands as part of a recently funded DAFM project ARID. In a collaboration with Dr Michelle McKeown (ERI, School of the Human Environment) the team will investigate the phenology (flowering time) and pollen development (viability and quantity) of red and white clover in mixed-species grass swards, across a range of Irish locations

with distinct climate variables (e.g., soil water content, temperature, rainfall). In parallel, they will assess the diversity and activity of insect pollinators in these mixed swards and in their adjacent habitats.

The abiotic and biotic data collected will lead to a mathematical model identifying the dominant drivers controlling clover flowering and associated pollinator diversity and activity, which will be further tested in controlled glasshouse experiments mimicking field conditions. This research project will allow the team to identify clover/pollinator interactions in an agricultural context; collect data on the resilience of clover in varying climates and its impact on clover pollinators, and identify the abiotic drivers (e.g., temperature, water availability) of clover/pollinator interactions.

“

The research site provided by MAS is a significant addition to our developing Agricultural Science Programme at UCC. It will allow us to conduct research that will focus on delivering adoptable solutions to combat the key sustainability challenges of emissions, water quality and biodiversity loss while also safeguarding the economic and social sustainability of our family farms.

Dr William Burchill
FBD Lecturer in Soil Science and
ERI Academic

IMPACT OF CLIMATE CHANGE ON IRELAND'S FLORA AND FAUNA

The impact of climate change on Ireland's nature is outlined in new UCC research with rare native plant species set to go extinct and non-native sika deer on track to increase across Ireland. Plants that have been part of Irish nature including Spring Vetch, Wood Crane's bill, the Nettle-leaved Bellflower and Mackay's Heath will disappear as Ireland's climate changes.

“

Urban green spaces may help to mitigate the negative impacts of climate change and increased herbivory pressure on some of our most threatened plant species. Given the avoidance of urban centres by deer in Ireland, these areas could provide a refuge for many plant species, including endangered and vulnerable species to not only persist, but thrive under future climates. The role that citizens have embraced in rewilding these areas is a testament of local support to the biodiversity crisis

Author Dr Paul Holloway
the ERI and Dept of Geography

“

We must prioritise the conservation of native flora from the potential negative impacts of both native and non-native deer species, as plants play a fundamental role in maintaining biodiversity, supporting native wildlife, ensuring the long-term resilience of our natural habitat, and protecting part of Ireland's natural heritage.

Lead author James O'Mahony
described the importance of the research



SOCIETAL IMPACT: SUPPORTING POLICY DEVELOPMENT FOR 'OUT OF SEASON' BATHING IN IRELAND

The EU Bathing Water Directive states that “Member States shall annually identify all bathing waters and define the length of the bathing season”. In recent years there has been a surge in interest in winter or “out of season” bathing, particularly during successive C-19 lockdowns. As a consequence, there have been numerous calls from both political and public groups for the extension of the official bathing season, to extend monitoring of the microbial quality status of bathing waters beyond the “summer” period to include year-round analysis and reporting. An evidence-based research study was conducted by Dr Linda O'Higgins on behalf of the Department of Housing Local Government and Heritage in Jan 2023 which collated all available scientific evidence to help inform policy for

the development of enhanced water quality monitoring and management of bather risk specifically during the ‘out of season’ period. The report included an assessment of current best practice strategies for management and communication of out of season risks, both from within the EU and internationally, and critical review of so-called “real-time” analytical approaches for quantifying microbial water quality in terms of robustness and accuracy of data generated. An evaluation of season-specific health and safety risks at Ireland's designated bathing sites, and additional management measures to better protect the health of “out of season” bathers was then made. Recommendations were provided to inform policy development.



DELIVERING SUSTAINABLE URBAN FORESTS

The UCC Arboretum group (led by Drs Eoin Lettice and Barbara Doyle Prestwich of the ERI and School of BEES) has been very active following the awarding of significant new funding with a one-day symposium on urban trees being just one highlight of 2023.

On April 27th, 2023, the symposium brought together experts, practitioners, policymakers, and stakeholders from diverse backgrounds to discuss a critical topic: “Delivering Sustainable Urban Forests.” This one-day symposium, aimed to shed light on the essential role of urban trees in creating vibrant, healthy, and sustainable cities and towns. The discussions held during the symposium underscored the critical importance of urban forests in promoting biodiversity, addressing climate challenges, enhancing culture, supporting human health and well-being, and contributing to achieving the UN Sustainability Goals. The ‘urban forest’ includes many trees in public ownership (street

trees, parks, public institutions such as UCC Arboretum) as well as (the majority) in private ownership. Cork City Council, for example, have recently published their draft Cork City Tree Strategy.

The symposium was one of the outputs of the Irish Tree Explorers Network (ITEN) - supported by funding from the Science Foundation Ireland ‘Discover’ call. ITEN is a collaboration between the School of BEES (Dr Eoin Lettice and Dr Barbara Doyle Prestwich) and the School of English and Digital Humanities (Prof. Claire Connolly) and it builds on the success of the Tree Explorers projects that have been based in the globally accredited UCC Arboretum since 2021. The network also allows for interconnected research projects and one such project is a current collaboration with the Tree Root Microbiome Project examining the root microbiome of Monterey Pine across the globe.



SCIENTIFIC EXCELLENCE: FOSSIL STUDY SHEDS LIGHT ON FAMOUS SPIRALS FOUND IN NATURE

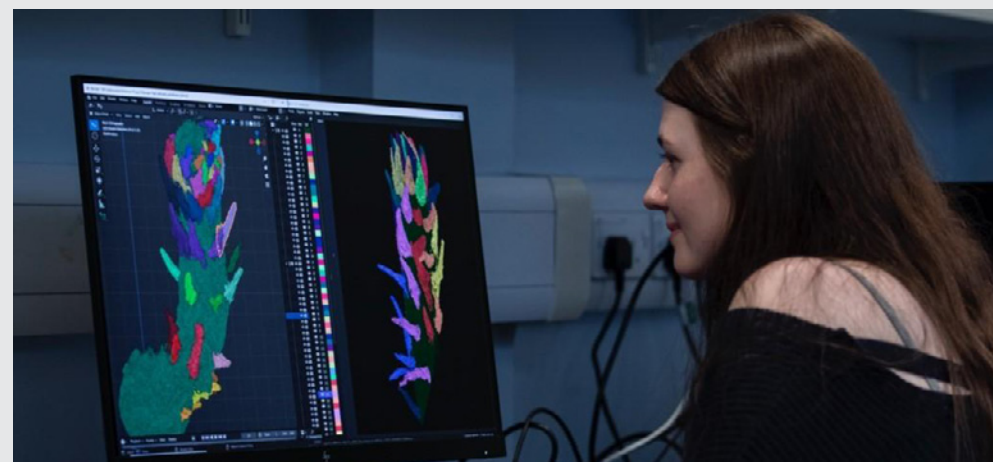
A 3D model of a 407-million-year-old plant fossil has overturned thinking on the evolution of leaves. The research has also led to fresh insights about spectacular patterns found in plants. The research published in the journal *Science* overturns a long held theory around a famous pattern in nature. Palaeontology PhD student at the ERI and School of BEES, Holly-Anne Turner is the first author on the study and conducted the study while an undergraduate student and Research Assistant at the University of Edinburgh. Using digital reconstruction techniques the researchers produced the first 3D models of leafy shoots in the fossil clubmoss *Asteroxylon mackiei* – a member of the earliest group of leafy plants. The findings revealed that leaves and reproductive structures in *Asteroxylon mackiei*, were most commonly arranged in non-Fibonacci spirals that are rare in plants today.

The findings indicate that the arrangement of leaves into distinctive spirals, that are common in nature today, were not common in the most ancient land plants that first populated the earth’s surface. Instead, the ancient plants were found to have another type of spiral. This negates a long-held theory about the evolution of plant leaf spirals, indicating that they evolved down two separate evolutionary paths.

“

*The clubmoss *Asteroxylon mackiei* is one of the earliest examples of a plant with leaves in the fossil record. Using these reconstructions we have been able to track individual spirals of leaves around the stems of these 407-million-year-old fossil plants. Our analysis of leaf arrangement in *Asteroxylon* shows that very early clubmosses developed non-Fibonacci spiral patterns*

Author Holly-Anne Turner



FRONTIERS FOR A HEALTHIER FUTURE

The SFI Frontiers for the Future Programme provides opportunities for independent investigators to conduct highly innovative, collaborative research in science, technology, engineering and mathematics (STEM) with the potential to deliver impact, whilst also providing opportunities for high-risk, high-reward research projects. Among the new research projects totalling €5,464,481 that will be funded at UCC, are three projects led by ERI Academics which strive for a healthier environment:

- **Environmental Intelligence - Modelling Complex Human-Environment Interactions For Maximising Environmental Health In Urban Areas**

Led by Dr Marguerite Nyhan (School of Engineering & Architecture, ERI and MaREI), the Environmental Intelligence frontier research project will significantly advance the science of sustainable, healthy and liveable cities of the future. This ground-breaking research will harness sensors, largescale Information Communications Technologies (ICT) datasets, artificial intelligence and machine learning to understand urban dynamics, air pollution and greenspace in unprecedented accuracy and scale in several cities in Ireland and the United States. Importantly, Dr Nyhan will examine associations between human exposures, behaviour change and health outcomes with a view towards informing the planning and design of cities as well as urban environmental health policies.

- **Low-Cost Monitoring Using Spectroscopy For High Quality Information On Urban Nitrogen Dioxide (Locomoshun).**

Led by Dr Dean Venables (School of Chemistry and the ERI), the LOCOMOSHUN project aims to develop a novel optical sensor for nitrogen dioxide (NO₂), a priority air pollutant. Sensors developed in this project will be accurate and affordable, allowing them to be used to expand city air quality monitoring and extend it to towns and low-income countries. The sensors will be demonstrated in a vehicle emissions study and in an innovative citizen science study in which pupils study air quality around their schools.

- **Functional Traits Of Grass Weeds – Investigating The Processes That Determine Weediness.**

Led by Professor Astrid Wingler (School of BEES and the ERI), this project investigates the biological basis of growth and seed formation in wild oat, a common weed in cereal fields. It also determines the competition with barley to aid selection of more competitive crop varieties for sustainable production with reduced herbicide use.

SCIENTIFIC EXCELLENCE: MARINE PLASTIC EXPOSURE RISK FOR OCEANIC BIRDS IDENTIFIED

For the first time areas of the world's ocean that represent a high risk of plastic exposure for seabirds have been identified in a 2023 study in Nature Communications. A team of global researchers, including researchers at UCC, tracked the movement data of over 7,000 seabirds to identify the areas of the world's ocean where seabirds would most likely come into contact with plastic.

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Seabirds can die when they get entangled in plastic but eating the plastic is likely the main problem. Why they eat it is not fully understood but plastic can look like the food that they eat, for example squid, small fish and plankton. But it is also thought that algae growing on the plastic gives off an odour that makes it smell like food.

Prof John Quinn
ERI and School of BEES researcher
and co-author of the study

“

On the somewhat positive side, this research does not identify Ireland as one of the world's hotspots for marine litter but in fact most Irish seabirds have traces of plastic in their guts. We don't really know what impact this is having and we cannot afford to be complacent because Ireland has a statutory obligation to protect our seabird populations. That said, our manx shearwaters winter off Argentina, and their exposure risk to plastic is much higher there

Co-author Dr Mark Jessopp
ERI, MaREI, School of BEES



2.3 CIRCULAR ECONOMY

A shift from a “take-make-consume” to a closed-loop economy where resources are kept in use for as long as possible is now an imperative for society and economy. The ERI Circular Economy challenge is focused on producing food and goods in a closed-loop approach with minimal or no waste.



PIONEERING SUSTAINABLE BIOMANUFACTURING FOR A GREENER FUTURE

Precision fermentation and microbial biomanufacturing, represent cutting-edge approaches in biotechnology, revolutionizing the production of tailored biobased products through fermentation. When combined with sustainable feedstock selection and biorefinery techniques, they offer solutions to diverse societal and environmental challenges including food security, resource sustainability, ecosystem restoration, climate action, and public health.

SUSFERM, the new multi-disciplinary UCC Centre for Sustainable Fermentation and Bioprocessing Systems for Food and the Bioeconomy, led by ERI researchers Prof John Morrissey (School of Microbiology) and Professor Maria De Sousa Gallagher (School of Engineering), includes a research infrastructure funded by Science Foundation Ireland that provides industrial and academic researchers access to state-of-the-art fermentation technology. This will enable them to unlock the power of microbial diversity, fermentation, and biomanufacturing to develop new bioproducts and processes that are more sustainable than those currently

used in the food and industrial biotechnology sectors. SUSFERM is also developing new post-graduate and professional programmes to provide graduates with the interdisciplinary skills that are required to design, develop, and optimise commercial operations.



DECARBONISING OUR ENERGY INFRASTRUCTURE

Recently appointed Lecturer in Sustainable Materials, Dr Brendan Bulfin, has published a demonstration of a new chemical process concept that shows great promise for decarbonising our energy infrastructure. The publication titled “Countercurrent chemical looping for enhanced methane reforming with complete conversion and inherent CO₂ separation”, describes an experimental demonstration of the concept performed at ETH Zurich. It offers a new method of upgrading both natural gas and biogas for the production of more valuable chemicals and fuels. One major benefit of this process is that it inherently separates carbon dioxide from the products, which can then be sequestered or utilized. The reactor concept uses a design which is analogous to a countercurrent heat exchanger, but for chemical reactions, which significantly enhances the chemical conversion process. This helps to avoid the need for expensive and energy-intensive separation processes. Dr. Bulfin plans to further develop the process for applications in both blue Hydrogen production and the upgrading of biogas for sustainable fuel production.

CATALYSIS IN THE POLYMER CIRCULAR ECONOMY

Recent work published by PhD student Rachel Breen, supervised by Dr Gillian Collins (RSC Sustainability, 2024, 2, 1040), develops a metal free catalyst for PET plastic to obtain molecules that are not possible by conventional metal catalyzed routes. The catalyst was also effective for the conversion of polylactic acid (PLA) to methyl lactates, which are useful as green solvents. PLA exemplifies the complexity of the challenges we face with plastic

waste. While on one hand it is a bioplastic derived from renewable sources, it does not biodegrade outside industrial composting, it contributes to microplastic pollution in the environment and its increased use is contaminating recycling waste streams, so developing upcycling pathways are essential. In related work, Doireann O’Leary Brennan is a new PhD student funded by an IRC Government of Ireland Postgraduate Scholarship, working

on polyolefin plastics. These highly stable polymers contain only carbon and hydrogen making it difficult to degrade. Her work centers on using transition metal oxides, specifically tailoring the catalyst to maximize the yield of high-value organic products while minimising the production of less valuable products such as CO₂.

AQUATIC PLANTS FOR SUSTAINABILITY

As small floating plants with impressive crude protein contents (25-40% of dry matter), duckweeds (Lemnaceae) and water ferns (Azolla spp.) provide a novel opportunity for plant protein production through wastewater remediation, as part of closed-loop production systems.

In 2023 publications, ERI researchers drawn from multiple disciplines of plant and environmental science, and mechanical, electrical, and chemical engineering, demonstrated the design and operation of the multitiered, indoor duckweed cultivation system. Led by Professor Marcel Jansen and Dr Neil Coughlan, the development of space-efficient indoor growing systems represents a dramatic step towards efficient duckweed cultivation within closed-loop production systems. The technology is a considerable opportunity for agri-food sectors in Ireland and abroad, which presently are under economic and regulatory pressures to valorise wastewaters with high concentrations of nitrogen and phosphorus. Current funding of

this research by DAFM and the EU is specifically targeting farm-waste, as well as meat and fish-processing waste as products suitable for valorisation using duckweed.

Like duckweed, Azolla spp. have garnered considerable interest as a means to remediate wastewaters through the removal of excess nutrients. As Principal Investigator, Dr Coughlan has recently commenced the Azbio project, funded by the SFI and the EPA under the SFI-IRC Pathway Programme. This project will develop pre-requisite expertise needed to optimise year-round indoor industry-based cultivation, and the exploitation of valuable Azolla biomass. Building on the success of ERI-UCC collaborations, Azbio will implement cultivation for wastewater valorisation and provide a platform for exploration of Azolla as a high-protein dietary supplement to diminish ruminant methane production, with waste biomass for use as a horticultural peat alternative.



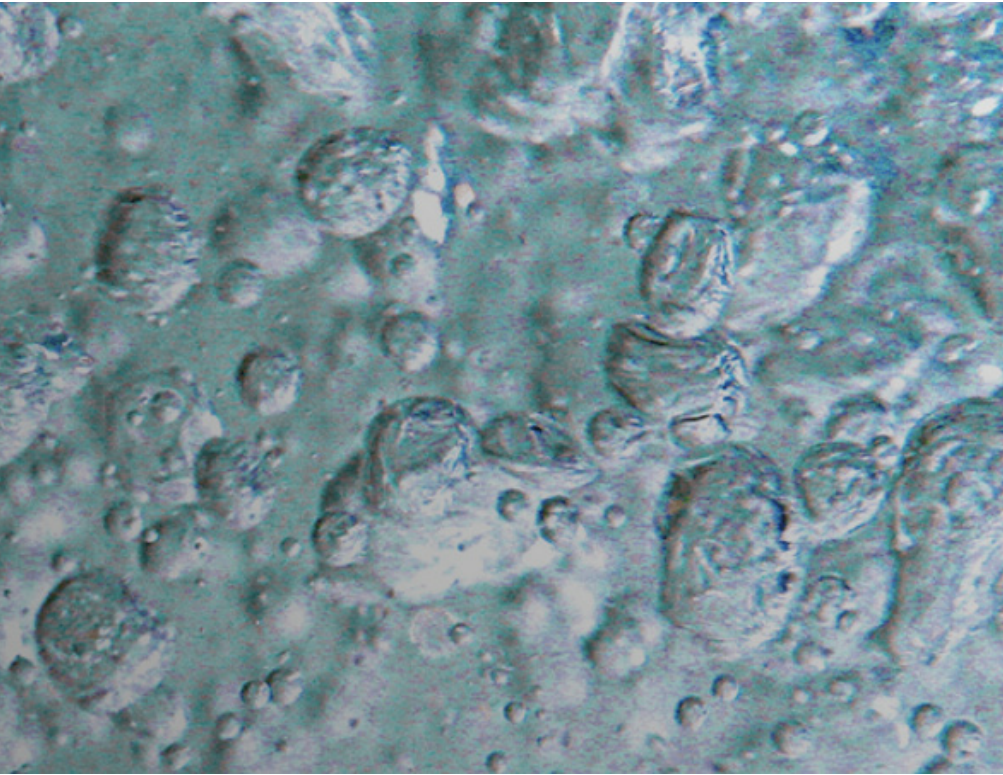
Indoor multi-tiered duckweed cultivation systems.



Mixed Azolla and duckweed culture.

SOLAR-TO-CHEMICAL ENERGY

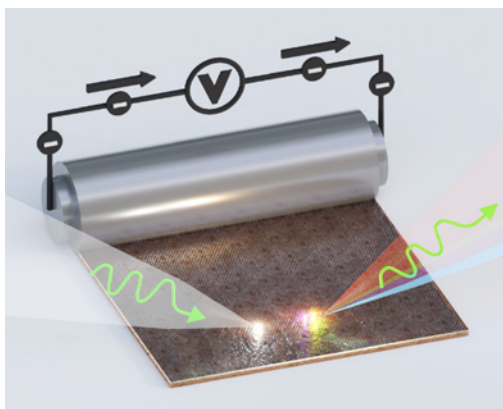
Inspired by photosynthesis, the FreeHydroCells project (coordinated by a UCC team including ERI's Prof Justin Holmes, Prof Colm O'Dwyer, Dr Scott Monaghan and Dr Ievgen Nedrygailov) aims to maximize solar energy absorption and efficiently convert it to hydrogen fuel, mirroring a leaf's process of using sunlight and water for plant growth while releasing oxygen. The FreeHydroCells project aims to develop a novel system inspired by photosynthesis in plants, which efficiently absorbs solar energy and water to produce hydrogen fuel. The system consists of thin film semiconducting material arrays submerged in water, converting solar energy into chemical energy stored in hydrogen bonds. This technology offers a low-cost, environmentally friendly alternative to fossil fuels. The project's objectives include overcoming limitations in current photoelectrochemical energy harvesting, identifying sustainable semiconductor materials, and maximizing energy absorption while minimizing conversion loss. The interdisciplinary consortium behind FreeHydroCells hopes to achieve cheap, scalable, and efficient solar-to-chemical energy conversion, potentially revolutionizing global energy supply with clean hydrogen.



SEEING BATTERY BEHAVIOR IN TECHNICOLOR

Screening sustainable battery materials, analysing reasons for degradation, or seeking the basis for better performance or environmental reasons for bad batteries are key requirements for the latest generations of Li-ion batteries and sustainable alternatives.

Longevity and performance rely on a fuller understanding of all battery material components and how they behave during operation. Professor Colm O'Dwyer's research group (ERI, School of Chemistry) have developed a non-destructive method for looking inside batteries and watching how the material behaves in real-time. By taking inspiration from photonic crystal optics and the electrochemistry of materials that governs how the materials in batteries behave, the team can track how the reactions with lithium occur and how stable battery materials can be. The method tracks how the color of ordered porous materials change when reacting with lithium, and allows us to see how the material structure changes when charging and discharging – material stability is fundamentally linked to battery longevity.

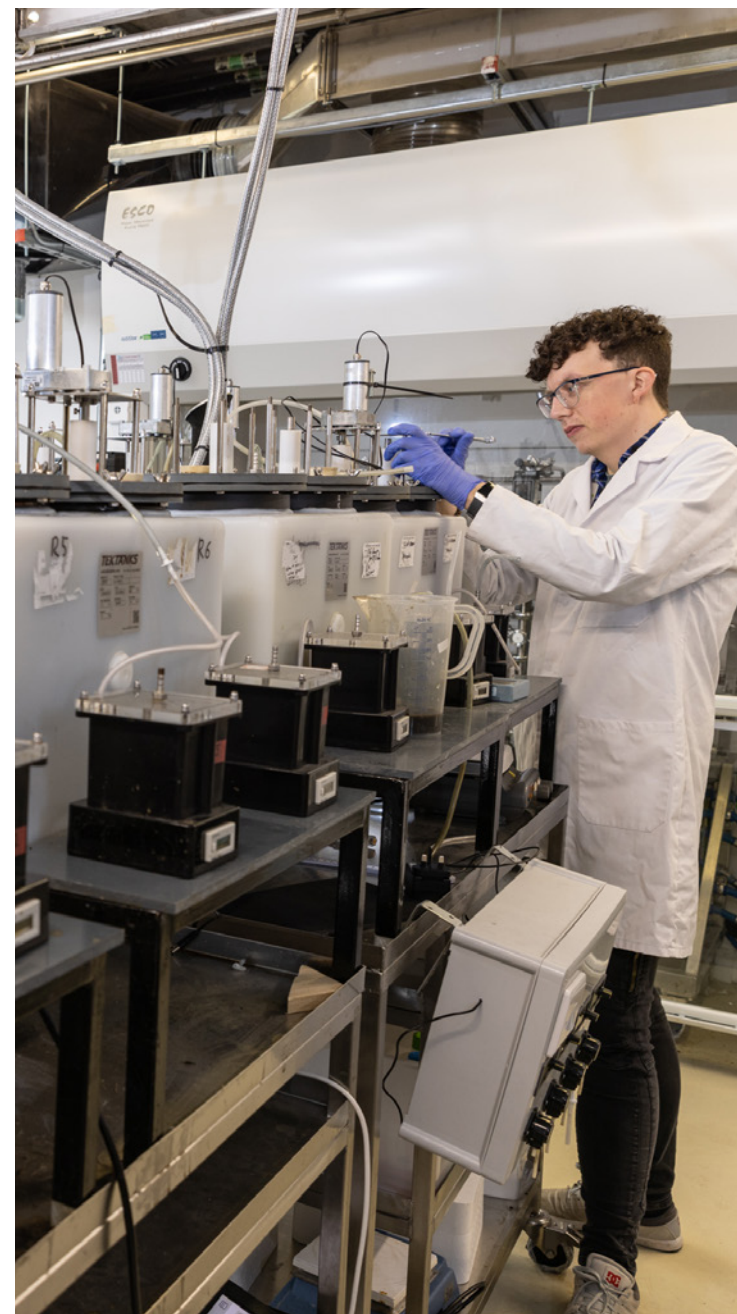


DECARBONISING THE IRISH ECONOMY

Ireland must transition to a completely decarbonised economy by 2050 as stated in Ireland's 2021 Climate Action Plan. To sustainably decarbonise the economy, the production of food, energy and materials must transition to a circular bioeconomy from the current linear “take, make and dispose” fossil-based economy. Dr Archishman Bose (ERI, Process and Chemical Engineering) is currently leading three projects with a focus on embedding sustainability and circular economy principles into different sectors of the Irish economy.

- CABBIE:** This project aims to advance the development of a Cascading Algal Biomethane Biorefinery System (CABBS) to produce biomethane from upgraded biogas using microalgae. The goal is to create a sustainable and circular bioeconomy by replacing natural gas and diesel with biomethane in various sectors, including industry, heavy transport, and agriculture.
- EMERGE:** In collaboration with Co-PI Dr Xue Ning, Dr James Browne, Irish Distillers Limited, this project focuses on providing sustainable technological solutions to multiple sectors, including anaerobic digestion, wastewater treatment, and industries requiring electrodes. By utilizing digestate from anaerobic digesters, the project aims to produce pyrochar and hydrochar for safe and economic use in various applications, such as adsorbents for removing contaminants from wastewater and sustainable energy-dense materials for electrodes.
- ENTYRE:** In collaboration with Co-PI Dr Gillian Collins and Dr Richard O'Shea, this project addresses the challenges of end-of-life tire management in the context of upcoming regulations and policies aimed at promoting circular economy principles and reducing environmental impact. It involves analyzing the techno-economic and environmental impacts of different pathways for utilizing waste tires, including recycling, energy recovery, and innovative conversion methods. The goal is to develop viable pathways and roadmaps for the sustainable use of end-of-life tires in Ireland, considering factors such as decarbonization and circular economy goals.

Overall, these projects highlight the importance of sustainability, resource efficiency, and circular economy principles in addressing environmental challenges and promoting economic growth in Ireland.



SCIENTIFIC EXCELLENCE: CIRCULAR ECONOMY ENERGY & ENVIRONMENTAL SYSTEMS (CEEES) RESEARCH GROUP LEAD AMONGST TOP CITED IN IRELAND

Research.com has ranked **Professor Jerry Murphy** (ERI, MaREI, School of Engineering and Architecture):



Google Scholar also ranks **Professor Jerry Murphy** (ERI, MaREI, School of Engineering and Architecture):



Additionally, a recent publication from the CEEES research group, **Decarbonising ships, planes and trucks: An analysis of suitable low-carbon fuels for the maritime, aviation and haulage sectors** authored by Dr Nathan Gray, Dr Shane McDonagh, Dr Richard O'Shea, Dr Beatrice Smyth and Professor Murphy was



Highlight

UCC and Queen's University establish first all-island sustainability network

UCC and Queen's University Belfast (Queen's) have established Ireland's first all-island network dedicated to delivering on the United Nations (UN) Sustainable Development Goals (SDGs).

Sustainable Development Solutions Network Ireland (SDSN Ireland), which was launched in February 2023 at an event in Dublin, will work with local authorities, NGOs, civil society organisations and policymakers to bring the latest research and best practice to bear on producing solutions for the SDGs. It is the first time a university in Northern Ireland and in Ireland have formed a partnership to develop an all-island approach to sustainable development goals.

In 2018, Ireland adopted its first SDG National Implementation Plan. The plan sets out the Government's response to the

Sustainable Development Goals (SDGs) and commits Ireland to mainstreaming the SDGs across national policy and achieving all 17 of the Goals by 2030. The Irish National Development Plan 2018-2027 allocates 21.8 billion euro to SDG-related projects, including those on renewable energy and energy security.

SDSN Ireland will be co-located between both universities and some of the activities that both UCC and Queen's have agreed through SDSN Ireland include a seed funding scheme to support SDG related development projects, a bursary scheme for students which would enable them to study both sides of the border (an opportunity that no longer exists as Northern Ireland can no longer avail of the future Erasmus programme) and the development of masters and diploma courses on SDGs between both universities.

SDSN Ireland will be part of the global Sustainable Development Solutions Network led by Professor Jeffrey Sachs, which was established in 2012 by the UN to promote integrated approaches to implement the SDGs and the Paris Agreement on Climate Change, and now operates in 144 countries across the world.

"Sustainability challenges such as climate change, biodiversity loss, clean water and air, and achieving a circular economy do not recognise human-made borders. While Governments have primary responsibility for implementing the SDG's, the Goals belong to all of society. Achieving the SDG's will require a concerted and integrated effort and together with Queen's University Belfast we will seek to advance an all island approach in collaboration with other Higher education institutions and stakeholders to our common challenge."

Professor John O'Halloran
President of UCC

"This unique partnership with UCC will help accelerate further island-wide collaboration on sustainability research, building on important initiatives such as Shared Island Funds, US-Ireland Research and Development Partnership, and The Co-Centre Programme. SDSN Ireland will have a key role to play in driving research and innovation, skills and policy-making and importantly, in enhancing community engagement around all of the sustainable development goals."

Professor Ian Greer
President and Vice-Chancellor of Queen's
University Belfast



3 | Research Centres

3.1 MAREI, THE SFI RESEARCH CENTRE FOR ENERGY, CLIMATE AND THE MARINE

MaREI is coordinated by the ERI and is Ireland's SFI Centre for energy, climate and marine research, development and innovation working across 12 Irish academic institutions and collaborating with over 50 industry partners. The Centre is led by Co-Directors Prof Brian Ó Gallachóir and Prof Jerry Murphy. The Centre Manager is Dr Gillian Bruton.



SUPPORTING EVIDENCE-BASED CLIMATE POLICY

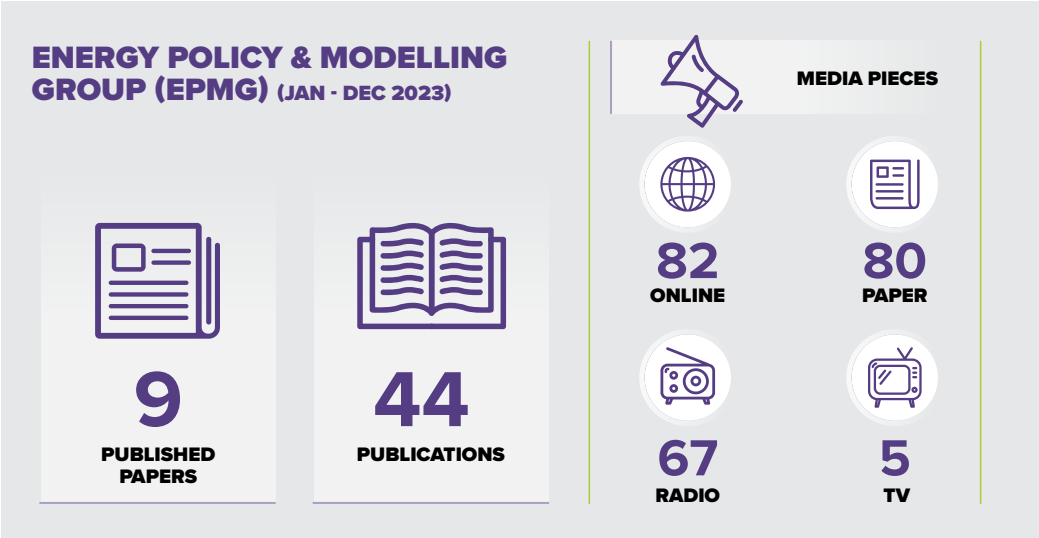
MaREI's Energy Policy Modelling Group (EPMG) are at the cutting edge of research-informed climate policy in Ireland. While there is a strong understanding in scientific research on the problem of climate change, their innovative research focusses on climate action solutions that not only reduce greenhouse gas pollution but increases the resilience of Irish society. They are unique in the breadth and depth of their research because they consider the multi-dimensional impact of energy and climate across society rather than in individual silos. This allows them to understand important interactions between heating our homes, using land, generating electricity, and driving cars in a manner that is coherent and consistent with the need to reduce pollution and avoid climate change. They are advancing collaborative research with the policy system in a number of ways. Their infographics translate research results into policy insights very effectively. They are building absorptive capacity within Government departments through workshops exploring the implications of their research results. Delivering invited expert testimonies to Oireachtas Committees further extends their reach to decision makers. They co-produce policy through membership on national committees on Carbon Budgets, Energy Security, Agriculture and a Just Transition. They have shared modelling insights, experiences, and results in a timely, open, and transparent manner to deepen governments understanding of climate solutions.

EPMG are recognised nationally and internationally as expert leaders in climate & energy modelling. This peer esteem comes in different forms. Their papers are cited significantly with two EPMG researchers in the top 5 cited scientists globally in 'energy modelling' on Google Scholar. They secured the most references of any research team in Ireland (23 references) in the IPCC Climate Change Assessment (AR6) WG III Report. They are regularly invited to present innovative research methodologies and to chair and facilitate discussions at world class scientific conferences such as the International Energy Workshop (IEW), where energy systems modelling is the focus and the Integrated Assessment Modelling Consortium (IAMC), where the IPCC WG III scientific community meet to discuss innovations in assessment methods for mitigation pathways. They advised the International Renewable Energy Agency in 2022 on bridging between energy modelling and climate policy as part of the Clean Energy Ministerial Initiative on Long Term Energy Scenarios for the Clean Energy Transition. They publish extensively in high impact journal papers including Nature Energy, Nature Communications and Scientific Reports. During this reporting period they published 9 journal papers, presented at 44 workshops and conferences and are leaders in research communications engaging in 234 media pieces in 2023.

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MaREI is one of the standout success stories in Ireland's efforts to achieve excellence and impact in research. It is positioned at an important intersection in the vital effort that is needed to address Ireland's climate and energy challenges. Through building talented, diverse and multi-disciplinary research teams MaREI has generated a high quality research output and a European and global reputation amongst the research community. Perhaps most impressively, MaREI has implemented a sophisticated and persistent engagement strategy to ensure the policy relevance and impact of this research. As a result MaREI is highly respected and trusted by policy makers and is providing crucial expertise to successfully guide Ireland's transition to net zero.

Jim Breslin
Former Secretary General
Department of Further and Higher Education,
Research, Innovation and Science.



UNDERWATER RADIATED NOISE POLLUTION: MAREI SCEI

MaREI researchers in collaboration with international experts developed several resources to support best practice in science communication around Underwater Radiated Noise. Examples include:

Sound Terminology Infographic: which focuses on the correct use of terminology specifically around Sound Level and Sound Pressure Level.

Impact: Sound Terminology Infographic was viewed over 74 times on the project news and gathered great interaction and engagement on Twitter with 144 total engagements.

An Ocean of Sound - Classroom Poster: which introduces concepts such as frequency, amplitude, decibels, and spectrograms.

Impact: Classroom Poster on Ocean Sound was widely disseminated via the project's social media and received with 270 engagements on LinkedIn and 178 engagements on Twitter.

Animated Video: Slowing Down Vessels Can Lead to Much Quieter Oceans is based on peer review publication by SATURN researchers and allows lay audiences to learn about the problem of underwater radiated noise from shipping and how reducing vessel speeds can make a big impact. The animation is available on YouTube with captions in numerous languages.

Impact: Animated Video received over 945 views on YouTube in 3 months

SATURN policy brief: 'On the Need for Standardized Bioacoustical Terminology' outlines that many terms that are currently in use in research and policy documents lack clear and harmonised definitions. SATURN recommends the adoption of existing international terminology standards and the development of standardized and agreed-upon terminology (field of aquatic bioacoustics) to facilitate effective communication, a pre-requisite for monitoring and mitigation efforts worldwide.

Impact: The SATURN Policy Brief just published in December of 2023 received 34 direct engagements on Twitter and 78 engagements on LinkedIn at that time and is deemed an important resource by SATURN'S project partner who are in the Marine Strategy Framework

MICROPLASTIC POLLUTION: MaREI SCEI researchers in collaboration with international experts also developed several resources addressing microplastic pollution in our oceans via the ANDROMEDA and RESPONSE projects, which concluded in September 2023. These resources include:

Microplastic Pollution Factsheet and Citizen Science Factsheet which provide an overview of the sources, pathways and impacts related to microplastic pollution in our marine environment - available in 6 languages.

Impact: The ANDROMEDA factsheets were widely distributed in project partner countries as they are available in multiple languages, they allowed teachers in different countries to use the resource with younger audiences in school setting. ANDROMEDA partners themselves also used the factsheets to reach out to younger audiences in partner countries to raise awareness about Microplastics, the ANDROMEDA project and to promote the developed citizen science smartphone app. Outreach activities also took place in Spain and Malta together with beach clean sampling activities across eight test sites. These events utilized the produced factsheets in their national languages. University of Malta have partnered with Plastic Pirates Go Europe post project duration to expand the project's school outreach programme, for which the factsheets will also be used.

RESPONSE: Weight of Evidence Model Flyer designed to be used at front-facing events such as conferences, stakeholder meetings and workshops to promote uptake and use of the model.

Impact: The Flyer has been used to promote testing and uptake of the model by the RESPONSE coordination team, who have developed an online interface to allow researchers at international level to test and use the resource.

Report from Agnew et al., Science Communication of Marine Plastic Pollution:

The report examines best practice science communication and share researchers, policy and decision makers experiences with navigating science communication challenges based on the RESPONSE Stakeholder workshops.

Impact: The report received to date over 600 reads on Research Gate of which over 400 are full text in addition to drawing attention on the RESPONSE project's social media outlets. The report was presented at the Marine Institute international meeting of the JPI-Oceans microplastics projects in September 2023; the 13th Annual Marine Economics and Policy Research Symposium in Galway in December 2023 and the "Small particles, big concerns: Marine Microplastics revisited" event on the 6th of December, which took place at the European Parliament.

EU MISSION OCEAN

Over the course of 2023 the MaREI Centre built on its considerable success to date in the Horizon Europe Work Programme for EU Mission Restore our Ocean and Waters, with a number of new projects being secured to complement those already spanning ecological restoration (A-AAGORA), citizen engagement (PREP4BLUE), pollution reduction (SOS-ZEROPOL 2030) and ocean governance (BlueMissionAA). The TIDALArts project builds on the innovative co-creation methods and outputs currently being developed by MaREI

researchers within PREP4BLUE and will provide further opportunity to showcase the Centre's significant expertise in this area. Similarly, the iNNO SED project builds on the Centre's successful projects focused on the restoration of habitats and species of the Danube Basin (e.g. DANUBE4ALL, DANUBIUS IP) and will specifically address current challenges associated with river sediments (structural and pollution) from source to the Black Sea. MaREI is a work package leader in both projects (Kathrin Kopke – iNNO SED; Dr. David Whyte – TIDALArts).



LEADING DEVELOPMENT OF OFFSHORE RENEWABLE ENERGY IN EUROPE

As coordinator of the Horizon Europe funded MARINERG-i PP project MaREI remains at the forefront of accelerating offshore renewable energy technologies in Europe. Led by Dr. Jimmy Murphy and Dr. Fiona-Devoy McAuliffe of MaREI, MARINERG-i PP will continue consolidation and cooperation between the Offshore Renewable Energy (ORE) testing facilities of Europe to advance development and realise the potential of this sector. This will strengthen European scientific and engineering expertise as well as foster innovation in ORE technologies, while ensuring MARINERG-i's progress on the European Strategy Forum on Research Infrastructures (ESFRI) roadmap, and ultimately positioning MARINERG-i as the only operational platform of this scale worldwide.



3.2 THE CENTRE FOR RESEARCH INTO ATMOSPHERIC CHEMISTRY (CRAC)

CRAC is a leading national centre for atmospheric chemistry research carrying out laboratory, field and modelling studies to support clean air quality. The Centre is based in the School of Chemistry and the ERI. The CRAC Centre Director is Prof John Wenger.



DEVELOPING AN AIR QUALITY FORECAST

Despite serious health effects, the links between behaviour, air quality and health are often invisible to the public. BEHAVI-AIR, a project funded by Science Foundation Ireland under its Challenge Fund programme, aims to address these issues and to explore the potential of using behavioural change to protect people's health and reduce air pollution. In particular, the project aims to promote public awareness and behavioural change around air pollution by combining advances in air quality forecasting with community-engaged design thinking. The project team comprises an unusual interdisciplinary combination of applied psychology (Lead-PI, Dr Marica Cassarino) and chemistry (Co-PI, Dr Dean Venables) with colleagues Dr Roberto Cibin, and Laura Horgan in the School of Applied Psychology, Chaitra Reddy from CRAC, Dr Kevin Ryan from Cork City Council and Denise Cahill from Cork Healthy City.

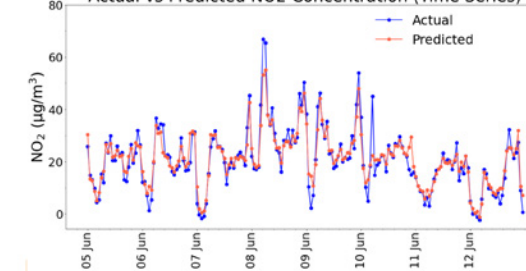
The project has two parts. The first element is to develop effective messaging and understand what makes messages persuasive to people in different circumstances. As part of this work, the research team carried out a roundtable discussion with Cork residents on Clean Air Day (7 September) to formulate a shared vision for clean air in the city. The workshop identified actions to increase public engagement and communication and is being developed into a series of co-creation workshops to be held around the city. These workshops will work with local communities to co-design air quality messaging and assess the best tools to communicate this information.

The second part of the project is to use machine learning to forecast air pollution over the next day. Pollution forecasts are vital to identify scope to change behaviours around air pollution.

That might mean, for example, alerting people to when air quality is likely to be poor so that they can reduce polluting behaviours and avoid unnecessary exposure. Predicted air pollution levels show good agreement with observations, showing the combined influence of both human activity patterns and meteorology on pollutant concentrations.



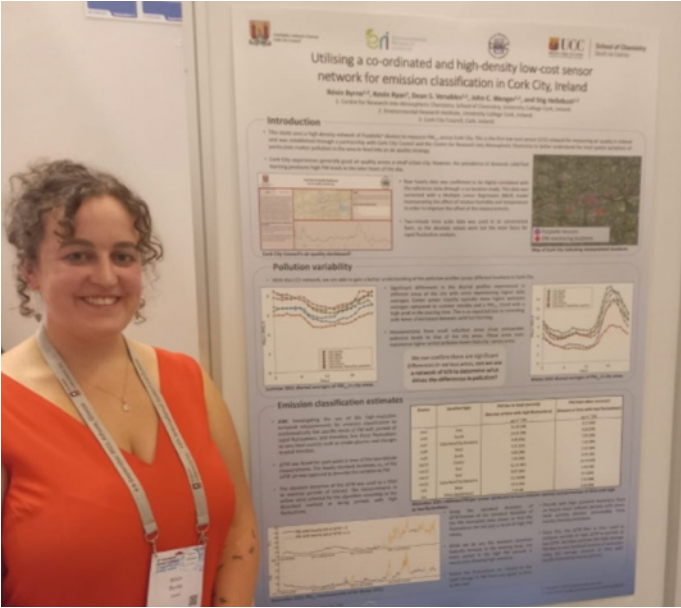
Actual vs Predicted NO₂ Concentration (Time Series)



NEW USES FOR LOW-COST AIR QUALITY SENSORS

CRAC PhD student Rósín Byrne demonstrated in her article “Highly local sources and large spatial variations in PM2.5 across a city: evidence from a city-wide sensor network in Cork, Ireland”, which was published in RSC journal Environmental Science: Atmospheres, that low-cost sensors that measure ambient particulate matter, although they are less accurate than reference monitors, can provide useful and actionable information regarding sources of air pollution due to their ability to capture data with high spatial resolution and high temporal resolution.

The study showed that these features allow for a measurement-based approach to estimate contributions from local pollution sources as separate from regional or transported air pollution without performing chemical analysis of the ambient aerosol. This methodology has the potential to both lower the cost and increase the monitoring coverage for agencies tasked with managing air quality on a local level.

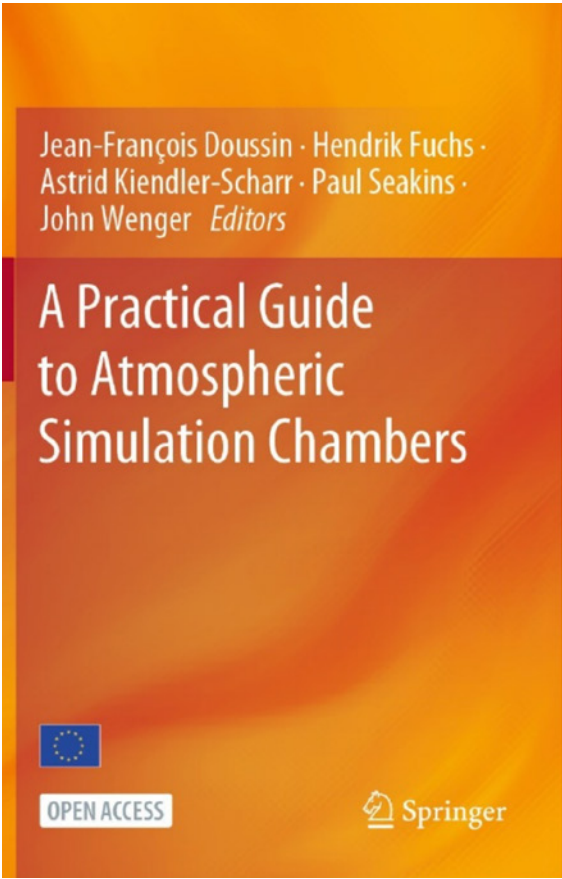


Rósín Byrne presenting her work at the International Aerosol Conference in Athens, 2022.

NEW OPEN ACCESS BOOK ON ATMOSPHERIC SIMULATION CHAMBERS

Prof John Wenger is co-editor of a book titled “A Practical Guide to Atmospheric Simulation Chambers” published by Springer in 2023. State-of-the-art simulation chambers, like the one operated by CRAC in UCC, provide unprecedented opportunities for atmospheric scientists to perform experiments that address the most important questions in air quality and climate research. The book covers technical details about chamber preparation and practical guidelines

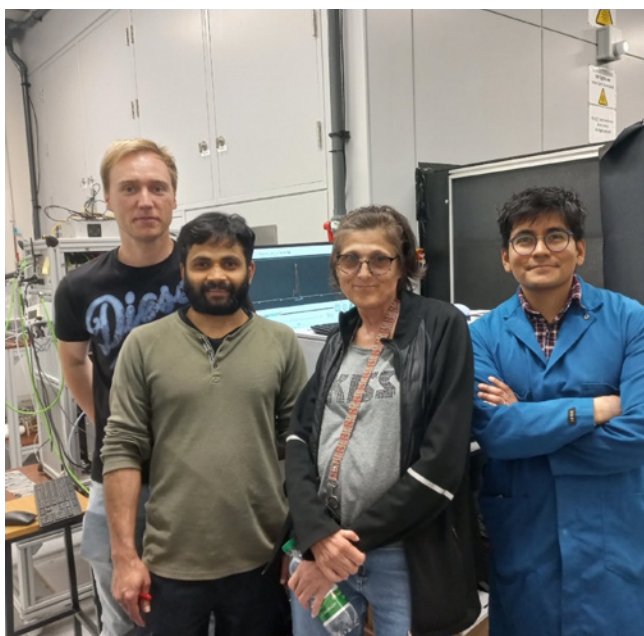
on their usage, while also delivering relevant historical and contextual information. It is a key publication for knowledge transfer within the simulation chamber research community and also provides the global atmospheric science community with a unique resource that outlines best practice for the operation of simulation chambers. Thie open access title has proven to be very popular, with over 14,000 downloads since its launch in April 2023.



Left: Book title. Right: Prof John Wenger (CRAC) with fellow co-editor, Prof Jean-Francois Doussin (Head of the Oceanic and Atmospheric division, CNRS-INSU, France) at the book launch event.

INTERNATIONAL RESEARCHERS VISIT THE IRISH ATMOSPHERIC SIMULATION CHAMBER

CRAC had the pleasure of hosting researchers from the University of Wuppertal, Germany, at the Irish Atmospheric Simulation Chamber (IASC) facility for a 5-day intensive training course designed and delivered by Prof Andy Ruth, Dr Mixtli Campos-Pineda and Dr Satheesh Chandran. The visitors received personalized tuition and hands-on experience of cavity-based spectroscopy techniques used for measuring atmospheric gases and radicals. This novel training activity was supported by the transnational access programme within the ATMO ACCESS project, whose aim is to provide sustainable access to atmospheric research facilities across Europe. CRAC will be hosting more international visitors at IASC in 2024.



Dr Niklas Illmann (University of Wuppertal), Dr Satheesh Chandran (CRAC), Dr Iulia Patroescu-Klotz (University of Wuppertal) and Dr Mixtli Campos-Pineda (CRAC) at the IASC Facility, during the research training visit in May 2023.

MAKING AN IMPACT AT THE EGU GENERAL ASSEMBLY

CRAC was very well represented at the European Geophysical Union General Assembly in Vienna, April 2023. There were two podium presentations and two posters from our PhD researchers, while Dr Dean Venables was co-convenor of a special session titled “Advanced Spectroscopic Measurement Techniques for Atmospheric Science”. It was a wonderful conference and the Apple Strudel was fantastic!



CRAC Researchers at the EGU General Assembly in Vienna, April 2023: Dr Dean Venables, Dr Hayley Furnell, Róisín Byrne, Emma Galloway, Eibhlín Halpin, Prof John Wenger.

JUNOX23 NO/NO₂ INTERCOMPARISON CAMPAIGN

In June 2023 Dr Mixtli Campos-Pineda and Prof Andy Ruth of CRAC participated in an international intercomparison campaign for the routine measurement of ambient nitrogen dioxide (NO₂) and nitric oxide (NO). The goal of the campaign was to improve the quality of NO_x measurements through standardized calibration procedures and experiments to investigate the effects of interfering factors such as water vapor, ozone (O₃), nitrous acid (HONO), and glyoxal (C₂H₂O₂). The intercomparison campaign was conducted at the SAPHIR atmospheric simulation chamber and JULIAC tower at the Institute for Energy and Climate Research (IEK-8 Troposphere) of Forschungszentrum Jülich in Germany. The interlaboratory test campaign is part of the quality assurance/control measures for national facilities within the European ACTRIS infrastructure. In total there were researchers from 15 European partner institutions with over 36 instruments. The UCC researchers shipped their home-built cavity-enhanced absorption instrument to Jülich and successfully applied it in a comprehensive number of experiments including, comparison with gas standards and commercial calibration setups, test for humidity, formaldehyde, HONO and ozone interferences, as well as ambient measurements from the JULIAC-tower.

The UCC instrument is now utilized as a calibration standard for NO₂ in the Irish Atmospheric Simulation Chamber (IASC) as part of CRAC's activities within an SFI Frontier Award (21/FFP-A/8973).



Fig. 1. SAPHIR chamber and JULIAC tower at Forschungszentrum Jülich in Germany (Forschungszentrum Jülich)



Fig. 2. Some of the participants of the JuNOx23 campaign (Forschungszentrum Jülich GmbH, Max Gerrit Adam).

3.3 CENTRE FOR LAW AND THE ENVIRONMENT

The Centre for Law and the Environment is a centre of excellence for research, teaching and policy work relating to environmental law, policy, regulation and governance. Based in the School of Law, the Centre supports and promotes a wide range of research activity in Environmental, Marine, Climate, Energy and Natural Resources Law. Although the Centre is rooted firmly in the discipline of Law, it is engaged in significant interdisciplinary research collaborations and extensive advocacy and outreach activity. The Centre is led by its Co-Directors Professor Owen McIntyre and Professor Áine Ryall. During 2023, the Centre was delighted to welcome our new colleague Professor Femi Amao who was appointed Professor of Company Law and Sustainability, a key post in UCC Futures – Sustainability.



POSTGRADUATE RESEARCH SYMPOSIUM IN ENVIRONMENTAL LAW 2023

In conjunction with the annual Law and the Environment Conference, the 13th annual Postgraduate Research Symposium in Environmental Law was held at the School of Law UCC on 19 April 2023. Following an open call for applications, the 2023

symposium provided an important opportunity for 15 postgraduate research students from Ireland, the United Kingdom, Belgium, France and Germany to present to their peers on aspects of their doctoral research.



Participants at the Postgraduate Research Symposium in Environmental Law 2023.

LAW AND THE ENVIRONMENT CONFERENCE 2023

The 19th annual Law and the Environment Conference was held at UCC on 20 April 2023. Convened by Professor Owen McIntyre, the conference addressed the theme Environmental Law as Administrative Governance. The conference attracted a very high level of interest, with over 200 attendees drawn from across legal practice, academia, government, civil society and industry enjoying 44 expert presentations arranged across 12 specialist sessions.

As always, the conference provided a unique forum for presenting the latest developments and cutting-edge research, and for an inter-sectoral and inter-disciplinary exchange of views on all aspects of environmental law, policy, regulation and governance. A selection of the papers presented at the 2023 conference and the associated postgraduate research symposium was submitted for publication across three special issues of the journal Environmental Liability: Law, Policy and Practice which were published in early 2024.



Prof Owen McIntyre, UCC (Conference Convenor); Prof Catherine Malecki, Université Rennes 2; Prof Mark Poustie, Dean, School of Law UCC; Prof Patrick Parenteau, Vermont Law and Graduate School. Photo credit: Pat Rice

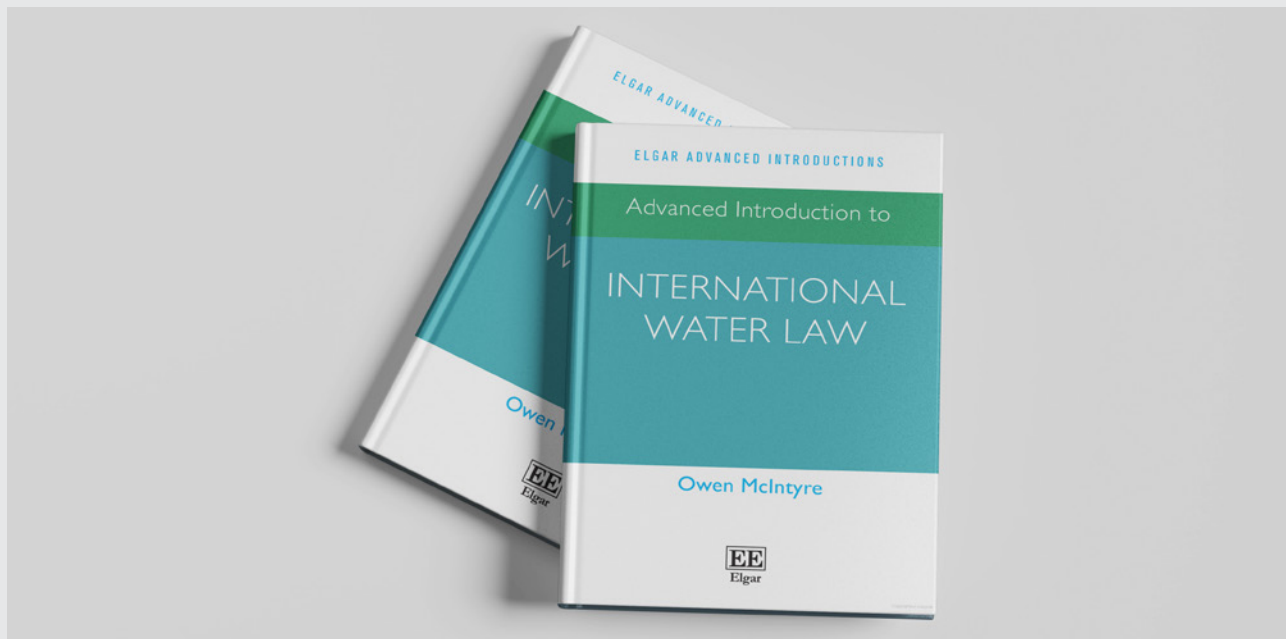
RESEARCH HIGHLIGHTS 2023

The Centre delivers a wide range of high-impact, frontier research activity. In 2023, Centre PIs continued to publish their work in important edited collections with leading international publishers and in prestigious national and international peer reviewed journals. Professor Owen McIntyre's new book, *Advanced Introduction to International Water Law*, was published by Edward Elgar in December 2023.

Professor Aoife Daly was awarded a prestigious European Research Council Consolidator Grant to the value of almost €2 million. Professor Daly's Youth Climate Justice project analyses the growing trend of child and youth climate activism, particularly how children and young people are claiming and asserting their own rights under the UN Convention on the Rights of the Child.

Professor McIntyre was the recipient of an Irish Research Council New Foundations Award for his project *Doubling Global Hydropower Capacity by 2050 – What about the Transboundary Dimension?* Niamh Guiry was awarded an Environmental Protection Agency – Irish Research Council Government of Ireland Postgraduate Scholarship (2023-2026) for her doctoral research on *Mapping the Legal Influences of and Implications for International Law of the 2030 Sustainable Development Goals*.

In June 2023, Dr Sarah Enright was awarded the PhD for her thesis *Regional cooperation for the establishment and management of transboundary Marine Protected Areas: a reflection on normative shifts in international environmental law* supervised by Professor Owen McIntyre and Dr Anne Marie O'Hagan (MaREI).



Cover of *Advanced Introduction to International Water Law*.

MARINE INSTITUTE FUNDING FOR OCEAN LAW AND GOVERNANCE

In 2023, MaREI and the School of Law UCC, together with the School of Natural and Built Environment and School of Law in Queen's University Belfast, were successful in securing €1.5 million in funding from the Marine Institute to undertake the Co-existence and Co-location in shared island Marine governance (CoCoMar) project. This five-year project focuses on the evolving marine governance frameworks that apply around the island of Ireland, concentrating specifically on transnational working as a key mechanism to achieve international, regional (EU and OSPAR) and national law and policy commitments in an EU Member State (Ireland) and non-EU jurisdiction, Northern Ireland, part of the United Kingdom. Marine spaces do not respect legal or administrative boundaries and natural ecosystems must be managed coherently to achieve international commitments relating to sustainable development, climate change and biodiversity loss. Through a comprehensive programme of targeted, collaborative desk-based research, supplemented by focused transnational fora, CoCoMar will build capacity on the island to progress more integrated marine governance by providing new knowledge, evidence and advice for policymakers to implement actions that are urgently required. The project funding will facilitate the recruitment of three new PhD candidates, two in QUB and one in UCC to be supervised by Professor Owen McIntyre and Dr Anne Marie O'Hagan (MaREI).

DISASTER RESEARCH CLUSTER

As part of the broader UNIC project – The European University of Cities in Post-Industrial Transition – Dr Dug Cubie and Dr Marie Aronsson-Storrier (School of Law) and Dr Lydia Cumiskey (MaREI) commenced a small-scale pilot project to promote networks and connections between urban stakeholders in Cork, Ireland and Malmö, Sweden entitled Promoting Resilient Cities through Community Participation and Communication of Climate and Disaster Risks (PROCOMMS). The first workshop with participants from the two local authorities, academics and civil society actors took place in Cork on 26 October 2023, with a follow-on workshop in Malmö in January 2024. Key outputs from the project are a proposed good practice guide for climate and risk communication and exploration of further funding opportunities.

ENVIRONMENTAL LAW ENFORCEMENT: EMERGING CHALLENGES 2023

Centre members participated in the annual Environmental Law Enforcement: Emerging Challenges conference organised by the Environmental Protection Agency (EPA) and the Irish Centre for European Law (ICEL) at Dublin Castle on 16 November 2023. Following a competitive selection process, PhD candidate Niamh Guiry was selected to present her research on 'The Persistent Enforcement Challenges of Wildlife Crime in Ireland



L-R: Margaret Gray SC, KC; Sinéad Mercier, UCD; Laura Burke, Director General EPA; Mr Justice Donal O'Donnell, Chief Justice of Ireland; Niamh Guiry, UCC; Dr Tom Ryan, Director of the Office of Environmental Enforcement, EPA. Photo credit: Susan Kennedy

COLLABORATION AND PEER ESTEEM ACTIVITY

Centre PIs are called on regularly to provide expert input to law and policy developments at the highest level. In October 2023, Professor Owen McIntyre delivered an invited keynote presentation at Cairo Water Week 2030, on the theme of Procedural Frameworks for Cooperative Transboundary Water Management: The Role of International Water Law. In her capacity as Chair of the UN ECE Aarhus Convention Compliance Committee, Professor Áine Ryall was invited to participate in a number of high-level events as part of Human Rights 75, including the Regional Dialogue for Europe and Central Asia on the right to a clean, healthy and sustainable environment, Brussels, 20 October 2023 and the Roundtable on the Future of Human Rights, the Environment and Climate, United Nations, Geneva, 12 December 2023. Professor Owen McIntyre co-convened an international workshop on International Law and Transboundary Hydropower Projects at the University of Bologna, 9-10 March 2023.

During 2023 the Centre was delighted to host visiting scholars Dr Ivan Salvadori, University of Verona; Prof Catherine Malecki, Université Rennes 2; Prof Patrick Parenteau, Vermont Law and Graduate School; and Prof Madeline Kass, Seattle University School of Law.

INTEGRATION OF RESEARCH AND TEACHING

Research-informed teaching, at both undergraduate and postgraduate levels, is a fundamental element the Centre's activity. The Centre offers the LLM Environmental and Natural Resources Law and the LLM Marine and Maritime Law, as well as specialist undergraduate modules in environmental law.

Postgraduate modules include Environmental Law in Practice and the Environmental Law Clinic which provides students with the opportunity to advise real-world clients on ongoing legal projects and problems. The Centre's Co-Directors contribute annually to the University Wide Module on Sustainability.



3.4 CLEANER PRODUCTION PROMOTION UNIT (CPPU)

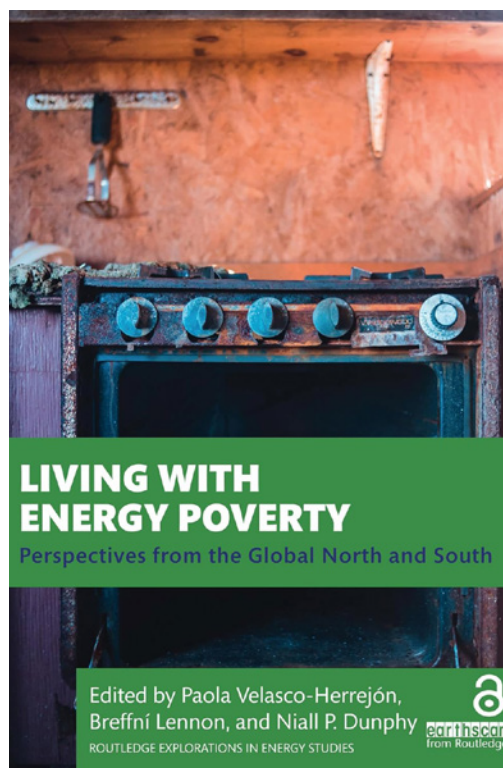
CPPU conducts engaged research focused on the theme of society, sustainability and energy, with a particular emphasis on people's relationship with energy and the energy system. The unit is led by Dr Niall Dunphy (School of Engineering and Architecture, and ERI).



LIVING WITH ENERGY POVERTY

December 2023 saw the publication of a timely book *Living with Energy Poverty: Perspectives from the Global North and South* edited by Dr Paola Velasco Herrejón, Dr Breffní Lennon, and Dr Niall Dunphy. This edited volume grew out of the EU-funded by EnergyMeasures project and co-ordinated by CPPU.

The book, part of Routledge's Explorations in Energy Studies series, brings together scholars from the Global South and the Global North and examines the diverse range of issues linked to energy poverty across different scales. Of particular note is the link between energy poverty and sustainability, particularly Sustainable Development Goal 7 – Ensure access to affordable, reliable, sustainable and modern energy for all. This book will be of interest to policymakers, practitioners, and scholars seeking a diverse range of fresh insights into the everyday reality of energy poverty and for those who wish to gain a better understand the challenges a people-centred, just energy transition can present.



NEW PROJECT ON REIMAGINING CITY LIFE

UCC researchers have been awarded funding for a project on reimagining city life to embrace the challenges of climate action and promote stable, just, and healthy urban environments. JustCities Hub a project led by Dr Niall Dunphy, with co-principal investigators Dr Alexandra Revez, Prof. Brian Ó Gallachóir and Dr Gerard Mullally, was successful in the Environmental Protection Agency Research Call 2023. JustCities Hub encapsulates a combined concern for embracing the challenges of climate action and promoting stable, just, and healthy urban environments. It adopts a nested research design with emphasis on the connection between scientific knowledge and practice.

On the one hand it seeks to capture and explore timely knowledge on enabling climate justice change in the city and on the other it seeks to engage in problem-solving and evaluating solutions for climate change from a transdisciplinary and multi-stakeholder perspective. The project also explores and evaluates mechanisms

for mobilising the development of micro-interventions, in a manner that supports, encourages, and empowers the potential and the diverse spaces of civic engagement within the city. Furthermore, it provides a strategic plan to bolster climate justice in the city through co-creation and foresight activities.



SUCCESSFUL COMPLETION OF REALISE PROJECT

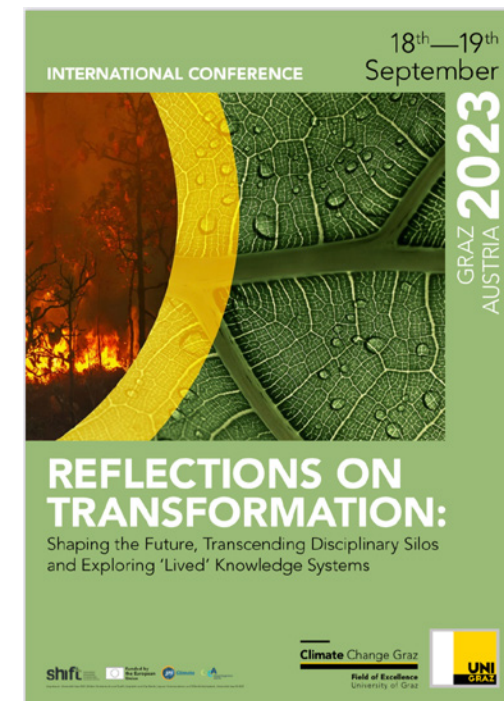
The Horizon 2020 funded project 'REALISE: Demonstrating a Refinery-Adapted Cluster-Integrated Strategy to Enable Full-Chain CCUS Implementation' successfully concluded in October 2023. The project focused on carbon capture and storage of industrial emissions, specifically those from refineries. The CPPU team led by Dr Niall Dunphy led a package of work considering the societal, socio-political and commercial context for CCS deployment, including developing an approach to education and public engagement. In a report on societal readiness, the CPPU research proposed policy recommendations and regulatory changes to address some of the barriers to CCS

implementation such as public scepticism, technical expertise shortage, policy lacunae, as well as uncertainties around cost and demand. Their recommendations to national governments include: providing public information campaigns on the potential of CCUS technologies to mitigate climate change; developing detailed decarbonisation roadmaps that explain the role of CCS in phasing out of fossil fuels; partnering with other countries to create and share CCS-related infrastructure; and, undertaking a regulatory audit to identify and characterise shortcomings in legal and regulatory frameworks necessary for CCS.



APPRECIATING SSH PERSPECTIVES ON CLIMATE CHANGE MITIGATION AND ADAPTION

UCC researchers continue to play leading roles in the COST action SHiFT: social sciences and humanities for transformation and climate resilience, with Dr Alex Revez (MaREI & CPPU), Dr Niall Dunphy (CPPU), and Dr Evan Boyle (MaREI) serving as the Action Vice Chair, Science Communication Coordinator and WG leader respectively. A highlight of the year for SHiFT was the conference "Reflections on Transformation: Shaping the future, transcending disciplinary silos and exploring lived knowledge systems", held in Graz, Austria on 18-20 September 2023. This well-attended conference brought together a multitude of disciplines to develop different concepts, central to the need to transform society in the face of climate change, and the challenges this raises. The conference explored different facets and versions of transformations (change, reform, revolution, transition etc, both in history and theory). It had an inclusive ethos engaging with a plurality of knowledge systems and approaches to transformation and in so doing seeking to transcend disciplinary silos.



RESEARCHERS REIMAGINE CITIZENS' ROLE WITHIN THE ENERGY SYSTEM

Within the context of the ongoing ENCLUDE H2020 project, CPPU's Dr Niall Dunphy, Dr Alexandra Revez and Dr Breffní Lennon have produced a typology of energy citizenship. This typology groups expressions of energy citizenship into four key categories based around access to energy, consumption, production, and politics and governance. Fifteen expressions of energy citizenship were described, three under the 'access to energy' category, and four in each of the others. Significantly, these expressions include those who are at the

margins of society (and the energy system), a group usually ignored in such discussions. This typology (available from <https://bit.ly/3OIKFmB>), the appreciation of an inclusive multifaceted energy citizenship that underpin its, and the understanding of the different manifestations of citizenship around energy described in it contribute to both understanding and mobilising the decarbonisation potential of citizens.



3.5 UN ENVIRONMENT PROGRAMME GEMS/WATER CAPACITY DEVELOPMENT CENTRE

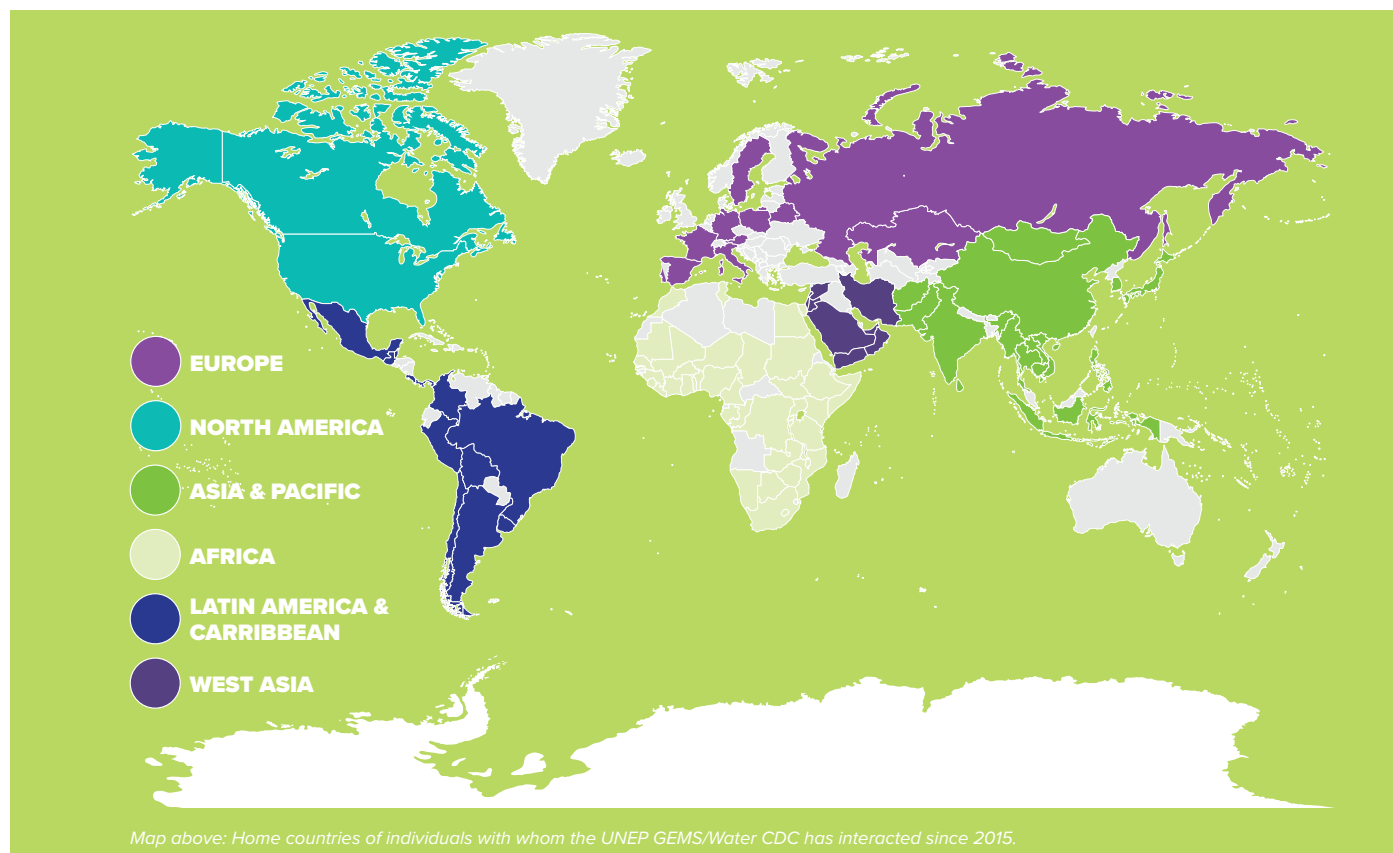
The United Nations Environment Programme (UNEP) GEMS/Water Capacity Development Centre (CDC) provides global capacity development in water quality monitoring and assessment working on a programme of activities to support the Sustainable Development Goals (SDGs), specifically SDG 6 – Clean Water and Sanitation. The Centre is, based in the Environmental Research Institute, is part of the School of Biological, Earth, and Environmental Sciences (BEES) and is led by its Director, Dr Tim Sullivan.



A BRIEF LOOK BACK AT WHAT THE UNEP GEMS/WATER CAPACITY DEVELOPMENT CENTRE (CDC) HAS ACHIEVED SO FAR.

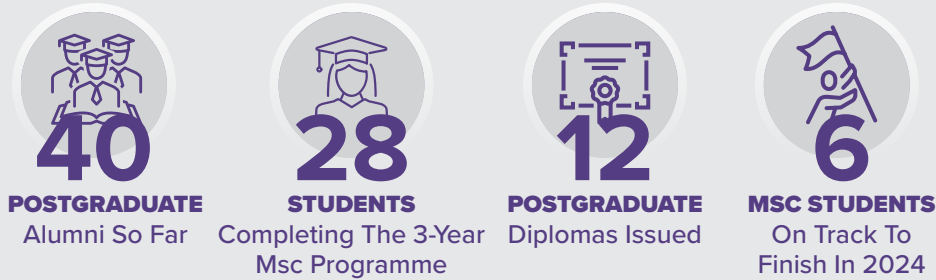
With the closing of Phase 2 of the UNEP GEMS/Water CDC at UCC in December 2023, this is an opportunity to give everyone a brief snapshot of the impact that the capacity development activities of the UNEP GEMS/Water programme has had on water quality monitoring globally.

Having the Capacity Development Centre at UCC since 2015 has marked a shift towards to broader capacity development through training and education. Housed between the School of Biological, Earth and Environmental Sciences, and the ERI, the CDC built a robust set of online postgraduate programmes, including a Postgraduate diploma and MSc programme, accredited continuous professional development courses open to current water sector professionals and a corresponding range of free-to-all, courses on UNEP's eLearning platform since 2015. And it has offered periodic short workshops, both remote and in situ. Further, the CDC's reach is truly global: it has now worked with individuals and agencies from 111 countries around the world over the course of its institutional life.

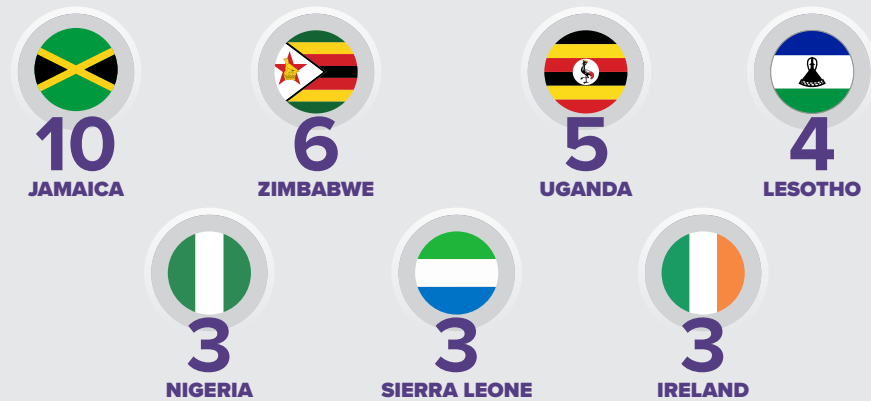


THE NUMBERS TELL THIS PART OF THIS TALE OF SUCCESS

POSTGRADUATE EDUCATION:



These students of advanced study have come from **24 COUNTRIES**



These students are overwhelmingly from **DEVELOPING COUNTRIES:**

92% are from countries classified by the UN Conference on Trade and Development as ‘developing’. This clearly indicates the CDC’s critical function in providing advanced training for individuals from countries where such training is in short supply.

CONTINUOUS PROFESSIONAL DEVELOPMENT:



The students who have taken part come from **32 COUNTRIES**



The most recent development has been the open access courses on UNEP’s eLearning platform, and despite having only been in operation since 2022, over **40 students have earned a total of over 50 certificates** at this point.

WORKSHOPS:

9 CDC WORKSHOPS since 2016, meeting in Kenya twice, and once each Brazil, Thailand, Senegal, Jordan and Fiji, and with one workshop held remotely. These workshops, providing bespoke guidance to targeted cohorts, have featured **155 participants**.

INNOVATION WORKSHOP IN PETTEN, NETHERLANDS

The United Nations Institute for Training and Research (UNITAR) Division for Prosperity, in collaboration with UNEP and the World Meteorological Organization (WMO), co-organized the Innovation Workshop in Water Quality Monitoring and Assessment, held in Petten, the Netherlands, from the 27th to the 29th of September. 65 participants attended the event, which was conducted in a hackathon-style format and aimed to pull collective intelligence to innovate on water quality monitoring and assessment challenges.

CDC Director Dr Tim Sullivan attended and provided extensive input into the innovation workshop. There has been sustained follow-up in the months following the workshop, and some five peer-reviewed articles have been prepared/submitted to the *Frontiers in Water Journal* – one article by workshop organizers and four articles (one per challenge) by workshop participants – to capture the results, recommendations and lessons learned from the workshop and to effectively convey them to diverse experts and stakeholders.

The workshop focused on four key challenges: Data to Action:

- Transforming data into actionable insights for water stewardship
- Empowering citizen scientists to improve water quality from monitoring to action
- Melding Aquawatch and Global Indigenous Knowledge
- Routine Monitoring of Antimicrobial Resistance in Water



Participants at the Innovation workshop held at the JRC site in Petten, The Netherlands in September 2023

PARTICIPATION IN THE WWQA ANNUAL MEETING HELD NAIROBI, KENYA.

CDC Director Dr Tim Sullivan and GEMS/ Water Ambassador Dr Deborah Chapman also travelled to Nairobi to attend the WWQA annual meeting in September 2023. The core aims of this meeting were to promote dialogue, engagement, and exchange among a multidisciplinary audience ranging from scientists to local communities and youth organizations. There was a particular focus on highlighting how water quality data can be gathered and used to promote practical local action and how, as a result, all members of society can maintain a permanent dialogue with decision-making at a supra-national level to advance water quality issues.

Attendees included scientists, water specialists, researchers, and UN officials. A broad spectrum of stakeholders was also well-represented via Local Water Forums, including local officials, youth advocates, business figures, researchers, and interested citizens. These diverse participants united to address water quality concerns and present current work under the various WWQA workstreams, with a special emphasis on how to generate data and connect it to action by engaging local organizations.

An opportunity was also taken to host an important combined meeting of the Strategic and Technical Advisory Councils (SAC & TAC) of the WWQA in Nairobi. The purpose of this meeting was to gather consensus and input on the strategic direction and key future objectives of the WWQA.



Delegates attending the WWQA Annual meeting in Nairobi, Kenya, in September 2023

3.6 AQUACULTURE AND FISHERIES DEVELOPMENT CENTRE (AFDC)

The AFDC is a centre of excellence for aquaculture and fisheries research focusing on fisheries and fish population genetics, health of aquaculture species, and marine mammal research based in the School of BEES and affiliated to the ERI. The Centre is led by its Director, Prof Sarah Culloty.



HOW THE ENVIRONMENT SHAPES THE GENETIC DIVERSITY OF SHELLFISH

Fine-scale knowledge of genetic structure is crucial for conserving genetic resources, even in marine species where visible barriers to gene flow may not be apparent. The common cockle (*Cerastoderma edule*) is an economically and ecologically important bivalve found in the Northeast Atlantic Ocean. Previous studies have shown significant genetic structure across the Northeast Atlantic and within small geographic areas, emphasizing the need for further investigation at fine scales.

A recent Nature Heredity paper authored by Prof Sarah Culloty, Dr Sharon Lynch and Dr Kate Mahony of the Shellfish Health Group with European partners that were involved in the COCKLES Project (Atlantic Area Interreg) studied two distinct areas, and revealed that environment factors like sea temperature and salinity affect genetic divisions.

In this study, two contrasting geographic regions were analyzed: the fragmented SW British Isles and the putatively homogeneous Galicia in NW Spain. Using genetic data researchers examined genetic diversity and differentiation. Results largely confirmed previous findings but also revealed new insights. While Galicia exhibited a homogeneous genetic structure, the SW British Isles region showed four distinct genetic regions correlated with oceanographic features and environmental factors like sea surface salinity and temperature. These findings shed light on the factors influencing genetic structure in cockle populations and can inform specific management policies tailored to each region's socio-economic characteristics. Overall, this study contributes to the understanding of genetic diversity and differentiation in cockle populations, providing valuable data for sustainable management actions across the species' distribution range in the Northeast Atlantic.

OUTREACH IN ACTION: PROMOTING SUSTAINABILITY THROUGH SHELLFISH RESEARCH

In addition to presenting research from the Shellfish Health Group to President Michael D. Higgins upon his visit to the campus in September, Dr Sharon Lynch was also invited to attend the President of Ireland Michael D. Higgins's Garden Party Cherishing Ireland's Biodiversity and Sustainability at Áras an Uachtaráin in June 2023 (pictured below).

A short film about Dr Sharon Lynch and the Shellfish Health Group's long collaboration with Rossmore Oysters in Cork Harbour to support sustainable oyster culture and fisheries was produced by Swimming Heads Production in August 2023.



THE WILD SIDE OF SALMON: HOW ESCAPED FISH BECOME FERAL EXPLORERS

Imagine a daring escape from the confines of a fish farm—a breakout worthy of a Hollywood movie. But for Atlantic salmon, this isn't just fiction—it's feralization, a wild adventure that begins when they slip away from human captivity into the vastness of the ocean. Atlantic salmon raised in fish farms or hatcheries are like city dwellers suddenly thrust into the untamed wilderness. They must adapt quickly to survive, learning to navigate treacherous currents, evade hungry predators, and hunt for their meals in the open ocean. As these escapees venture into the wild, something remarkable happens. They undergo a genetic makeover, evolving traits that help them thrive in their newfound freedom. From changing their migration patterns to honing their hunting skills, feralized salmon become true survivors.

But it's not just survival of the fittest—it's also about fitting into their new environment. Feral salmon interact with native species, reshaping ecosystems and forging new connections in the natural world. While feralization can bring diversity to salmon populations, it also raises concerns.

These rogue fish may outcompete native species, spread diseases, or even interbreed with their wild cousins. Conservationists face the challenge of balancing the benefits and risks of feralization to protect our precious aquatic ecosystems.

Understanding the evolutionary ecology of feralization in Atlantic salmon is important for informing conservation and management efforts aimed at maintaining healthy and sustainable salmon populations in natural environments. To this end, Dr Tom Reed (AFDC, School of BEES, ERI) and a wider team of salmonid biologists and geneticists across the island of Ireland have launched an exciting new research project which aims to tackle a series of fundamental questions concerning the genomic and epigenetic basis of “reverse domestication” processes. The topic is also highly relevant to applied conservation issues pertaining to aquaculture escapes and fisheries management. The project will involve collaborations with colleagues from the Marine Institute of Ireland and Queens University Belfast, and groups from across Europe and the US.



Highlight

Mary Robinson Amongst Speakers At Major New UCC Climate Conference



Leading figures from international development, business, academia, and the media gathered for a major new climate conference at UCC in November 2023, which commenced on the eve of the COP28 global climate negotiations, convened by Dr Marguerite Nyhan of the Sustainable Futures Project.

Former President of Ireland and United Nations High Commissioner for Human Rights Mary Robinson was the keynote guest at the first Sustainable Futures Forum, held in UCC’s Glucksman Gallery.

RTÉ presenter Miriam O’Callaghan was the MC for the event which examined some of the key challenges facing Ireland as it seeks to meet ambitious targets set out in its Climate Action Plan. Sustainable urban and rural development, the role of technology and innovation within industry, ensuring climate justice, and the role of the media on climate change were amongst the topics that were examined during the forum.

Speakers and contributors on the day included:

- Mary Robinson, Chair of The Elders and former President of Ireland and United Nations High Commissioner for Human Rights
- Dr Julie Newman, Director of Sustainability, Massachusetts Institute of Technology
- Roberto Estevez, Energy Analyst, World Bank
- Kevin O’Sullivan, Environment and Science Editor, Irish Times; Tom Fitzpatrick, Editor, Irish Examiner; Caroline O’Doherty, Environment Correspondent, Irish Independent
- Dr Kevin Marshall, Head of Education & Skills, Microsoft; Robert O’Mahony, Head of Sustainability, Global Operations, Logitech
- Danny McCoy, CEO, IBEC
- Dr Vivienne Patterson, Head of Skills, Engagement and Statistics, Higher Education Authority

“Over 500 researchers are engaged on sustainability at UCC and our research has shaped key national climate policies as we look to create a sustainable future. We are simply running out of time and the Sustainable Futures Forum provides a crucial space to discuss the solutions to critical sustainability and climate issues at a national and international level.

UCC President Professor John O’Halloran

“On the eve of COP28, the Sustainable Futures Forum will shape solutions to some of the most pressing climate and sustainability issues of our time. Through our Forum, prominent figures in international development, academia, industry, and Irish society will provide leadership and expert guidance on the important issues of climate justice, financing the just transition, and the role that universities, enterprises and the media have in promoting a fair and equitable sustainable future.

Dr Marguerite Nyhan
Chair of the Sustainable Futures Forum, Associate Professor at the ERI and Research Affiliate at Massachusetts Institute of Technology

Sustainable Futures is a national sustainability education initiative led by UCC. Its educational programmes provide current and future leaders with the knowledge and skills they need to lead the transition to a sustainable and net zero future. Sustainable Futures partners include Maynooth University, Atlantic Technological University, and enterprises including Microsoft Ireland and Logitech.

4 | Outreach and Public Engagement

NEW IDEAS FOR PUBLIC ENGAGEMENT

The Creative Climate Action Spark fund will fund 24 projects piloting new ideas for public engagement at a local, community level, or communities of practice including BluePrint, a MaREI project coordinated by Dr Lydia Cumiskey and Dr Denise McCullagh which will capture lived experiences and narratives in a flood-affected community in Derry. BluePrint facilitates an intergenerational art-infused co-creation process, capturing lived experiences and narratives in the community in Derry, resulting in co-created engagement materials for wider dissemination/outreach, supporting local climate resilience. All-island two-way learning and exchange between Derry and Mayo, co-produces a 'creative co-creation' toolkit (documenting processes and methods with examples, resources and templates accessible digitally) targeting local governments working with flood-affected communities. BluePrint's interdisciplinary and collaborative project team blends science, arts and governance involving UCC, The Playhouse, Derry City and Strabane District Council, and Mayo County Council, supported by collaborators the Climate Action Regional Office Atlantic Seaboard North and Northern Ireland Environment Link/ Climate Northern Ireland, contributing expertise, capacity and networks for wider impact.

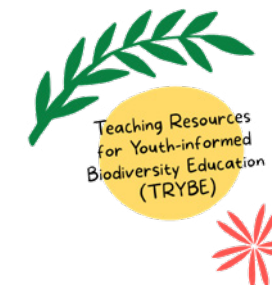
ANALYSING THE IMPACT OF THE CREATIVE CLIMATE ACTION INITIATIVES

This Creative C-Change report presents key insights and learnings from MaREI, ERI and the Future Sustainability Research Group's engagement with five Creative Ireland-funded Creative Climate Action projects. The five selected projects were Crumlin Taking Action Together, Field Exchange, Kinship, Línthe na Farraige and Repair Acts. The overarching aim of the research was to capture the impact of these arts, cultural and creative projects and their events on climate change awareness, engagement and action in Ireland. In this research, authors Dr Marguerite Nyhan, Dr Joanne Mac Mahon and Dr Alexandra Revez found that the Creative Climate Action events had a significant impact on audience members and participants in terms of increased awareness, positive engagement and motivation to act in relation to climate change. It was observed that the Creative Climate Action experiences provided new ways of engaging and new spaces for connecting and communicating in relation to the environment and climate change. Over 90% of audiences and participants agreed or strongly agreed that the arts/ creative community has a role to play in addressing climate change and that artistic/ creative events can inspire people to take positive environmental action.

EMPOWERING YOUTH FOR BIODIVERSITY: THE TRYBE INITIATIVE

TRYBE was an innovative initiative aimed at educating and empowering children and young people aged 8-16 about biodiversity and addressing the critical challenges of biodiversity loss. Through co-design and co-creation processes led by the MaREI Centre's Public Engagement Manager Aoife Deane with support from Catriona Reid and colleagues from DCU and a children's rights and participation specialist, educational resources were developed based on the recommendations of the Children and Young People's Assembly on Biodiversity Loss.

These resources included the Biodiversity Activity Book and the Bitesize Biodiversity resource pack, which were designed in collaboration with children, educators, and researchers. The project also involved piloting these resources, gathering feedback, and making improvements. TRYBE's dissemination efforts included launching the resources during Science Week and World Education Day, as well as utilizing social media and direct mailshots to reach schools nationwide. The project received positive feedback from schools, teachers' organizations, and key stakeholders, demonstrating its impact in promoting awareness and engagement in biodiversity topics among children and young people. Ongoing research aims to evaluate the co-creation process and its impact on empowering youth to address biodiversity issues. Through TRYBE, young people are being equipped with



the knowledge and tools to become stewards of biodiversity and champions for sustainability in their communities.

Five children who participated in the TRYBE project spoke at the Joint Oireachtas Committee on Environment and Climate Action on Nov 21st, 2023. At the Committee the young people highlighted the outputs of the TRYBE project, giving specific attention to the Biodiversity Activity Book (copies of the book were given to Committee members) and the online secondary school resources. Minister Malcolm Noonan also met with the children prior to the Committee meeting and talked about the importance and impact of their work.

“

TRYBE has produced this really beautiful publication and there's loads of activities for schools and lots of fun to have, and while they're having fun, learning a lot more about nature and about species. It's a really wonderful resource.

Minister Malcolm Noonan highly praised the Biodiversity Activity Book

GARDEN RHYTHMS: DANCE AND PLANT SCIENCE COLLABORATIONS AT GLENKEEN

Early in 2023, the ERI partnered with UCC Creative, Dance Cork Firkin Crane, and the Crespo Foundation (Frankfurt am Main, Germany) to develop two pilot residencies for Irish or Irish-based dance artists in collaboration with plant scientists from the ERI, which would take the form of a response to Glenkeen Garden in West Cork.

The dance artists and plant scientists initiated their collaborations with a workshop in the UCC theatre lab for a taste of the 'Creative R&D' that the partnerships would involve. After that initial workshop stage, selected dance artists Gráinne O'Carroll and Isabella Oberländer paired up with ERI/School of BEES Plant Scientists Dr Rossana Henriques and Dr Eoin Lettice for a week-long intensive collaboration in the beautiful surroundings of Glenkeen Garden. Inspired by the setting and each other's work, the pairs created performance pieces which were staged in September at the Dance Cork Firkin Crane Theatre.



Photo credit: Marcin Lewandowski.

IRELANDS FOSSIL HERITAGE

Ireland's Fossil Heritage is a science engagement project funded by SFI and the European Research Council (ERC) and led by Professor Maria McNamara of the School of BEES and the ERI. The project aims to increase awareness of, and interest in, Irish fossils by offering a diverse range of free resources to the public, including school workshops, a travelling exhibit, science and art collaborations and lots of interactive web content for all ages and backgrounds. In 2023, the project team hosted the 2nd National Fossil Art Contest for children with a grand prize of a fossil-hunting trip with real UCC palaeontologists. The winning entries were exhibited in the UCC Glucksman Gallery. The theme of the competition was "Irish fossils ALIVE" and the winner of each age category also received a guided tour of the fossil labs in UCC and a behind-the-scenes look at UCC's fossil collections.

A VELVET OR VIOLENT CLIMATE REVOLUTION: WHICH WILL WE CHOOSE?

The climate emergency has left us facing fundamental questions of every facet of modern society. Central amongst these is the issue of equity – both between and within nations. In a special guest seminar hosted by the ERI in Summer 2023, Professor Kevin Anderson unpicked the policy gulf that exists between the temperature and equity commitments enshrined in the Paris Agreement and the emission trajectory of so called "developed" nations.

Professor Anderson is professor of Energy and Climate Change at the University of Manchester and visiting professor at the Universities of Uppsala (Sweden) and Bergen (Norway). Formerly he held the position of Zennström professor (in Uppsala) and was director of the Tyndall Centre for Climate Change Research (UK).

Professor Anderson took this opportunity to look beyond techno-optimistic solutions, concluding there are now no non-radical futures. The choice is between immediate and profound social

and technical change or waiting a little longer for chaotic and violent social change and in 2023 the window for this choice is rapidly closing.

This event was hosted by the ERI, An Taisce, Cork City Council, Cork Environmental Forum, Cork Nature Network, Green Spaces for Health, SHEP Earth Aware and Cork Healthy Cities as part of An Taisce's 75th Anniversary Programme.

“

Nature will not be fooled" by empty rhetoric, subterfuge and unsubstantiated optimism – and nor should we.

Professor Kevin Anderson



CELEBRATING THE LIFE OF ELLEN HUTCHINS

To commemorate the 208th anniversary of the death of Ellen Hutchins, the Botanist of Bantry Bay, the ERI and the Ellen Hutchins Festival hosted the launch of the recording of *Seaweed and Sealing Wax 2: letters from 1812* – an audio recording of a performance piece depicting the correspondence between Ellen and fellow botanist, Dawson Turner. Audience members heard from Madeline Hutchins - Ellen's relative, a researcher and co-founder of the Ellen Hutchins Festival which runs annually in August. Performer and writer, Karen Minihan, read extracts from Ellen's, with context and notes provided by Finola Finlay of the Roaringwater Journal. There was also the opportunity to have a private tour of the archives on display in the Ellen Hutchins Archives Cabinet in the ERI Ellen Hutchins Reading Room. Established in September 2022 when the former ERI Lee Road

Building was renamed the Ellen Hutchins Building, the room has a collection of books on botany, biodiversity and caring for plants and the planet. There is a display, a short film and information on Ellen's life and work with beautiful seaweed specimens and a small exhibition on the correspondence from the early 1800s including postage stamps and seals.

Additionally, as part of Cork's Culture Night 2023, the ERI and the Ellen Hutchins Festival hosted an Open House in the Ellen Hutchins Building in honour of the pioneering botanist. This interactive family event explored nature, science, art and history through adventures with leaves, wax, paint and lenses with UCC Plant Scientists, Aquatic biologist Frances Gallagher and historical re-enactor, Carrie O'Flynn.



Dr James Richardson of the School of BEES and the ERI also presented his research into the biology and genetic diversity of the chocolate tree, *Theobroma cacao*, and its relatives. The work showed how the relatives of cacao might be used to tackle challenges to the chocolate industry that includes threats to the trees from disease and climate change, and was complemented by guest Rose Daly, from The Chocolate Shop in the English Market, who displayed samples taken from plantations from around the world.

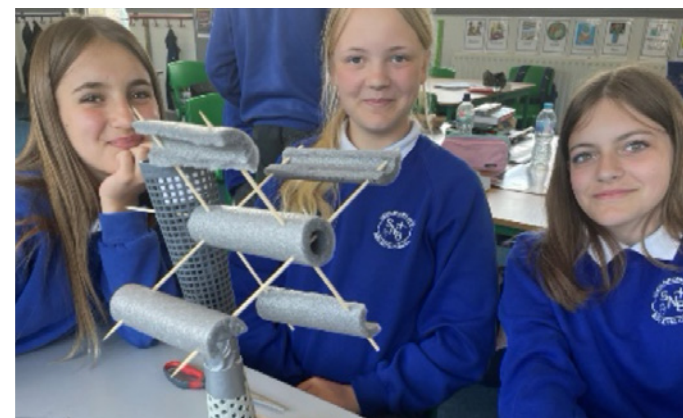
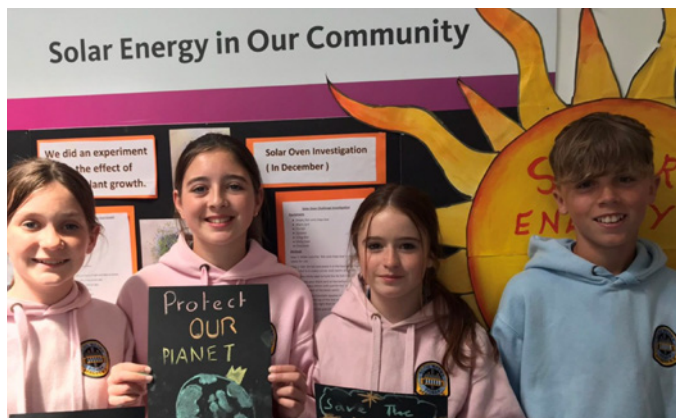


CLIMATE ACTION IN A BOX

In 2023, the ERI partnered with Cork-based SME STEAM Education to deliver a 5-lesson Climate Action Programme called Climate in a Box to 4th, 5th and 6th classes in a number of Irish schools including two Gaelscoileanna and a school as far away as Cavan!

The Climate Action programme has been developed by STEAM Education and consists of five 1-hour lessons exploring the causes of climate change, solutions and opportunities for climate action. The lessons are centred around fun, hands-on activities which engage the kids in the topic and make the theory accessible.

Five researchers from the ERI research community volunteered to deliver this programme for 1 hour each week for 5 weeks. Dr Linda O'Higgins (ERI) carried out the programme in Rennies National School, Nohoval, Co.Cork; Dr Gillian Collins (ERI/School of Chemistry) provided the programme to Gaelscoil Uí Ríordáin in Ballincollig; Dr Eilis O'Reilly (ERI/School of Public Health) delivered the programme to Gael scoil Ui Riada in Cork; Dr Aoife Daly (ERI/ School of Law) visited Glasheen Boy's School, Cork City and Dr Lydia Cumiskey (ERI/MaREI) travelled to Ballyconnell Mixed National School in Co. Cavan. The volunteers received training from STEAM Education prior to carrying out the programme and the programme was offered to the school free of charge.



Photos courtesy of our volunteers

THE ERI WELCOMES OUR THREE NEW ECO-HUMANITIES AFFILIATES

The UCC Eco-Humanities Research Group aims to bring the perspectives of the humanities to bear on the multiple interlocking ecological and existential crises of our time. They are a group of scholars from across and beyond the humanities disciplines whose work is concerned with climate and biodiversity crisis and with their far-reaching implications for values, ideologies, identities, and symbolic systems. Together, they explore how their work in the humanities can help individuals and communities, including communities of researchers in the natural and social sciences, to navigate the growing conceptual, emotional, ethical and other demands of contemporary ecological crises. We also consider the place of critical ecological awareness within humanities education at undergraduate and postgraduate level, and within transdisciplinary research

In 2023, three of the Eco-Humanities Research Group Co-convenors formally joined the ERI:

- **Dr Jenny Butler** of the Study of Religions Department in CACSSS. Dr Butler conducts ethnological research in the area of religion and culture and is interested in spiritual connection to the land, nature, and wider environment.
- **Dr Laurence Davis** is a critical political theorist lecturing in the Department of Government and Politics. His primary research and teaching interests are in radical political thought and imagination, with an emphasis on bringing the perspectives of the Humanities to bear on the multiple and interlocking global crises of our time.
- **Dr Crystal Addey** of the Department of Classics and School of the Human Environment in CACSSS is also founder of the UCC Eco-Humanities Research Group. Dr Addey is interested in the ways that our worldviews, cosmologies, and patterns of thinking can empower our ability to understand and deal with contemporary environmental issues.



DID YOU SPOT OUR ERI RESEARCHERS AT...?

Bloom Festival 2023

The Irish Tree Explorers Network led by Dr Eoin Lettice and Dr Barbara Doyle Prestwich (ERI, School of BEES) in collaboration with Dr Claire Connolly (School of English) were exhibiting to over 100,000 visitors at the national Bord Bia Bloom festival in May. Also exhibiting at the event's Sustainable Living Stage/Conservation Section was Dr Tom Doyle's (School of BEES, ERI) and artist Shevaun Doherty's jellyfish-inspired garden.

Pint of Science Festival 2023

Pint of Science brings scientists to local pubs and cafes to discuss their latest research and findings with the public. Kicking off the Festival in Cork in May, ERI's Dr. Fionn Rogan spoke about exploring sustainable energy futures with computer modelling and storytelling, while Dr. Boris Drosz discussed how to make drinking water safe using machine learning.

World Water Day 2023

The theme of World Water Day 2023 is accelerating change to solve the water and sanitation crisis and to highlight this, student Luke Ring from the UCC Brainwaves project (BEES/ERI) produced a short video about the importance of clean water. The Brainwaves project continues to work on innovative water remediation systems using the duckweed plant.

The College of SEFS Science In Society Public Lecture Series 2023

This lecture series looks at the role of science in modern society, in the modern developed economy, and the broad ethical issues raised by scientific and technological advances. The 2023 series included lectures from ERI academics Prof Jerry Murphy, Dr Tom Doyle, Dr Michelle McKeown and Prof Gerard Killeen.

The College of SEFS Inaugural Professorial Lecture Series 2023

Inaugural lectures are an occasion to welcome new professors and learn of their work to date, research and emerging goals. The UCC community, as well as the local, national, and international community are encouraged to attend these opportunities to engage with our recently-appointed professors and their scholarship. In 2023, ERI researchers Prof Maria McNamara, Prof Hannah Daly and Prof Gregorio Iglesias were amongst those who presented.

Cork's Life Long Learning Festival 2023

Selected fossils from the UCC palaeontological collections were on display as part of the Fossils for our Future project's Life Long Learning Festival event. Project lead, Dr Chris Mays (ERI, BEES) outlined the significance of the fossils for understanding Earth's past and present, and a live fossil preparation demo was also provided as part of the project's citizen science element.



Highlight

ERI Researchers Receive Presidential Visit



Seated: Prof John O'Halloran, President, UCC; Mrs. Sabina Higgins; President Higgins; President Vella; Mrs Miriam Vella; Dr Jean van Sinderen-Law; Back: Dr Gillian Bruton (MaREI/ERI); Dr Jimmy Murphy (MaREI/ERI); Dr Sharon Lynch (School of BEES/ERI); Prof Jerry Murphy (MaREI/ERI); Prof Andy Wheeler (School of BEES/ERI); Dr Clodagh Harris (Dept of Government/ERI); Prof Brian O'Gallachoir (MaREI/ERI); Dr Aoife Daly (School of Law/ERI); Prof Sarah Culloty (SEFS/ERI); Dr Paul Bolger (ERI).

On March 2nd 2023, the President of Ireland, Michael D. Higgins, his wife Ms Sabina Higgins, and President of Malta, H.E. Dr George Vella, and his wife Mrs Miriam Vella visited the UCC campus as part of a State Visit by the Maltese delegation to Ireland.

In response to specific interest from the delegation in the areas of the marine, climate action and maritime research, then-ERI Director Prof Sarah Culloty provided an overview of the Institute's research in these areas and 6 ERI researchers presented on their own work:

- Dr Jimmy Murphy (Engineering, MaREI, ERI) spoke about Marine Renewables, particularly the Lir National Ocean Test Facility and the H2020 MUSICA project which includes University of Malta. MUSICA will provide a full suite of Blue Growth solutions for a small island like Ireland (or indeed Malta).
- Dr Sharon Lynch (BEES, ERI) spoke about the importance of aquaculture and coastal communities for island nations such as Ireland and Malta.

- Prof Andy Wheeler (BEES, iCrag, ERI) spoke about marine geology and deep sea mapping and ocean exploration.
- Prof Brian O'Gallachoir (Engineering, MaREI, ERI) spoke about the Imagining 2050/Dingle 2030 projects as examples of interdisciplinary research.
- Dr Aoife Daly (School of Law, Centre for Law and Environment, ERI) described her work on climate justice and young people.
- Dr Clodagh Harris (Government and Politics, ERI) spoke about her experience serving on the Citizens Assemblies for climate and biodiversity in Ireland.

“

We warmly welcome them to our campus to view some of our treasures, meet our students, and hear about our leading environmental research.

Professor John O'Halloran
President of UCC

While here President Higgins and President Vella also visited the Honan Chapel, met with Maltese students studying in Cork and to commemorate World Book Day, viewed The Great Book of Ireland, (Leabhar Mór na hÉireann) which has been described as 'Ireland's modern-day Book of Kells.'

The delegation also viewed The Atlas of the Great Irish Famine, which was published by UCC's Cork University Press (CUP), and its 728 pages and over 1,000 images offer a new and extraordinary insight into a defining period in Irish history.

5 Awards & Recognitions

ESAI POSTGRADUATE OF THE YEAR

Congratulations to Larissa Macedo Cruz de Oliveira (ERI/ BEES/Dept of Geography) who is the winner of the ESAI Postgraduate Researcher of the Year Award. Larissa received her prize at the opening ceremony of Environ 2023 conference. Fellow ERI student Hannah Mealy also won Best Biodiversity Presentation

UCC RESEARCH AWARDS 2023

Congratulations to ERI recipients of UCC research awards - Prof Hannah Daly (Research Communicator of the Year), Dr Jean O'Dwyer (Early-Stage Researcher of the Year), Prof Colm O'Dwyer (Research Award for Open Science), Dr Marguerite Nyhan (Consultancy Project of the Year), UCC Palaeontology (Research Team of the Year) and Dr Alicia Mateos Cárdenas (President's Award for Research Impacting SDGs).

CARBON BUDGETS WORKING GROUP

Congratulations to Dr Kian Mintz-Woo (ERI/Dept of Philosophy) on his appointment to the Carbon Budgets Working Group of the Climate Change Advisory Council. Dr Mintz-Woo will contribute to the carbon budgets methodology for the coming five-year carbon budgets, by bringing in a climate justice and just transitions perspective.

UCC INNOVATION AWARDS 2023

Congratulations to Dr Brenda Long (ERI/School of Chemistry/ Tyndall) who was the 2023 winner of the UCC SPRINT Disruptive Technology Award. Dr Long has developed a new catalytic technology which will enable a 32 improvement in performance in electric vehicles. This new technology has the potential to change the fuel cell landscape offering a cheaper, cleaner alternative to battery electric vehicles.

INDUSTRY AWARD

Congratulations to the INTERREG SELKIE project on winning the MaREI Project of the Year at the Marine Renewables Industry Association (MRIA) forum in Feb. The UCC Selkie TJ Horgan, Dr Fiona Devoy McAuliffe, and Dr Jimmy Murphy, are developing a streamlined commercialisation pathway for the Marine Renewable Energy (MRE) Industry.

UCC STEM AWARDS 2023

Congratulations to the ERI's Dr Paul Bolger, Dr Eoin Lettice and Dr Archishman Bose - recipients of UCC STEM awards 2023. Dr Bolger was the winner of the SEFS Staff Citizenship of the Year Award, Dr Lettice received the SEFS Excellence in Education & Public Engagement Award, and Dr Bose was a winner of the Postgraduate Research Publication of the Year.

UNEP APPOINTMENT

Prof Marcel Jansen (ERI, BEES) has been appointed to the UNEP Environmental Effects Assessment Panel, one of three panels that informs the Parties to the Montreal Protocol on matters arising from ozone depletion, UV radiation and the interaction of climate change. He will lead a working group on terrestrial ecosystems and biogeochemical cycles, as well as a working group on microplastics.

ICRAG FUTURE LEADER AWARD 2023

Congratulations to Hannah Binner (ERI, School of BEES, iCRAG) who received the Postgraduate iCRAG Future Leader Award this year. Hannah has demonstrated excellence in research, education and public engagement and EDI initiatives. Currently chair of the iCRAG EDI committee, Hannah's work focuses on soil science, pollution/contamination problems, and geohazards in Ireland.

MAREI RESEARCHERS LISTED AS TOP SCIENTISTS IN IRELAND

Congratulations to ERI/MaREI researchers Prof Gregorio Iglesias, Dr Gordon Lightbody, Prof Jerry Murphy and Prof Brian Ó Gallachóir who were ranked amongst the Top Engineering and Technology Scientists in Ireland by research.com. Position in the ranking is based on a scholar's Discipline H-index which includes exclusively papers and citation metrics for an examined discipline.

ENERGY CORK

Congratulations to Dr Paul Leahy who was appointed as Chair of Energy Cork for 2023. Energy Cork is an industry-driven cluster pursuing coordinated actions to strengthen enterprise and employment within the energy sector in the Cork region. Supported by Cork City Council and Cork County Council.

6 | ERI in the Media 2023

A BIG SHIFT AWAY FROM CAR-CENTRIC TRAVEL WILL GREATLY IMPROVE OUR QUALITY OF LIFE

Prof Hannah Daly,
The Irish Times.

 THE IRISH TIMES

PUFFINS LOSE THE ABILITY TO FLY FOR UP TO TWO MONTHS EVERY YEAR, EXPOSING THEM TO WINTER STORMS.

Jamie Darby,
The Irish Examiner.

 Irish Examiner

COUNTRYWIDE – WILDFIRES IN IRELAND

Dr Fiona Cawkwell,
RTE Radio One.

 RTE RADIO 1

WHEN WILL MY ELECTRICITY BILLS START TO COME DOWN?

Dr Paul Deane,
RTE Brainstorm.

 RTE Brainstorm

7 THINGS YOU SHOULD KNOW ABOUT CARBON CAPTURE

Dr Elena Tsalaporta,
RTE Brainstorm.

 RTE Brainstorm

UNUSUALLY LARGE NUMBERS OF JELLYFISH BEING WASHED UP ON IRISH SHORES

Dr Tom Doyle,
the Irish Times.

 THE IRISH TIMES

AI OFFERS NEW APPROACH TO HELP COLD WATER CORALS

Dr Larissa Macêdo Cruz de
Oliveira, the Irish Times.

 THE IRISH TIMES

IRELAND'S SOLAR REVOLUTION: THE COUNTRY'S FASTEST GROWING RENEWABLE POWER SOURCE IS HAVING A PROFOUND IMPACT

the MaREI Centre,
The Irish Times.

 THE IRISH TIMES

DO WE NEED TO CHANGE HOW WE EAT TO ACHIEVE CLIMATE GOALS?

Dr Kian Mintz-Woo,
Today FM, Kenny Show, Newstalk,
17th Sept 2022.

 TODAY fm

TWO-THIRDS OF CORK'S GREENHOUSE GASES COME FROM HOME ENERGY AND ROAD TRANSPORT

Dr Marguerite Nyhan,
Irish Examiner.

 Irish Examiner

WIND TURBINE BLADES: INSIDE THE BATTLE TO OVERCOME THEIR WASTE PROBLEM

Dr Peter Deeney, Dr Paul Leahy and
Dr Kieran Ruane in The Conversation.

 THE CONVERSATION

WHY IS THE AIR WE BREATHE IN IRELAND SO POLLUTED?

Dr Dean Venables and Dr Marica
Cassarino, the Irish Examiner

 Irish Examiner

JANUARY

MARCH

MAY

JULY

SEPTEMBER

NOVEMBER

FEBRUARY

APRIL

JUNE

AUGUST

OCTOBER

DECEMBER

CAN WE COPE WITH CLIMATE CHANGE?

Dr Jean O'Dwyer,
Independent Thinking.

 INDEPENDENT THINKING

BEAN AND GONE, IS YOUR MORNING COFFEE A THING OF THE PAST?

Dr Eoin Lettice,
the Irish Examiner.

 Irish Examiner

THE CLIMATE QUESTION

Dr Paul Leahy,
BBC Sounds.

 BBC SOUNDS

HOW THE CURLEW BECAME IRELAND'S POSTER CHILD FOR EXTINCTION

Dr Paul Holloway,
RTE Brainstorm.

 RTE Brainstorm

IRELAND WILL SOON HAVE A MEDITERRANEAN-STYLE CLIMATE

Dr Chris Mays,
Newstalk.

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FEMALE RESEARCHERS TAKE TOP AWARDS

Dr Brenda Long,
the Evening Echo.

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HOW SOME PTerosAURS BECAME GIANTS THANKS TO PARENTAL CARE

Dr Zixiao Yang,
RTE Brainstorm.

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IS THE GOVERNMENT CLIMATE-FRIENDLY WHEN BUYING GOODS AND SERVICES?

Dr Alexandra Revez, Dr Maria
Kirrane and Fiona Thomson, RTE.

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LOUTH LECTURER MICHELLE MCKEOWN SAYS 'WE CAN ALL DO SOMETHING ABOUT CLIMATE CHANGE' AS SHE PRESENTS NEW RTE SERIES 'HEATED'

Dr Michelle McKeown,
the Irish Independent.

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FIVE WORRYING TRENDS FOR THE IRISH ENVIRONMENT

Prof Brian Ó Gallachóir, Dr Paul Deane
and Dr Paul Bolger, RTE Brainstorm.

 RTE Brainstorm

ARCHISHMAN BOSE: UNIVERSITIES WILL BE AT THE FOREFRONT OF CLIMATE ACTION

Dr Archishman Bose,
the Irish Examiner.

 Irish Examiner

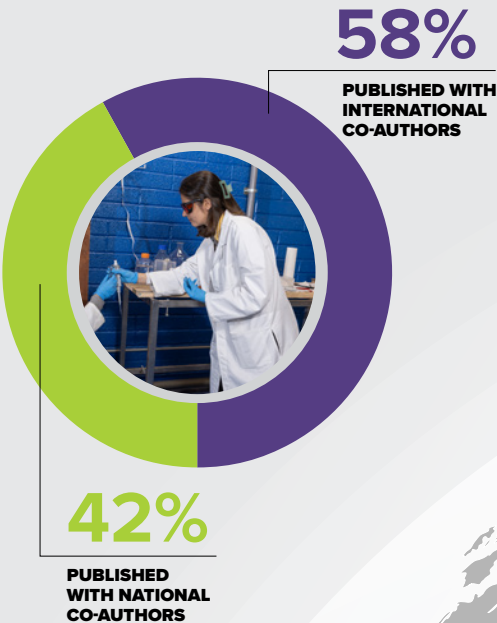
SOCIETY AND SUSTAINABILITY

Dr Niall Dunphy,
the Parachute Candidate Podcast.

 MARIA WALSH Parachute Candidate

7 | ERI Around the World in 2023

The ERI has collaborative partnerships with over 500 national and international universities and companies, which result in hundreds of publications annually. The top 15 countries with which we produced the most publications in 2023 are highlighted here.



8 | ERI 2023 PhD and Research Masters Awards

POSTGRADUATE		QUALIFICATION	SUPERVISOR(S)
Akinola	Joel Abidemi	PhD (Science)	Professor John Morrissey
Alcock	Emma Anne	PhD (Science)	Dr Gerard McGlacken
Ball	Samantha Nicole	PhD (Science)	Dr Fidelma Butler
Casey	Eadaoin	PhD (Science)	Professor Justin Holmes, Dr Gillian Collins
Coleman	Emma Marie	PhD (Science)	Professor Colm O'Dwyer
Curran	Anya Winona	PhD (Science)	Professor Colm O'Dwyer
Darby	Jamie	PhD (Science)	Dr Mark Jessopp, Professor John Quinn
Enright	Sarah Ryan	PhD (Law)	Professor Owen McIntyre, Dr Anne Marie O'Hagan
Felberbauer	Clara	MSc	Dr Stig Hellebust, Dr Dean Venables
Gray	Nathan	PhD (Engineering)	Dr David Wall, Dr Richard O'Shea, Professor Jerry Murphy
Horan	Sadhbh Anne	MSc	Dr Simon Harrison, Dr Eoin Lettice
Ikani	Lucky Sunday	Master of Research (Arts)	Dr Paul Holloway
Joshi	Siddharth	PhD (Engineering)	Professor Brian Ó Gallachóir, Dr Paul Holloway
Kett	Gary	PhD (Science)	Professor Sarah Culloty, Dr Sharon Lynch, Professor Marcel Jansen
Lehane	Jack Ryan	PhD (Engineering)	Dr Kieran Hickey, Dr Sarah Mulrooney, Dr Denis Linehan
Lynne	Linda Esther	MSc	Dr Fidelma Butler, Professor Ruth Ramsay O'Riordan
Macedo Cruz De Oliveria	Larissa	PhD (Science)	Dr Aaron Lim, Professor Andy Wheeler
Marron	Caoimhe Roisin	Master of Research (Science)	Dr Eoin Lettice, Dr Barbara Doyle Prestwich
McGeown	Eimear Anne	PhD (Commerce)	Dr Bernadette Power
Nagle	Angie	PhD (Engineering)	Dr Paul Leahy, Dr Ger Mullally, Dr Niall Dunphy
Ning	Xue	PhD (Engineering)	Dr Richen Lin, Dr David Wall, Dr Richard O'Shea, Professor Jerry Murphy
Nowbakht	Parvaneh	PhD (Science)	Dr Paul Holloway
O'Brien	Jessica Margaret	PhD (Arts)	Dr Annalisa Setti
O'Ceilleachair	Donal	PhD (Engineering)	Dr David Wall, Dr Richard O'Shea, Professor Jerry Murphy
O'Donovan	Declan	PHD (Science)	Professor Ruth Ramsay O'Riordan
O'Driscoll	Conor	PhD (Commerce)	Dr Frank Crowley
O'Hanlon	Sally Anne	PhD (Science)	Professor Colm O'Dwyer
Peischl	Jeffrey	PhD (Science)	Professor Andy Ruth
Rusmanis	Davis	PhD (Engineering)	Dr David Wall, Dr Richard O'Shea, Professor Jerry Murphy
Sarwar	Md Apu	PhD (Science)	Professor Eric Moore
Stasluleviciute	Edita	MSc	Professor Emer Rogan, Dr Mark Jessopp
Swan	Sophia Joan	Master of Research (Science)	Dr Simon Harrison, Dr Timothy Sullivan
Wynne	Robert	PhD (Science)	Professor Phillip McGinnity

9 | ERI 2023 Peer-Reviewed Publications

1. Adamczak S.K., McHuron E.A., Christiansen F., Dunkin R., McMahon C.R., Noren S., Pirotta E., Rosen D., Sumich J. and Costa D.P. (2023) *Growth in marine mammals: a review of growth patterns, composition and energy investment*, *Conservation Physiology*, 11 (1) coad035.

2. Addey C. (2023) *Divination and Dialogue in Porphyry and Iamblichus*. In: E.G. Simonetti and C. Hall (Editors) *Divination and Revelation in Later Antiquity*. Cambridge University Press, Cambridge, pp. 73-96.

3. Addey C. and Bregman J. (2023) *Julian and Sallust on the Ascent of the Soul and Theurgy*. In: S. Ahbel-Rappe, D.A. Layne and C. Addey (Editors) *Soul Matters. Plato and Platonists on the Nature of the Soul*, SBL Press Atlanta, GA, pp. 321-344.

4. Ahbel-Rappe S., Layne D.A. and Addey C. (Editors) (2023) *Soul Matters. Plato and Platonists on the Nature of the Soul*, Writings from the Greco-Roman World Supplement Series, Volume 22, SBL Press Atlanta, GA, 560 pp.

5. Ahern M., O'Sullivan D.T.J. and Bruton K. (2023) *A dataset for fault detection and diagnosis of an air handling unit from a real industrial facility*, Data in Brief, 48109208.

6. Ahern M., O'Sullivan D.T.J. and Bruton K. (2023) *Implementation of the IDAIC framework on an air handling unit to transition to proactive maintenance*, Energy and Buildings, 284112872.

7. Al Mahdi H., Leahy P.G. and Morrison A.P. (2023) *Experimentally derived models to detect onset of shunt resistance degradation in photovoltaic modules*, Energy Reports, 10604-612.

8. Al Mamari H.H., Borel J., Hickey A., Courtney E., Merz J., Zhang X., Friedrich A., Marder T.B. and McGlacken G.P. (2023) *Regioselective Iridium-Catalyzed C8-H Borylation of 4-Quinolones via Transient O-Borylated Quinolines*, Chemistry - A European Journal, 29 (48) e202301734.

9. Alatawi H., Hogan A., Albalawi I., Alsefri S. and Moore E. (2023) *Efficient determination of non-steroidal anti-inflammatory drugs by micellar electrokinetic chromatography in wastewater*, Analytical Methods, 15 (11) 1402-1409.

10. Albalawi I., Hogan A., Alatawi H., Alsefri S. and Moore E. (2023) *A novel comparative study for simultaneous determination of Cd (II) and Pb (II) based on ruthenium complex-nanoparticles-nafion modified screen-printed gold electrode*, Sensors and Actuators B: Chemical, 380133273.

11. Alcock E., Mackey P., Turlik A., Bhatt K., Light M.E., Houk K.N. and McGlacken G.P. (2023) *The Aldol-Tishchenko Reaction of Butanone, Cyclobutanone and a 3-Pentanone Derived Sulfinylimine and DFT Calculations of the Stereo-determining Step*, Chemistry - A European Journal, 29 (22) e202203029.

12. Aldhmour F.M. and Doyle E. (2023) *Knowledge Sharing of Postgraduates Online: The Intention-Behavior Gap*, Information Sciences Letters, 12 (2) 717-733.

13. Alkhatib H., Lemarchand P., Norton B. and O'Sullivan D.T.J. (2023) *Comparative simulations of an electrochromic glazing and a roller blind as controlled by seven different algorithms*, Results in Engineering, 20101467.

14. Alkhatib H., Lemarchand P., Norton B. and O'Sullivan D.T.J. (2023) *Comparison of control parameters for roller blinds*, Solar Energy, 256110-126.

15. Alkhatib H., Lemarchand P., Norton B. and O'Sullivan D.T.J. (2023) *Optimal temperature-actuated control of a thermally-insulated roller blind*, Building and Environment, 244110751.

16. Alkhayoun H., Marley J., Wiecezorek S. and Tyson R.C. (2023) *Stochastic resonance in climate reddening increases the risk of cyclic ecosystem extinction via phase-tipping*, Global Change Biology, 29 (12) 3347-3363.

17. Alsaeedi M., Alghamdi H., Hayes P., Hogan A.M., Gilchrist E.S., Dowling K.G., English J.A. and Glennon J.D. (2023) *Evaluation of hydrophilic interaction chromatography versus reversed-phase chromatography for fast aqueous species distribution analysis of Nickel(II)-Histidine complex species*, Journal of Chromatography A, 1693463857.

18. Alsefri S., Balbaied T., Alatawi H., Albalawi I., Hogan A. and Moore E. (2023) *Development of the QuEChERS Extraction Method for the Determination of Polychlorinated Biphenyls (Aroclor 1254) in Soil Samples by Using GC-MS*, Separations, 10 (4) 250.

19. Amadi M., Killeen G.F. and Haario H. (2023) *Models of acquired immunity to malaria: a review*. In: P. Ghaffari (Editor) *Bio-Mathematics, Statistics and Nano-Technologies: Mosquito Control Strategies*, Chapman and Hall/CRC, New York.

20. Amiri M., Afruz A., Nozari-Asbemarz M., Bezaatpour A., Vocke H., Taffa D.H. and Wark M. (2023) *Overall Water Splitting by Bio-Modification of Fe3O4 with Co-Ni Complexes*, Journal of the Electrochemical Society, 170 (8) 084511.

21. Andrade L., Chique C., Hynds P., Weatherill J. and O'Dwyer J. (2023) *The antimicrobial resistance profiles of Escherichia coli and Pseudomonas aeruginosa isolated from private groundwater wells in the Republic of Ireland*, Environmental Pollution, 317120817.

22. Andrade L., P Ryan M., P Burke L., Hynds P., Weatherill J. and O'Dwyer J. (2023) *Assessing antimicrobial and metal resistance genes in Escherichia coli from domestic groundwater supplies in rural Ireland*, Environmental Pollution, 333121970.

23. Arosio R., Hobley B., Wheeler A.J., Sacchetti F., Conti L.A., Furey T. and Lim A. (2023) *Fully convolutional neural networks applied to large-scale marine morphology mapping*, Frontiers in Marine Science, 101228867.

24. Arosio R., Wheeler A.J., Sacchetti F., Guinan J., Benetti S., O'Keeffe E., van Landeghem K.J.J., Conti L.A., Furey T. and Lim A. (2023) *The geomorphology of Ireland's continental shelf*, Journal of Maps, 19 (1) 2283192.

25. Azizi Z., Hirst R.J., Newell F.N., Kenny R.A. and Setti A. (2023) *Audio-visual integration is more precise in older adults with a high level of long-term physical activity*, PLoS ONE, 18 (10 October) e0292373.

26. Badmi R. and Prestwich B.D. (2023) *Linker H1 is an 'epi'centre of plant defence*, Trends in Genetics, 39 (9) 644-645.

27. Ball S., Caravaggi A. and Butler F. (2023) *Hareport hazard: Identifying hare activity patterns and increased mammal-aircraft strike risk at an International Airport*, Remote Sensing in Ecology and Conservation, 9 (1) 33-45.

28. Ball S., Caravaggi A., Nicholson J. and Butler F. (2023) *Mammal management: Strike mitigation measures and practices at European airports*, Journal of Air Transport Management, 110102408.

29. Bank L.C., Gentry T.R., Al-Haddad T., Alshannaq A., Zhang Z., Bermek M., Henao Y., McDonald A., Li S., Poff A., Respert J., Woodham C., Nagle A., Leahy P., Ruane K., Huynh A., Soutsos M., McKinley J., Delaney E. and Graham C. (2023) *Case studies of repurposing FRP wind blades for second-life new infrastructure*, Current Perspectives and New Directions in Mechanics, Modelling and Design of Structural Systems - Proceedings of the 8th International Conference on Structural Engineering, Mechanics and Computation, 2022, 1441-1446.

30. Bao X., Liu M., Fu D., Shi C., Cui H., Sun Z., Liu Z. and Iglesias G. (2023) *Damage identification for jacket offshore platforms using Transformer neural networks and random decrement technique*, Ocean Engineering, 288115973.

31. Barimo J.F. and Mullally G. (2023) *Walking at the Margins of the Anthropocene: A Novel Curriculum to Enhance Sustainability Learning and Teaching*, Proceedings of the International Conference on Sustainable Development Conference, 12 pp.

32. Barnes P.W., Robson T.M., Zepp R.G., Bornman J.F., Jansen M.A.K., Ossola R., Wang Q.-W., Robinson S.A., Foeroid B., Klekociuk A.R., Martinez-Abaigar J., Hou W.-C., Mackenzie R. and Paul N.D. (2023) *Interactive effects of changes in UV radiation and climate on terrestrial ecosystems, biogeochemical cycles, and feedbacks to the climate system*, Photochemical and Photobiological Sciences.

33. Benitez L.E., Brinkerink M., Shivakumar A. and Deane P. (2023) *Modelling the impacts of carbon pricing in India's power system using a dynamic optimization approach*, Electricity Journal, 36 (6) 107291.

34. Bennison A., Clark B.L., Votier S.C., Quinn J.L., Darby J. and Jessopp M. (2023) *Handedness and individual roll-angle specialism when plunge diving in the northern gannet*, Biology Letters, 19 (9) 20230287.

35. Berokoff J., de la Hera I. and Reichert M.S. (2023) *Image Processing of Thigh Color Pattern Is an Effective Method for Identifying Individual Cope's Gray Treefrogs*, Hyla chrysoscelis, Ichthyology and Herpetology, 111 (4) 612-620.

36. Bingel-Jones H. (2023) *Ein Interview Mit Dem Lyriker Und Theologen Christian Lehnert: Gespräch Über Dichtung, Religion, Naturmystik Und Seinen Lyrikband Opus 8. Im Flechtwerk* (2022). Mit Zwei Unveröffentlichten Gedichten Von Christian Lehnert, German Life and Letters, 76 (3) 447-464.
37. Bingel-Jones H. (2023) *Wunde(r) Natur. Religiöse, ökologische und poetologische Naturwahrnehmung in der Lyrik Christian Lehnerts am Beispiel einer Gedichtanalyse (Die Perlmuttfalter aus dem Moor vermehren)*, Monatshefte, 115.4.
38. Binner H., Sullivan T., Jansen M.A.K. and McNamara M.E. (2023) *Metals in urban soils of Europe: A systematic review*, Science of the Total Environment, 854158734.
39. Biolcati V., Wilson M., Fiddymont S., Unitt R., Ryan C.C., Hoffmann A.G., Gillis J., France F., Ó Macháin P. and Iacopino D. (2023) *The Book of Uí Mhaine: An Interdisciplinary Analysis of the Materiality of the Gaelic Manuscript Tradition*, Heritage, 6 (7) 5393-5409.
40. Boaden, M., Hulshof, R. and Sleeman, D.P. (2023) *Caravanning Greater White-toothed Shrews (Crocidura russula) in Co. Wexford*, Irish Naturalists' Journal 40, 154-156.
41. Bondjers G., Igumbor J., Peixoto A., Killeen G.F., Nyondo-Mipando L., Opiyo R., Muula A. and Lampiao F. (2023) *Supervision: A curriculum to equip both new and experienced PhD supervisors*, Press Books.
42. Booth C.G., Guilpin M., Darias-O'hara A.-K., Ransijn J.M., Ryder M., Rosen D., Pirota E., Smout S., McHuron E.A., Nabe-Nielsen J. and Costa D.P. (2023) *Estimating energetic intake for marine mammal bioenergetic models*, Conservation Physiology, 11 (1) coac083.
43. Boudou M., Khandelwal S., ÓhAiseadha C., Garvey P., O'Dwyer J. and Hynds P. (2023) *Spatio-temporal evolution of COVID-19 in the Republic of Ireland and the Greater Dublin Area (March to November 2020): A space-time cluster frequency approach*, Spatial and Spatio-temporal Epidemiology, 45100565.
44. Boyle E. (2023) *Rethinking energy studies: Equity, energy and Ivan Illich (1926–2002)*, Energy Research and Social Science, 95102903.
45. Boyle E. (2023) *The Oceanic Feeling: Experiencing the Eternal through Swimming*, Theory, Culture and Society.
46. Boyle, E., McGookin, C., O'Mahony, C., Bolger, P., Byrne, E., Ó Gallachóir, B. and Mullally, G. (2023) *Understanding how institutions may support the development of transdisciplinary approaches to sustainability research*, Research for All, 7, 1, 1-19.
47. Bozzolo Lueckel F.B., Moran C., Bopaiah A., Deane P., Lynch M. and Monaghan R.F.D. (2023) *FLEXIBLE GRID HYDROGEN PRODUCTION: BEYOND THE COLOURS TAXONOMY*, IET Conference Proceedings, 2023 (7) 65-73.
48. Bradfield T., Butler R., Dillon E.J., Hennessy T. and Loughrey J. (2023) *Attachment to land and its downfalls: Can policy encourage land mobility?*, Journal of Rural Studies, 97192-201.
49. Bradfield T., Butler R., Dillon E.J., Hennessy T. and Loughrey J. (2023) *The impact of long-term land leases on farm investment: Evidence from the Irish dairy sector*, Land Use Policy, 126106553.
50. Brearley F.Q., Mansur M. and Eichhorn M.P. (2023) *Spatial patterning of Gonystylus brunnescens in eastern Borneo*, Folia Oecologica, 50 (1) 55-59.
51. Brennan M., Hennessy T., Dillon E. and Meredith D. (2023) *Putting social into agricultural sustainability: Integrating assessments of quality of life and wellbeing into farm sustainability indicators*, Sociologia Ruralis, 63 (3) 629-660.
52. Britton J.R., Lynch A.J., Bardal H., Bradbeer S.J., Coetzee J.A., Coughlan N.E., Dalu T., Tricarico E., Gallardo B., Lintermans M., Lucy F., Liu C., Olden J.D., Raghavan R. and Pritchard E.G. (2023) *Preventing and controlling nonnative species invasions to bend the curve of global freshwater biodiversity loss*, Environmental Reviews, 31 (2) 310-326.
53. Brown M.B., Fennessy J.T., Crego R.D., Fleming C.H., Alves J., Brandlová K., Fennessy S., Ferguson S., Hauptfleisch M., Hejzmanova P., Hoffman R., Leimgruber P., Masiaine S., McQuarrel K., Mueller T., Muller B., Muneza A., O'Connor D., Olivier A.J., ... Stabach J. (2023) *Ranging behaviours across ecological and anthropogenic disturbance gradients: A pan-African perspective of giraffe (Giraffa spp.) space use*, Proceedings of the Royal Society B: Biological Sciences, 290 (2001) 20230912.
54. Bulfin B., Carmo M., Van de Krol R., Mougín J., Ayers K., Gross K.J., Marina O.A., Roberts G.M., Stechel E.B. and Xiang C. (2023) *Editorial: Advanced water splitting technologies development: Best practices and protocols*, Frontiers in Energy Research, 11149688.
55. Bulfin B., Zuber M., Gräub O. and Steinfeld A. (2023) *Intensification of the reverse water–gas shift process using a countercurrent chemical looping regenerative reactor*, Chemical Engineering Journal, 461141896.
56. Burke L.P., Chique C., Fitzhenry K., Chueiri A., O'Connor L., Hooban B., Cahill N., Brosnan E., Olaore L., Sullivan E., Reilly L., Morris D., Hynds P. and O'Dwyer J. (2023) *Characterization of Shiga toxin-producing Escherichia coli presence, serogroups and risk factors from private groundwater sources in western Ireland*, Science of the Total Environment, 866161302.
57. Butler I.P., Banta R.A., Tyuftin A.A., Holmes J., Pathania S. and Kerry J. (2023) *Pectin as a biopolymer source for packaging films using a circular economy approach: Origins, extraction, structure and films properties*, Food Packaging and Shelf Life, 40101224.
58. Butler S., Coakley M. and Doyle E. (2023) *Constructive developmental interiority: Deliberately transformative action research*, Action Research.
59. Butschek F., Peters J.L., Remmers T., Murphy J. and Wheeler A.J. (2023) *Geospatial dimensions of the renewable energy transition — The importance of prioritisation*, Environmental Innovation and Societal Transitions, 47100713.
60. Buzid A., Boertjes J., Gilchrist E.S., Glennon J.D. and Luong J.H.T. (2023) *Analysis and electroanalysis of perchlorate in water and food samples: a critical review*, Analytical Methods, 15 (28) 3382-3392.
61. Buzigi E. and Onakuse S. (2023) *Food price volatility and socio-economic inequalities in poor food consumption status during coronavirus disease-2019 lockdown among slum and non-slum households in urban Nansana municipality, Uganda*, Nutrition Journal, 22 (1) 4.
62. Byrne E.P. (2023) *The evolving engineer; professional accreditation sustainability criteria and societal imperatives and norms*, Education for Chemical Engineers, 4323-30.
63. Byrne K., Collins C., Bolger M.K. and Butler F. (2023) *Science Education in Primary Students in Ireland: Examining the Use of Zoological Specimens for Learning*, Journal of Zoological and Botanical Gardens, 4 (3) 507-526.
64. Byrne R., Ryan K., Venables D.S., Wenger J.C. and Hellebust S. (2023) *Highly local sources and large spatial variations in PM2.5 across a city: evidence from a city-wide sensor network in Cork, Ireland*, Environmental Science: Atmospheres.
65. Cadogan E., Lionetti F., Murphy M. and Setti A. (2023) *Watching a video of nature reduces negative affect and rumination, while positive affect is determined by the level of sensory processing sensitivity*, Journal of Environmental Psychology, 90102031.
66. Canwat V. and Onakuse S. (2023) *Organic agriculture and agri-food system democracy: an institutional perspective from Kenya*, Humanities and Social Sciences Communications, 10 (1) 873.
67. Canwat V. and Onakuse S. (2023) *Table banking plus certified organic agriculture: an integrated microfinance approach to sustainable livelihoods*, Journal of Development Effectiveness, 15 (2) 165-182.
68. Capstick S., Bulfin B., Naik J.M., Gigantino M. and Steinfeld A. (2023) *Oxygen separation via chemical looping of the perovskite oxide Sr0.8Ca0.2FeO3 in packed bed reactors for the production of nitrogen from air*, Chemical Engineering Journal, 452139289.
69. Carr C.M., Keller M.B., Paul B., Schubert S.W., Clausen K.S.R., Jensen K., Clarke D.J., Westh P. and Dobson A.D.W. (2023) *Purification and biochemical characterization of SM14est, a PET-hydrolyzing enzyme from the marine sponge-derived Streptomyces sp. SM14*, Frontiers in Microbiology, 141170880.
70. Carravieri A., Lorient S., Angelier F., Chastel O., Albert C., Bräthen V.S., Brisson-Curadeau É., Clairbaux M., Delord K., Giraudeau M., Perret S., Poupert T., Ribout C., Viricel-Pante A., Grémillet D., Bustamante P. and Fort J. (2023) *Carryover effects of winter mercury contamination on summer concentrations and reproductive performance in little auks*, Environmental Pollution, 318120774.
71. Carroll A., Grant A., Zhang Y., Gulzar U., Douglas-Henry D., Nicolosi V. and O'Dwyer C. (2023) *The Effect of TiO2 and GeO2 Composite Mixing on the Behavior of Macroporous Li-Ion Battery Anode Materials*, Journal of the Electrochemical Society, 170 (12) 120521.
72. Casaban D. and Tsalaporta E. (2023) *Life cycle assessment of a direct air capture and storage plant in Ireland*, Scientific Reports, 13 (1) 18309.
73. Casaban D. and Tsalaporta E. (2023) *The impact of direct air capture during the last two decades: A bibliometric analysis of the scientific research Part II*, Sustainable Chemistry for Climate Action, 2100021.

74. Casey E., Breen R., Gómez J.S., Kentgens A.P.M., Pareras G., Rimola A., Holmes J.D. and Collins G. (2023) *Ligand-Aided Glycolysis of PET Using Functionalized Silica-Supported Fe2O3 Nanoparticles*, ACS Sustainable Chemistry and Engineering, 11 (43) 15544-15555.
75. Castanho A., Brites C., Rocha C., Moura A.P., Oliveira J.C. and Cunha L.M. (2023) *Adaptation of the food choice questionnaire using a design thinking approach and application to rice consumption by the major European consumers*, Food Quality and Preference, 110104951.
76. Castanho A., Guerra M., Brites C., Oliveira J.C. and Cunha L.M. (2023) *Design thinking for food: Remote association as a creative tool in the context of the ideation of new rice-based meals*, International Journal of Gastronomy and Food Science, 31100664.
77. Castanho A., Pereira C., Lageiro M., Oliveira J.C., Cunha L.M. and Brites C. (2023) *Improving γ -Oryzanol and γ -Aminobutyric Acid Contents in Rice Beverage Amazake Produced with Brown, Milled and Germinated Rices*, Foods, 12 (7) 1476.
78. Cele L.P., Hennessy T. and Thorne F. (2023) *Regional technical efficiency rankings and their determinants in the Irish dairy industry: A stochastic meta-frontier analysis*, Agribusiness, 39 (3) 727-743.
79. Chakraborty T., Büttner S.H., Costin G. and Kankuzi C.F. (2023) *The petrogenesis of highly fractionated gem-bearing pegmatites of Malawi: evidence from mica and tourmaline chemistry and finite step trace element modelling*, Mineralium Deposita.
80. Chakraborty T., Kankuzi C.F., Glodny J., Frei D. and Büttner S.H. (2023) *The timing and tectonic context of Pan-African gem bearing pegmatites in Malawi: Evidence from Rb–Sr and U–Pb geochronology*, Journal of African Earth Sciences, 197104750.
81. Chambers E.L., Bonadio R., Fullea J., Lebedev S., Xu Y., Kiyani D., Bean C.J., Meere P.A., Mather B. and O'Reilly B.M. (2023) *Determining subsurface temperature & lithospheric structure from joint geophysical-petrological inversion: A case study from Ireland*, Tectonophysics, 869230094.
82. Chen Z., Ding X., Kiseeva E.S., Lin X., Huang J. and Huang F. (2023) *Vanadium isotope fractionation of alkali basalts during mantle melting*, Lithos, 442-443107082.
83. Clancy R., O'Sullivan D. and Bruton K. (2023) *Data-driven quality improvement approach to reducing waste in manufacturing*, TQM Journal, 35 (1) 51-72.
84. Clark B.L., Carneiro A.P.B., Pearmain E.J., Rouyer M.-M., Clay T.A., Cowger W., Phillips R.A., Manica A., Hazin C., Eriksen M., González-Solís J., Adams J., Albores-Barajas Y.V., Alfaro-Shigueto J., Alho M.S., Araujo D.T., Arcos J.M., Arnould J.P.Y., Barbosa N.J.P., ... Dias M.P. (2023) *Global assessment of marine plastic exposure risk for oceanic birds*, Nature communications, 14 (1) 3665.
85. Clayer F., Jackson-Blake L., Mercado-Bettín D., Shikhan M., French A., Moore T., Sample J., Norling M., Frias M.-D., Herrera S., De Eyto E., Jennings E., Rinke K., Van Der Linden L. and Marcé R. (2023) *Sources of skill in lake temperature, discharge and ice-off seasonal forecasting tools*, Hydrology and Earth System Sciences, 27 (6) 1361-1381.
86. Clifford J.P., Doran J., Crowley F. and Jordan D. (2023) *The relationship between city size, decentralisation and economic growth*, Journal of Economic Studies, 50 (6) 1171-1189.
87. Collins C., Barr Y., McKeown S., Scheun J., Tay C. and O'Riordan R. (2023) *An International Investigation of the Prevalence of Negative Visitor Behaviour in the Zoo*, Animals, 13 (16) 2661.
88. Collins C., McKeown S. and O'Riordan R. (2023) *A comprehensive investigation of negative visitor behaviour in the zoo setting and captive animals' behavioural response*, Heliyon, 9 (6) e16879.
89. Cooper E., Alcock E., Power M. and McGlacken G. (2023) *The α -alkylation of ketones in flow*, Reaction Chemistry and Engineering, 8 (8) 1839-1842.
90. Cordeiro P., Santos A.M.D., Steed G., Silva A.D.A., Meere P., Corcoran L., Simonetti A. and Unitt R. (2023) *The carbonate-hosted Gortdrum Cu-Ag(\pm Sb-Hg) deposit, SW Ireland: C-O-Sr-Nd isotopes and whole-rock geochemical signatures*, Journal of Geochemical Exploration, 248107196.
91. Costello K.E., Haberlin D., Lynch S.A., McAllen R., O'Riordan R.M. and Culloty S.C. (2023) *Regional differences in zooplankton-associated bacterial communities and aquaculture pathogens across two shelf seas*, Estuarine, Coastal and Shelf Science, 281108179.
92. Coughlan M., Trafford A., Corrales S., Donohue S., Wheeler A.J. and Long M. (2023) *Geological and geotechnical characterisation of soft Holocene marine sediments: A case study from the north Irish Sea*, Engineering Geology, 313106980.
93. Coughlan N.E., Maguire D., Oommen A.A., Redmond C., O'Mahoney R., Walsh E., Kühnhold H., Byrne E.P., Kavousi F., Morrison A.P. and Jansen M.A.K. (2023) *On the rise: Development of a multi-tiered, indoor duckweed cultivation system*, Water Environment Research, 95 (12) e10964.
94. Coughlan N.E., O'Shea W., Cuthbert R.N., Kelly T.C., Mitham N. and Nicholson J. (2023) *The fox in the box: acoustic deterrent and simulated predator disturbance to reduce problematic bird accumulations*, Wildlife Research, 50 (4) 237-247.
95. Courtney D.E. and O'Reilly É.J. (2023) *Does colour variety accurately quantify nutritional value in children's lunchboxes? A pilot study*, Public Health in Practice, 5100363.
96. Creane S., O'Shea M., Coughlan M. and Murphy J. (2023) *Hydrodynamic Processes Controlling Sand Bank Mobility and Long-Term Base Stability: A Case Study of Arklow Bank*, Geosciences (Switzerland), 13 (2) 60.
97. Creane S., O'Shea M., Coughlan M. and Murphy J. (2023) *Morphological Modelling to Investigate the Role of External Sediment Sources and Wind and Wave-Induced Flow on Sand Bank Sustainability: An Arklow Bank Case Study*, Journal of Marine Science and Engineering, 11 (10) 2027.
98. Crego R.D., Fennessy J., Brown M.B., Connette G., Stacy-Dawes J., Masiaine S. and Stabach J.A. (2023) *Combining species distribution models and moderate resolution satellite information to guide conservation programs for reticulated giraffe*, Animal Conservation.
99. Crego R.D., Hernández-Yáñez H., Rabeil T., Hingrat Y., Leimgruber P. and Stabach J.A. (2023) *Non-systematic surveys reveal increases in areas occupied by endangered and data-deficient Nubian bustard*, Global Ecology and Conservation, 47e02682.
100. Crestani G., Cunningham N., Badmus U.O., Prinsen E. and Jansen M.A.K. (2023) *UV-B Radiation as a Novel Tool to Modulate the Architecture of In Vitro Grown Mentha spicata (L.)*, Agronomy, 13 (1) 2.
101. Crestani G., Cunningham N., Csepregi K., Badmus U.O. and Jansen M.A.K. (2023) *From stressor to protector, UV-induced abiotic stress resistance*, Photochemical and Photobiological Sciences, 22 (9) 2189-2204.
102. Crowley F. and Doran J. (2023) *The geography of job automation in Ireland: what urban areas are most at risk?*, Annals of Regional Science, 71 (3) 727-745.
103. Cubie D. (2023) *Sources of International Disaster Law: Focus on Case Law* (2021), Yearbook of International Disaster Law Online, 4 (1) 640-647.
104. Cuenca J.J., Daly H.E. and Hayes B.P. (2023) *Sharing the grid: The key to equitable access for small-scale energy generation*, Applied Energy, 349121641.
105. Cullinane M., O'Connell R. and Murphy J. (2023) *Data-driven assessment of the Survivability and Maintainability of Offshore Renewable Energy devices in Ireland's harsh maritime climate*, OCEANS 2023 - Limerick, OCEANS Limerick 2023.
106. Cuthbertson K., Nitzsche D. and O'Sullivan N. (2023) *UK mutual funds: performance persistence and portfolio size*, Journal of Asset Management, 24 (4) 284-298.
107. Daly A. (2023) *Intergenerational rights are children's rights: Upholding the right to a healthy environment through the UNCRC*, Netherlands Quarterly of Human Rights, 41 (3) 132-154.
108. Daly A. and Kelleher O. (2023) *The case of young people v government of Ireland*, The Anthropocene Judgments Project: Futureproofing the Common Law, 101-116.
109. Darby J.H., Clairbaux M., Quinn J.L., Thompson P., Quinn L., Cabot D., Strøm H., Thórarinnsson T.L., Kempf J. and Jessopp M.J. (2023) *Decadal increase in vessel interactions by a scavenging pelagic seabird across the North Atlantic*, Current Biology, 33 (19) 4225-4231000.
110. Davenport J., Jessopp M., Harman L., Micaroni V. and McAllen R. (2023) *Feeding, agonistic and cooperative behavioural responses of shallow-water benthic marine scavengers*, Journal of Natural History, 57 (17-20) 1049-1065.
111. Davis L. (2023) *The Past and Future of Utopian Studies*, Utopian Studies, 34 (3) 478-488.
112. de Sousa I.G., Oliveira J., Mexia A., Barros G., Almeida C., Brazinha C., Vega A. and Brites C. (2023) *Advances in Environmentally Friendly Techniques and Circular Economy Approaches for Insect Infestation Management in Stored Rice Grains*, Foods, 12 (3) 511.
113. Deinert L., Ikoyi I., Egeter B., Forrestal P. and Schmalenberger A. (2023) *Short-Term Impact of Recycling-Derived Fertilizers on Their P Supply for Perennial Ryegrass (Lolium perenne)*, Plants, 12 (15) 2762.

114. Delaney E.L., Leahy P.G., McKinley J.M., Gentry T.R., Nagle A.J., Elberling J. and Bank L.C. (2023) *Sustainability Implications of Current Approaches to End-of-Life of Wind Turbine Blades—A Review*, Sustainability (Switzerland), 15 (16) 12557.
115. Deng C., Kang X., Lin R., Wu B., Ning X., Wall D. and Murphy J.D. (2023) *Boosting biogas production from recalcitrant lignin-based feedstock by adding lignin-derived carbonaceous materials within the anaerobic digestion process*, Energy, 278127819.
116. Devoy McAuliffe F., Kami Delivand M., Judge F., O'Connell R. and Murphy J. (2023) *Wild Atlantic Wind Farms, Are They Cost-Effective?*, OCEANS 2023 - Limerick, OCEANS Limerick 2023.
117. Diaz Huerta J., O'Shea R., Murphy J. and Wall D.M. (2023) *A perspective on methodologies and system boundaries to develop abatement cost for on-farm anaerobic digestion*, Bioengineered, 14 (1) 2245991.
118. Dinh Q.V., Dinh V.N. and Leahy P. (2023) *A method to map the levelised cost of hydrogen from offshore wind farms coupled to onshore electrolyzers via HVDC*, IOP Conference Series: Earth and Environmental Science, 1281 (1) 012005.
119. Dinh Q.V., Dinh V.N., Mosadeghi H., Todesco Pereira P.H. and Leahy P.G. (2023) *A geospatial method for estimating the levelised cost of hydrogen production from offshore wind*, International Journal of Hydrogen Energy, 48 (40) 15000-15013.
120. Donzella L., Sousa M.J. and Morrissey J.P. (2023) *Evolution and functional diversification of yeast sugar transporters*, Essays in Biochemistry, 67 (5) 811-827.
121. Doran J., Ryan G., McCarthy N. and O'Connor M. (2023) *Green innovation launch versus expansion: Do the public policy supports needed vary by firm size?*, International Journal of Innovation Management, 2350029.
122. Doussin J.-F., Fuchs H., Kiendler-Scharr A., Seakins P. and Wenger J. (Editors) (2023) *A Practical Guide to Atmospheric Simulation Chambers*, Springer International Publishing, Cham, 339 pp.
123. Doyle S., Cabot D., Griffin L., Kane A., Colhoun K., Redmond C., Walsh A. and McMahon B.J. (2023) *Home range of a long-distance migrant, the Greenland Barnacle Goose Branta leucopsis, throughout the annual cycle*, Bird Study, 70 (1-2) 37-46.
124. Dunphy N.P., Lennon B. and Velasco-Herrejón P. (2023) *Identifying Energy-Poor Households, Experiences from the Global North*. In: P. Velasco-Herrejón, B. Lennon and N.P. Dunphy (Editors) *Living with Energy Poverty. Perspectives from the Global North and South*, pp. 17-28.
125. Dunphy N.P., Lennon B. and Velasco-Herrejón P. (2023) *Towards a Better Understanding of Energy Poverty. In: P. Velasco-Herrejón, B. Lennon and N.P. Dunphy (Editors) Living with Energy Poverty. Perspectives from the Global North and South*, pp. 275-281.
126. Eakins J., Sirr G. and Power B. (2023) *Informally sourced solid fuel use: Examining its extent and characteristics of the users in the residential sector in Ireland*, Energy Policy, 172113293.
127. Edney A.J., Hart T., Jessopp M.J., Banks A., Clarke L.E., Cugnière L., Elliot K.H., Martinez I.J., Kilcoyne A., Murphy M., Nager R.G., Ratcliffe N., Thompson D.L., Ward R.M. and Wood M.J. (2023) *BEST PRACTICES FOR USING DRONES IN SEABIRD MONITORING AND RESEARCH*, Marine Ornithology, 51 (2) 265-280.
128. Egorov V., Gulzar U. and O'Dwyer C. (2023) *3D Printed Rechargeable Aqueous and Non-Aqueous Lithium-Ion Batteries: Evolution of Design and Performance*, ECS Advances 2 (4) 040508.
129. Elliott P.S., Harrington J.M., Millar S.R., Otvos J.D., Perry I.J. and Phillips C.M. (2023) *Plant-based diet indices and lipoprotein particle subclass profiles: A cross-sectional analysis of middle- to older-aged adults*, Atherosclerosis, 380117190.
130. Fauquembergue K., Ducassou E., Mulder T., Reijmer J.J.G., Borgomano J., Recouvreux A., Hanquiez V., Betzler C., Principaud M., Chabaud L., Fabregas N., Giraudeau J., Bout-Roumazielles V., Moal-Darrigade P., Perello M.-C. and Poli E. (2023) *Quaternary sedimentary processes on the Bahamas: From platform to abyss*, Marine Geology, 459107044.
131. Farrell, E., Smith, G., O'Hagan, A.M. and Le Tissier, M. 2023. *Building Coastal and Marine Resilience in Ireland. Research Report No. 429*. Environmental Protection Agency, Wexford.
132. Fennelly M., Hellebust S., Wenger J., O'Connor D., Griffith G.W., Plant B.J. and Prentice M.B. (2023) *Portable HEPA filtration successfully augments natural-ventilation-mediated airborne particle clearance in a legacy design hospital ward*, Journal of Hospital Infection, 13154-57.
133. Fernandez Ajó A., Pirota E., Bierlich K.C., Hildebrand L., Bird C.N., Hunt K.E., Buck C.L., New L., Dillon D. and Torres L.G. (2023) *Assessment of a non-invasive approach to pregnancy diagnosis in grey whales through drone-based photogrammetry and faecal hormone analysis*, Royal Society Open Science, 10 (7) 230452.
134. Fernández-Pascual E., Droz B., O'Dwyer J., O'Driscoll C., Goslan E.H., Harrison S. and Weatherill J. (2023) *Fluorescent Dissolved Organic Matter Components as Surrogates for Disinfection Byproduct Formation in Drinking Water: A Critical Review*, ACS ES and T Water, 3 (8) 1997-2008.
135. Flavin S., Meltonville M., Taverner C., Reid J., Lawrence S., Belloch-Molina C. and Morrissey J. (2023) *Understanding Early Modern Beer: An Interdisciplinary Case-Study*, Historical Journal, 66 (3) 516-549.
136. Flood S., Rogan F., Revez A., McGookin C., O'Dwyer B., Harris C., Dunphy N., Byrne E., Ó Gallachóir B., Bolger P., Boyle E., Glynn J., Barry J., Ellis G. and Mullally G. (2023) *Imagining climate resilient futures: A layered Delphi panel approach*, Futures, 147103100.
137. Flynn A., Tschouridis V.A. and Amann A. (2023) *Seeing double with a multifunctional reservoir computer*, Chaos, 33 (11) 113115.
138. Fournier A., Martinez A. and Iglesias G. (2023) *Impacts of climate change on wind energy potential in Australasia and South-East Asia following the Shared Socioeconomic Pathways*, Science of the Total Environment, 882163347.
139. Fouz D.M., Carballo R., López I., González X.P. and Iglesias G. (2023) *A methodology for cost-effective analysis of hydrokinetic energy projects*, Energy, 282128373.
140. Garvey S., Maccioni B., Serino A.C., Holmes J.D., Nolan M., Draeger N. and Long B. (2023) *Effect of alkanethiol chain length on the oxidation resistance of self-assembled monolayer passivated Ge(100) surfaces*, Thin Solid Films, 778139875.
141. Gibson K., Oliveira J.C. and Ring D. (2023) *Evaluation of the Impact of Buffer Management Strategies on Biopharmaceutical Manufacturing Process Mass Intensity*, Processes, 11 (8) 2242.
142. Gill L.W., Mac Mahon J., Knappe J. and Morrissey P. (2023) *Hydraulic conductivity assessment of falling head percolation tests used for the design of on-site wastewater treatment systems*, Water Research, 236119968.
143. Giménez J., Waggitt J.J. and Jessopp M. (2023) *Identification of priority cetacean areas in the north-east Atlantic using systematic conservation planning*, Aquatic Conservation: Marine and Freshwater Ecosystems, 33 (12) 1571-1579.
144. Giralt Paradell O., Goh T., Popov D., Rogan E. and Jessopp M. (2023) *Estimated mortality of the highly pathogenic avian influenza pandemic on northern gannets (Morus bassanus) in southwest Ireland*, Biology Letters, 19 (6) 20230090.
145. Girkin N.T., Burgess P.J., Cole L., Cooper H.V., Honorio Coronado E., Davidson S.J., Hannam J., Harris J., Holman I., McCloskey C.S., McKeown M.M., Milner A.M., Page S., Smith J. and Young D. (2023) *The three-peat challenge: business as usual, responsible agriculture, and conservation and restoration as management trajectories in global peatlands*, Carbon Management, 14 (1) 2275578.
146. Glarou M., Gero S., Frantzis A., Brotons J.M., Vivier F., Alexiadou P., Cerdà M., Pirota E. and Christiansen F. (2023) *Estimating body mass of sperm whales from aerial photographs*, Marine Mammal Science, 39 (1) 251-273.
147. Gorman G., Hellebust S., Venables D., Ryan K. and Cassarino M. (2023) *Introducing forecast-based public health warnings to promote engagement with air quality risk: a survey of citizens' attitudes in Cork, Ireland*, Journal of Risk Research, 26 (6) 594-609.
148. Gose M.-A., Humble E., Brownlow A., Mikkelsen B., Loftus C., Wall D., Rogan E., ten Doeschate M., Davison N. and Ogden R. (2023) *Stranding collections indicate broad-scale connectivity across the range of a pelagic marine predator, the Atlantic white-sided dolphin (Lagenorhynchus acutus)*, ICES Journal of Marine Science, 80 (4) 1120-1128.
149. Govella N.J., Johnson P.C.D., Killeen G.F. and Ferguson H.M. (2023) *Heritability of biting time behaviours in the major African malaria vector Anopheles arabiensis*, Malaria Journal, 22 (1) 238.
150. Grant A. and O'Dwyer C. (2023) *Asymmetrical Optical Response of Opal Photonic Crystals with Graded Thickness*, ECS Advances 2 (4) 043501.
151. Grant A. and O'Dwyer C. (2023) *Real-time nondestructive methods for examining battery electrode materials*, Applied Physics Reviews, 10 (1) 011312.

152. Grant A., Carroll A., Zhang Y., Gulzar U., Ahad S.A., Geaney H. and O'Dwyer C. (2023) *Comparing Cycling and Rate Response of SnO2 Macroporous Anodes in Lithium-Ion and Sodium-Ion Batteries*, Journal of the Electrochemical Society, 170 (12) 120505.

153. Grant A., Lonergan A. and O'Dwyer C. (2023) *Thickness control of dispersion in opal photonic crystals*, Optical Materials, 142114053.

154. Gresham A., Healey J.R., Eichhorn M.P., Barton O., Smith A.R. and Shannon G. (2023) *Horizontal viewsheds of large herbivores as a function of woodland structure*, Ecology and Evolution, 13 (11) e10699.

155. Griffin L.L., Nolan G., Haigh A., Condon H., O'Hagan E., McDonnell P., Kane A. and Ciuti S. (2023) *How can we tackle interruptions to human–wildlife feeding management? Adding media campaigns to the wildlife manager's toolbox*, People and Nature, 5 (4) 1299-1315.

156. Grunst A.S., Grunst M.L., Grémillet D., Kato A., Bustamante P., Albert C., Brisson-Curadeau E., Clairbaux M., Cruz-Flores M., Gentès S., Perret S., Ste-Marie E., Wojczulanis-Jakubas K. and Fort J. (2023) *Mercury Contamination Challenges the Behavioral Response of a Keystone Species to Arctic Climate Change*, Environmental Science and Technology, 57 (5) 2054-2063.

157. Grunst M.L., Grunst A.S., Grémillet D., Kato A., Bustamante P., Albert C., Brisson-Curadeau E., Clairbaux M., Cruz-Flores M., Gentès S., Grissot A., Perret S., Ste-Marie E., Jakubas D., Wojczulanis-Jakubas K. and Fort J. (2023) *A keystone avian predator faces elevated energy expenditure in a warming Arctic*, Ecology, 104 (5) e4034.

158. Gulzar U., Egorov V., Zhang Y. and O'Dwyer C. (2023) *Recyclable 3D-Printed Aqueous Lithium-Ion Battery*, Advanced Energy and Sustainability Research, 4 (10) 2300029.

159. Gulzar U., Lonergan A., Egorov V., Zhang Y., Grant A., Carroll A. and O'Dwyer C. (2023) *Methods—Ampero-Coulometry: A New Technique for Understanding Lithium-Sulfur Electrochemistry*, Journal of the Electrochemical Society, 170 (3) 030503.

160. Hackula A., O'Shea R., Murphy J.D. and Wall D.M. (2023) *Design, Construction, and Concept Validation of a Laboratory-Scale Two-phase Reactor to Valorize Whiskey Distillery By-products*, ACS Engineering Au, 3 (4) 224–234.

161. Hackula A., Shinde R., Hickey D., O'Shea R., Murphy J.D. and Wall D.M. (2023) *Two-phase anaerobic digestion for enhanced valorisation of whiskey distillery by-products*, Bioresource Technology, 383129239.

162. Häkkinen H., Taylor N.G., Pettorelli N., Sutherland W.J., Aldará J., Anker-Nilssen T., Aulert C., van Bemmelen R.S.A., Burnell D., Cadiou B., Campioni L., Clark B.L., Dehnhard N., Dias M.P., Enners L., Furness R.W., Hallgrímsson G.P., Hammer S., Hansen E.S., ... Petrovan S. (2023) *Co-developing guidance for conservation: An example for seabirds in the North-East Atlantic in the face of climate change impacts*, Conservation Science and Practice, 5 (8) e12985.

163. Hamed I., Moradi M., Ezati P., O'Higgins L., Meléndez-Martínez A.J., Frleta Matas R., Šimat V., McClements D.J., Jakobsen A.N. and Lerfall J. (2023) *Encapsulation of microalgal-based carotenoids: Recent advances in stability and food applications*, Trends in Food Science and Technology, 138382-398.

164. Hasan C.R., Cárthaigh R.M. and Wieczorek S. (2023) *Rate-Induced Tipping in Heterogeneous Reaction-Diffusion Systems: An Invariant Manifold Framework and Geographically Shifting Ecosystems*, SIAM Journal on Applied Dynamical Systems, 22 (4) 2991-3024.

165. Hennessy J., Fonteneau J., Scanail C.N.í., McKeown S., O'Donovan D. and Killeen G.F. (2023) *Territorial vocalization patterns of captive Asiatic lions (Panthera leo persica) in the middle of winter at high latitude*, Zoo Biology, 42 (5) 605-615.

166. Hernández-Téllez I., Aguirre J.I., de la Hera I., Onrubia A. and Tellería J.L. (2023) *Highland and lowland forest birds differ in their feather growth rates: A multispecies test in the southwestern Palaearctic*, Ibis.

167. Hickey M. and Morrison A.P. (2023) *Optimising standard solar cell designs for maximum efficiency using genetic algorithms*, International Journal of Modelling and Simulation.

168. Hin R.C., Hibbert K.E.J., Chen S., Willbold M., Andersen M.B., Kiseeva E.S., Wood B.J., Niu Y., Sims K.W.W. and Elliott T. (2023) *Corrigendum to "The influence of crustal recycling on the molybdenum isotope composition of the Earth's mantle"* [Earth Planet. Sci. Lett. 595 (2022) 117760][S0012821X2200396X] (10.1016/j.epsl.2022.117760), Earth and Planetary Science Letters, 604118010.

169. Hin V., de Roos A.M., Benoit-Bird K.J., Claridge D.E., DiMarzio N., Durban J.W., Falcone E.A., Jacobson E.K., Jones-Todd C.M., Pirotta E., Schorr G.S., Thomas L., Watwood S. and Harwood J. (2023) *Using individual-based bioenergetic models to predict the aggregate effects of disturbance on populations: A case study with beaked whales and Navy sonar*, PLoS ONE, 18 (8 August) e0290819.

170. Hobley B., Mackiewicz M., Bremner J., Dolphin T. and Arosio R. (2023) *Crowdsourcing Experiment and Fully Convolutional Neural Networks for Coastal Remote Sensing of Seagrass and Macroalgae*, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 168734-8746.

171. Hollands A.F. and Daly H. (2023) *Modelling the integrated achievement of clean cooking access and climate mitigation goals: An energy systems optimization approach*, Renewable and Sustainable Energy Reviews, 173113054.

172. Hoteit M., Hoteit R., Aljawaldeh A., Van Royen K., Pabian S., Decorte P., Cuykx I., Teunissen L., De Backer C., Bergheim I., Staltner R., Devine A., Sambell R., Wallace R., Allehdan S.S., Alalwan T.A., Al-Mannai M.A., Ouvrein G., Poels K., ... Van den Bulck H. (2023) *Call for emergency action to restore dietary diversity and protect global food systems in times of COVID-19 and beyond: Results from a cross-sectional study in 38 countries*, Heliyon, 9 (11) e21585.

173. Howard S.A., Carr C.M., Sbahtu H.I., Onwukwe U., López M.J., Dobson A.D.W. and McCarthy R.R. (2023) *Enrichment of native plastic-associated biofilm communities to enhance polyester degrading activity*, Environmental Microbiology, 25 (12) 2698-2718.

174. Hutzler M., Morrissey J.P., Laus A., Meussdoerffer F. and Zarnkow M. (2023) *A new hypothesis for the origin of the lager yeast Saccharomyces pastorianus*, FEMS Yeast Research, 23foad023.

175. Ikoyi I., Grange G., Finn J.A. and Brennan F.P. (2023) *Plant diversity enhanced nematode-based soil quality indices and changed soil nematode community structure in intensively-managed agricultural grasslands*, European Journal of Soil Biology, 118103542.

176. Imron M.A., Glass D.M., Tafirican M., Crego R.D., Stabach J.A. and Leimgruber P. (2023) *Beyond protected areas: The importance of mixed-use landscapes for the conservation of Sumatran elephants (Elephas maximus sumatranus)*, Ecology and Evolution, 13 (10) e10560.

177. Jansen M.A.K., Barnes P.W., Bornman J.F., Rose K.C., Madronich S., White C.C., Zepp R.G. and Andradý A.L. (2023) *The Montreal Protocol and the fate of environmental plastic debris*, Photochemical and Photobiological Sciences, 22 (5) 1203-1211.

178. Jayaprakash P., Barroso L., Vajente M., Maestroni L., Louis E.J., Morrissey J.P. and Branduardi P. (2023) *CRISPR-Cas9 engineering in the hybrid yeast Zygosaccharomyces parabailii can lead to loss of heterozygosity in target chromosomes*, FEMS Yeast Research, 23foad036.

179. Jiang Y., Byrne E., Glassey J. and Chen X. (2023) *Reduced-order modeling of solid-liquid mixing in a stirred tank using data-driven singular value decomposition*, Chemical Engineering Research and Design, 19640-51.

180. Joshi S., Ó Gallachóir B. and Glynn J. (2023) *A deep learning architecture for energy service demand estimation in transport sector for Shared Socioeconomic Pathways*, Scientific Reports, 13 (1) 3522.

181. Kacprzyk J., Clune S., Clark C. and Kane A. (2023) *Making a greener planet: nature documentaries promote plant awareness*, Annals of Botany, 131 (2) 255-260.

182. Kamidelivand M., Deeney P., Devoy McAuliffe F., Leyne K., Togneri M. and Murphy J. (2023) *Scenario Analysis of Cost-Effectiveness of Maintenance Strategies for Fixed Tidal Stream Turbines in the Atlantic Ocean*, Journal of Marine Science and Engineering, 11 (5) 1046.

183. Kamidelivand M., Deeney P., Devoy McAuliffe F., O'Connell R., Mulcahy I. and Murphy J. (2023) *Adapting Optimal Preventive Maintenance Strategies for Floating Offshore Wind in Atlantic Areas by Integrating O&M Modelling and FMECA*, OCEANS 2023 - Limerick, OCEANS Limerick 2023.

184. Kampff Z., van Sinderen D. and Mahony J. (2023) *Cell wall polysaccharides of streptococci: A genetic and structural perspective*, Biotechnology Advances, 69108279.

185. Kane A. and Amin B. (2023) *Amending the literature through version control*, Biology Letters, 19 (1) 20220463.

186. Kane A., Healy K. and Ruxton G.D. (2023) *Was Allosaurus really predominantly a scavenger?*, Ecological Modelling, 476110247.

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187. Kang X., Deng C., Shinde R., Lin R. and Murphy J.D. (2023) *Renewable deep eutectic solvents pretreatment improved the efficiency of anaerobic digestion by lignin extraction from willow*, Energy Conversion and Management, 288117115.
188. Keane A., Neff A., Blaha K., Amann A. and Hövel P. (2023) *Transitional cluster dynamics in a model for delay-coupled chemical oscillators*, Chaos, 33 (6) 063133.
189. Kearney P.M., Spillane M., Humphries R., Gannon A., Stamenic D., Bhuachalla C.N., Hoevel P., Arensman E., O'riordain M., Troya M.I., Khashan A.S., O'reilly E., Buckley C., O'connor L. and Perry I.J. (2023) *Compliance with local travel restrictions and face masks during first phase of COVID-19 pandemic in Ireland: a national survey*, Journal of Public Health (United Kingdom), 45 (2) 359-367.
190. Kehoe R.A., Light M.E., Jones D.J. and McGlacken G.P. (2023) *A phosphine free, inorganic base free, one-pot tandem Mizoroki-Heck olefination/direct arylation/hydrogenation sequence, to give multicyclic alkylated heteroarenes*, Green Chemistry, 25 (14) 5654-5660.
191. Kendall C.J., Bracebridge C., Lynch E.C., Mgumba M., Monadjem A., Nicholas A. and Kane A. (2023) *Value of combining transect counts and telemetry data to determine short-term population trends in a globally threatened species*, Conservation Biology, 37 (6) e14146.
192. Kenny T. and Sage C. (2023) *Challenging corporate charity: Food commons as a response to food insecurity*. In: M. Caraher, J. Coveney and M. Chopra (Editors) Handbook of Food Security and Society, 48-56.
193. Kenny T.A., Woodside J.V., Perry I.J. and Harrington J.M. (2023) *Consumer attitudes and behaviors toward more sustainable diets: a scoping review*, Nutrition Reviews, 81 (12) 1665-1679.
194. Kenobi K., Read W., Bowgen K.M., Macgregor C.J., Taylor R.C., Cámaro García W.C.A., Hodges C., Dennis P. and Holloway P. (2023) *Lasso penalisation identifies consistent trends over time in landscape and climate factors influencing the wintering distribution of the Eurasian Curlew (Numenius arquata)*, Ecological Informatics, 77102244.
195. Kharaty S., Harrington J.M., Millar S.R., Perry I.J. and Phillips C.M. (2023) *Plant-based dietary indices and biomarkers of chronic low-grade inflammation: a cross-sectional analysis of adults in Ireland*, European Journal of Nutrition, 62 (8) 3397-3410.
196. Khojasteh D., Shamsipour A., Huang L., Tavakoli S., Haghani M., Flocard F., Farzadkhoo M., Iglesias G., Hemer M., Lewis M., Neill S., Bernitsas M.M. and Glamore W. (2023) *A large-scale review of wave and tidal energy research over the last 20 years*, Ocean Engineering, 282114995.
197. Killeen G.F. and Sougoufara S. (2023) *Getting ahead of insecticide-resistant malaria vector mosquitoes*, The Lancet, 401 (10375) 410-411.
198. Klaas L., Bulfin B., Kriechbaumer D., Neumann N., Roeb M. and Sattler C. (2023) *Energetic optimization of thermochemical air separation for the production of sustainable nitrogen*, Reaction Chemistry and Engineering, 8 (8) 1843-1854.
199. Klaas L., Bulfin B., Kriechbaumer D., Roeb M. and Sattler C. (2023) *Impact of the Sr content on the redox thermodynamics and kinetics of Ca1-xSrxMnO3-δ for tailored properties*, Physical Chemistry Chemical Physics, 25 (13) 9188-9197.
200. Konakci N., Kislioglu M.S. and Sasmaz A. (2023) *Ni, Cr and Co phytoremediations by Alyssum murale grown in the serpentine soils around Guleman Cr deposits, Elazig Turkey*, Bulletin of Environmental Contamination and Toxicology, 110 (6) 97.
201. Korolev N., Kopylova M., Dubinina E. and Stern R.A. (2023) *Contrasting oxygen isotopes in garnet from diamondiferous and barren eclogitic parageneses*, Geochemical Perspectives Letters, 2715-19.
202. Korolev N.M., Nikitina L.P., Kuznetsov A.B., Goncharov A.G., Galankina O.L., Shilovskikh V.V. and Vlasenko N.S. (2023) *Metasomatic Origin of Lamellar-like Inclusions in Clinopyroxenes from Mantle Xenoliths of the Obnazhennaya Pipe (Kuoika Field, Yakutian Diamondiferous Province)*, Doklady Earth Sciences, 510 (2) 422-427.
203. Kuehnlenz S., Andreoni V. and Meyenburg I. (2023) *Capitalism and crises: A comparative analysis of mainstream and heterodox perceptions and related ethical considerations*, Business Ethics, the Environment and Responsibility, 32 (S1) 52-64.
204. Kyriazi Z., de Almeida L.R., Marhadour A., Kelly C., Flannery W., Murillas-Maza A., Kalaydjian R., Farrell D., Carr L.M., Norton D. and Hynes S. (2023) *Conceptualising Marine Biodiversity Mainstreaming as an Enabler of Regional Sustainable Blue Growth: The Case of the European Atlantic Area*, Sustainability, 15 (24) 16762.
205. Laino E. and Iglesias G. (2023) *Extreme climate change hazards and impacts on European coastal cities: A review*, Renewable and Sustainable Energy Reviews, 184113587.
206. Laino E. and Iglesias G. (2023) *Scientometric review of climate-change extreme impacts on coastal cities*, Ocean and Coastal Management, 242106709.
207. Lane J.V., Jeglinski J.W.E., Avery-Gomm S., Ballstaedt E., Banyard A.C., Barychka T., Brown I.H., Brugger B., Burt T.V., Careen N., Castenschioel J.H.F., Christensen-Dalsgaard S., Clifford S., Collins S.M., Cunningham E., Danielsen J., Daunt F., D'entremont K.J.N., Doiron P., ... Votier S.C. (2023) *High pathogenicity avian influenza (H5N1) in Northern Gannets (Morus bassanus): Global spread, clinical signs and demographic consequences*, Ibis.
208. Lavranou G., Henschion M., McCarthy M.B. and O'Reilly S.J. (2023) *Valorizing meat by-products for human consumption: understanding consumer attitude formation processes*, Frontiers in Animal Science, 41129241.
209. le Maitre J., Ryan G., Power B. and O'Connor E. (2023) *Empowering onshore wind energy: A national choice experiment on financial benefits and citizen participation*, Energy Policy, 173113362.
210. Lennon B. and Dunphy N.P. (2023) *Mind the gap: Citizens, consumers, and unequal participation in global energy transitions*. In: M. Nadesan, M.J. Pasqualetti and J. Keahy (Editors) Energy Democracies for Sustainable futures, Academic Press, 327-331.
211. Leroux J. and Mintz-Woo K. (2023) *How climate winners may actually help climate justice*, PLOS Clim 2 (2) e0000127.
212. Leydon C.L., Leonard U.M., McCarthy S.N. and Harrington J.M. (2023) *Aligning Environmental Sustainability, Health Outcomes, and Affordability in Diet Quality: A Systematic Review*, Advances in Nutrition, 14 (6) 1270-1296.
213. Li J., Huang R., Morrison A.P., Chen M., Teng C., Cheng Y., Yuan L., Shi Y. and Deng S. (2023) *Design of a room-temperature, sine-wave gated, InGaAs/InP SPAD based photon counting system with dead-time mitigation*, Journal of Lightwave Technology, 1-7.
214. Lin H., Ning X., Wang D., Wang Q., Bai Y. and Qu J. (2023) *Quorum-sensing gene regulates hormetic effects induced by sulfonamides in Comamonadaceae*, Applied and Environmental Microbiology, 89 (12) A18.
215. Loneragan A. and O'Dwyer C. (2023) *Many Facets of Photonic Crystals: From Optics and Sensors to Energy Storage and Photocatalysis*, Advanced Materials Technologies, 8 (6) 2201410.
216. Loneragan A., Gulzar U., Zhang Y. and O'Dwyer C. (2023) *Operando Color-Coding of Reversible Lithiation and Cycle Life in Batteries Using Photonic Crystal Materials*, ECS Sensors Plus 2 (4) 045401.
217. Lopez-Pascual D., Valiente-Blanco I., Morrison A.P., Diez-Jimenez E. (2023) *New Solar Photovoltaics Trends Toward Sustainable Development Goals*, In: W. Leal Filho, M.A.P. Dinis, S. Moggi, E. Price and A. Hope (Editors) SDGs in the European Region. Implementing the UN Sustainable Development Goals – Regional Perspectives, Springer, Cham, pp. 1205–1238.
218. Louis M., Korlević P., Nykänen M., Archer F., Berrow S., Brownlow A., Lorenzen E.D., O'Brien J., Post K., Racimo F., Rogan E., Rosel P.E., Sinding M.-H.S., van der Es H., Wales N., Fontaine M.C., Gaggiotti O.E. and Foote A.D. (2023) *Ancient dolphin genomes reveal rapid repeated adaptation to coastal waters*, Nature Communications, 14 (1) 4020.
219. Lynch S.A. and Culloty S.C. (2023) *The native oyster Ostrea edulis in Ireland: Its past challenges and future prospects*. In: J.B. Roney and M. Beekey (Editors) Coastal Environments in the West of Ireland, Chapter three (page 31) Cambridge Scholars Publishing, Cambridge.
220. Mahony L.O., Shea E.O., O'Connor E.M., Tierney A., Harkin M., Harrington J., Kennelly S., Arendt E., O'Toole P.W. and Timmons S. (2023) *'Good, honest food': older adults' and healthcare professionals' perspectives of dietary influences and food preferences in older age in Ireland*, Journal of Human Nutrition and Dietetics, 36 (5) 1833-1844.
221. Martin E.P., Ahmad S.T., Chandran S., Rosado A., Ruth A.A. and Anandarajah P.M. (2023) *Stability Characterisation and Application of Mutually Injection Locked Gain Switched Optical Frequency Combs for Dual Comb Spectroscopy*, Journal of Lightwave Technology, 41 (13) 4516-4521.
222. Martinez A. and Iglesias G. (2023) *Climate-change impacts on offshore wind resources in the Mediterranean Sea*, Energy Conversion and Management, 291117231.
223. Martinez A., Murphy L. and Iglesias G. (2023) *Evolution of offshore wind resources in Northern Europe under climate change*, Energy, 269126655.

224. Mathews D., Ó Gallachóir B. and Deane P. (2023) *Systematic bias in reanalysis-derived solar power profiles & the potential for error propagation in long duration energy storage studies*, Applied Energy, 336120819.
225. McGeady R., Runya R.M., Dooley J.S.G., Howe J.A., Fox C.J., Wheeler A.J., Summers G., Callaway A., Beck S., Brown L.S., Dooly G. and McGonigle C. (2023) *A review of new and existing non-extractive techniques for monitoring marine protected areas*, Frontiers in Marine Science, 101126301.
226. McGinley J., Healy M.G., Ryan P.C., O'Driscoll H., Mellander P.-E., Morrison L. and Siggins A. (2023) *Impact of historical legacy pesticides on achieving legislative goals in Europe*, Science of the Total Environment, 873162312.
227. McGuire J., Rogan F., Balyk O., Mac Uidhir T., Gaur A. and Daly H. (2023) *Developing decarbonisation pathways in changing TIMES for Irish homes*, Energy Strategy Reviews, 47101086.
228. McIntyre O. (2023) *Advanced Introduction to International Water Law*, Edward Elgar Publishing, Cheltenham, 222 pp.
229. McIntyre O. (2023) *SDG 6: Ensure Availability and Sustainable Management of Water and Sanitation for All*. In: I. Bantekas and F. Seatzu (Editors) *The UN Sustainable Development Goals: A Commentary*, Oxford University Press, Oxford, 441-508.
230. McIntyre O. (2023) *The Critical Contribution of Independent Accountability Mechanisms (IAMs) to the Global Governance Paradigm*, Perspectives, American University Washington College of Law, 2023, 1-9.
231. McIntyre O. (2023) *Transnational governance standards in ensuring sustainable development and operation of hydropower projects in transboundary basins*, Frontiers in Climate, 51329076.
232. Michel G., Coughlan M., Arosio R., Emery A.R. and Wheeler A.J. (2023) *Stratigraphic and palaeo-geomorphological evidence for the glacial-deglacial history of the last British-Irish Ice Sheet in the north-western Irish Sea*, Quaternary Science Reviews, 300107909.
233. Migneault A., Bennison A., Doyle T.K. and James M.C. (2023) *High-resolution diving data collected from foraging area reveal that leatherback turtles dive faster to forage longer*, Ecosphere, 14 (8) e4576.
234. Minassian G., Ghanem E., El Hage R. and Rahme K. (2023) *Gold Nanoparticles Conjugated with Dendrigrift Poly-L-lysine and Folate-Targeted Poly(ethylene glycol) for siRNA Delivery to Prostate cancer*, Nanotheranostics, 7 (2) 152-166.
235. Mintz-Woo K. (2023) *Compensation Duties*. In: G. Pellegrino and M. Di Paola (Editors) *Handbook of Philosophy of Climate Change*, Handbooks in Philosophy, Springer, Cham.
236. Mintz-Woo K. (2023) *Philosophical Foundations of Climate Change Policy*, Joseph Heath. Oxford University Press, 2021, viii + 339 pages. <https://doi.org/10.1093/oso/9780197567982.001.0001>, Economics and Philosophy, Published online 2023, 1-6.
237. Mintz-Woo K. (2023) *The NET effect: negative emissions technologies and the need–efficiency trade-off*. Global Sustainability, 6, e5.
238. Mitri N., Rahme K., Fracasso G. and Ghanem E. (2023) *Upgrading gold to green nanoparticles: applications in prostate cancer*, Advances in Natural Sciences: Nanoscience and Nanotechnology, 14 (2) 023001.
239. Modesto V., Ilarri M., Labecka A.M., Ferreira-Rodríguez N., Coughlan N.E., Liu X. and Sousa R. (2023) *What we know and do not know about the invasive Asian clam Corbicula fluminea*, Hydrobiologia.
240. Moghadam T.T., Ochoa Morales C.E., Lopez Zambrano M.J., Bruton K. and O'Sullivan D.T.J. (2023) *Energy efficient ventilation and indoor air quality in the context of COVID-19 - A systematic review*, Renewable and Sustainable Energy Reviews, 182113356.
241. Moloney D.J.F., Collins C., Holloway P. and O'Riordan R. (2023) *The Conservationist's Toolkit: A critical review of the need for a conceptual framework of both in-situ and ex-situ conservation strategies to ensure the success of restoration ecology*, Biological Conservation, 287110345.
242. Monadjem A., Farooq H. and Kane A. (2023) *Elevation filters bat, rodent and shrew communities differently by morphological traits*, Diversity and Distributions.
243. Monadjem A., Healy K., Guillermo T. and Kane A. (2023) *Dispersal ability is associated with contrasting patterns of beta diversity in African small mammal communities*, Journal of Biogeography, 50 (3) 539-550.
244. Mooney S., Boudou M., O'Dwyer J. and Hynds P.D. (2023) *Behavioral pathways to private well risk mitigation: A structural equation modeling approach*, Risk Analysis, 43 (8) 1599-1626.
245. Moradian S., Iglesias G., Broderick C. and Olbert I.A. (2023) *Assessing the impacts of climate change on precipitation through a hybrid method of machine learning and discrete wavelet transform techniques, case study: Cork, Ireland*, Journal of Hydrology: Regional Studies, 49101523.
246. Moran C., Moylan E., Reardon J., Gunawan T.A., Deane P., Yousefian S. and Monaghan R.F.D. (2023) *A flexible techno-economic analysis tool for regional hydrogen hubs – A case study for Ireland*, International Journal of Hydrogen Energy, 48 (74) 28649-28667.
247. Morrissey D., Lim A., Howell K.L., White M., Wheeler A.J. and Allcock A.L. (2023) *The north-east Atlantic margin: A review of the geology, geography, oceanography, and vulnerable megabenthic ecosystems of the continental slope of Ireland and the United Kingdom*, Oceanography and Marine Biology: An Annual Review, Volume 61, 61219-291.
248. Mulder T., Cavailhes T., Hanquiez V., Gillet H., Recouvreur A. and Fabregas N. (2023) *Giant deep submarine depressions: A combined dissolution-mechanical process along carbonate margins*, Bulletin of the Geological Society of America, 135 (3-4) 743-752.
249. Mullally G., O'Neill M., de Bhailís D., Tuohy B., Breen M., Duggan A. and Ní Loinsigh E. (2023) *Walking, talking, [Re-]imagining socio-ecological sustainability: Research on the move/moving research*, Irish Journal of Sociology, 31 (1) 37-62.
250. Natoli T. and Cubie D. (2023) *YIDL Dialogues with Practitioners: Ms Adelina Kamal – Former Executive Director of the ASEAN Coordinating Centre for Humanitarian Assistance (AHA Centre)*, Yearbook of International Disaster Law Online, 4(1) 3-12.
251. Naudé W. (2023) *Late industrialisation and global value chains under platform capitalism*, Journal of Industrial and Business Economics, 50 (1) 91-119.
252. Naudé W. (2023) *No, degrowth won't save us*, BMJ, bmj.p2245.
253. Neff A., Keane A., Dijkstra H.A. and Krauskopf B. (2023) *Bifurcation analysis of a North Atlantic Ocean box model with two deep-water formation sites*, Physica D: Nonlinear Phenomena, 456133907.
254. Niemitz L., Sorensen S., Wang Y., Messina W., Burke R. and Andersson-Engels S. (2023) *Towards a flexible polarimetric camera-on-Tip miniature endoscope for 3x3 Mueller matrix measurements of biological tissue*, Proceedings of SPIE - The International Society for Optical Engineering, 126271262733.
255. Ning X., Deng C., Hickey D.T., Hackula A., O'Shea R., Wall D.M., Lin R. and Murphy J.D. (2023) *Improving biomethane production from biochar-supplemented two-stage anaerobic digestion of on-farm feedstocks*, Journal of Cleaner Production, 423138723.
256. Ning X., Deng C., Kang X., O'Shea R., Wall D.M., Lin R. and Murphy J.D. (2023) *Biochar facilitates biofuel production through batch single-stage and two-stage digestion of grass silage and cattle slurry*, Journal of Cleaner Production, 426139155.
257. Nowbakht P., O'Sullivan L., Wall D.P. and Holloway P. (2023) *Implementation of novel polygon-based obfuscation methods to improve privacy of agricultural data*, Transactions in GIS, 27 (1) 84-104.
258. Nozari-Asbemar M., Abbasi-Ahd A. and Shokoufi N. (2023) *Headspace single-drop microextraction combined with nanodrop spectrophotometry for ultra-trace detection of ethanethiol using a suspended drop of AuNPs as a plasmonic sensor*, Journal of Sulfur Chemistry, 44 (5) 588-601.
259. Nyhan M.M. and Cryan J.F. (2023) *Embed impact on SDGs in research assessments*, Nature, 621 (7978) 258.
260. Ó Céileachair D., O'Callaghan S., Wall D.M., Goulding D., O'Connor D., Murphy J.D. and O'Shea R. (2023) *Logistical considerations and challenges in deploying virtual biomethane pipelines to serve on-farm biogas plants*, Journal of Cleaner Production, 407137075.
261. O'Brien J., Mason A., Chan J. and Setti A. (2023) *Can We Train Multisensory Integration in Adults? A Systematic Review*, Multisensory Research, 5 (1) .
262. O'Callaghan J., Fitzpatrick J., Lalor F. and Byrne E. (2023) *Investigating the energy, environmental, and economic challenges and opportunities associated with steam sterilisation autoclaves*, Chemical Product and Process Modeling, 18 (4) 671-689.
263. O'Connell R., Furlong R., Guerrini M., Cullinane M. and Murphy J. (2023) *Development and Application of a GIS for Identifying Areas for Ocean Energy Deployment in Irish and Western UK Waters*, Journal of Marine Science and Engineering, 11 (4) 826.

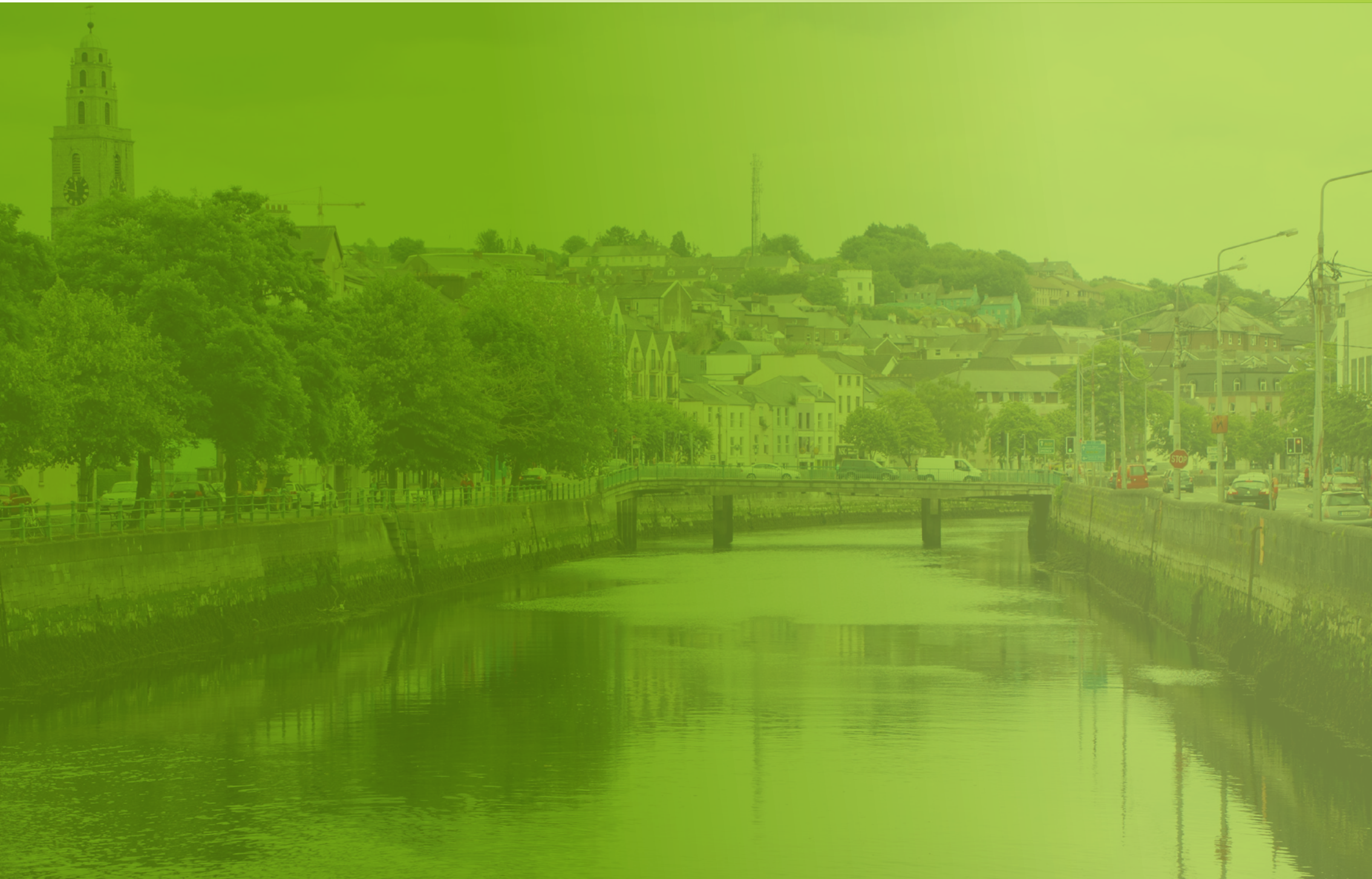
264. O'Connell R., Kamidelivand M., Polydoros I., Wright C., Bonar P., Williams A.J. and Murphy J. (2023) *The Integration of Tools for the Techno-Economic Evaluation of Fixed and Floating Tidal Energy Deployment in the Irish Sea*, *Energies*, 16 (22) 7526.
265. O'Connell R., Murphy J., Devoy McAuliffe F. and Dalton G. (2023) *A review of geographic information system (GIS) and techno economic (TE) software tools for renewable energy and methodology to develop a coupled GIS-TE software tool for marine renewable energy (MRE)*, *Proceedings of the Institution of Mechanical Engineers Part M: Journal of Engineering for the Maritime Environment*, 237 (3) 547-564.
266. O'Connor C.P.J., Wiecek S. and Amann A. (2023) *Loxodromes in open multisection lasers*, *Physical Review A*, 107 (5) 053520.
267. O'Dowd A., Hirst R.J., Setti A., Donoghue O.A., Kenny R.A. and Newell F.N. (2023) *The temporal precision of audiovisual integration is associated with longitudinal fall incidents but not sensorimotor fall risk in older adults*, *Scientific Reports*, 13 (1) 7167.
268. O'Dowd A., Hirst R.J., Setti A., Kenny R.A. and Newell F.N. (2023) *Older adults with slow sit to stand times show reduced temporal precision of audio-visual integration*, *Experimental Brain Research*, 241 (6) 1633-1642.
269. O'Driscoll C., Crowley F., Doran J. and McCarthy N. (2023) *How the relationship between socio-demographics, residential environments and travel influence commuter choices*, *Regional Studies*.
270. O'Driscoll C., Crowley F., Doran J. and McCarthy N. (2023) *Land-use mixing in Irish cities: Implications for sustainable development*, *Land Use Policy*, 128106615.
271. O'Driscoll C., Crowley F., Doran J. and McCarthy N. (2023) *Measuring land-use mixing across the Republic of Ireland: source data comparisons*, *Journal of Maps*, 19 (1) 2214165.
272. O'Driscoll K.K.M., Butler F. and Arnott G. (2023) *Editorial: Animal welfare science: Rising to the challenges of a changing world*, *Frontiers in Veterinary Science*, 101151773.
273. O'Keeffe S., O'Sullivan D. and Bruton K. (2023) *Development of a modelling tool to aid the transition to carbon neutral industrial manufacturing*, *Journal of Cleaner Production*, 425138604.
274. O'Leary D., Doran J. and Power B. (2023) *A multilevel approach to firm interrelationships across European regions*, *European Planning Studies*.
275. O'Leary D., Doran J. and Power B. (2023) *The role of relatedness in firm interrelationships*, *Journal of Economic Studies*, 51 (9) 36-58.
276. O'Leary D., Doran J. and Power B. (2023) *Urbanisation, concentration and diversification as determinants of firm births and deaths*, *Regional Studies*, 10 (1) 506-528.
277. O'Mahony J., Vanmechelen A. and Holloway P. (2023) *Quantifying the distribution and potential biotic interactions between deer and flora using species distribution modelling*, *Annals of GIS*, 29 (4) 553-568.
278. O'Mahony L., O'Shea E., O'Connor E.M., Tierney A., Harkin M., Harrington J., Kennelly S., Arendt E., O'Toole P.W. and Timmons S. (2023) *A qualitative study of older adults' and healthcare professionals' perspectives on the potential of functional food products to support healthy ageing*, *Journal of Functional Foods*, 107105689.
279. O'Mahony L., O'Shea E., O'Connor E.M., Tierney A., Harkin M., Harrington J., Kennelly S., Arendt E., O'Toole P.W. and Timmons S. (2023) *Older adults and healthcare professionals have limited awareness of the link between the Mediterranean diet and the gut microbiome for healthy aging*, *Frontiers in Nutrition*, 101104238.
280. O'Neill C., McCarthy M.B., O'Reilly S. and Alfnes F. (2023) *Food interests, preferences and behaviours: a profile of the sustainable food consumer*, *British Food Journal*, 125 (13) 352-374.
281. O'Regan A.C. and Nyhan M.M. (2023) *Towards sustainable and net-zero cities: A review of environmental modelling and monitoring tools for optimizing emissions reduction strategies for improved air quality in urban areas*, *Environmental Research*, 231116242.
282. O'Riordan V., Mac Uidhir T. and Rogan F. (2023) *Policy simulation modelling to inform national carbon budget pathways*, *Energy Strategy Reviews*, 50101237.
283. O'Riordan V., Rogan F., Ó Gallachóir B. and Daly H. (2023) *Impact of an emissions-based car tax policy on CO2 emissions and tax revenue from private cars in Ireland*, *International Journal of Sustainable Transportation*, 17 (9) 969-981.
284. O'Shea R., Yang Y., Kansagra K., Hickey D.T., Kohler D. and Murphy J.D. (2023) *Decarbonising distilled spirits: An assessment of the potential associated with anaerobic digestion of by-products at nine operational distilleries*, *Journal of Environmental Management*, 329116976.
285. O'Sullivan D.J., Bearne L.M., Harrington J.M. and McVeigh J.G. (2023) *Can social prescribing put the 'social' into the biopsychosocial management of people with long-term musculoskeletal disorders?*, *Musculoskeletal Care*, 21 (4) 1341-1352.
286. O'Sullivan E., Mulchrone K. and Wiecek S. (2023) *Rate-induced tipping to metastable Zombie fires*, *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 479 (2275) 20220647.
287. Oláh V., Irfan M., Szabó Z.B., Sajtos Z., Ragyák Á.Z., Dönczö B., Jansen M.A.K., Szabó S. and Mészáros I. (2023) *Species- and Metal-Specific Responses of the Ionome of Three Duckweed Species under Chromate and Nickel Treatments*, *Plants*, 12 (1) 180.
288. Orrell D.L., Questel J.M., Smoot C.A., Simpson T. and Hussey N.E. (2023) *Alembion carchariae (Copepod: Caligidae) host plasticity and distribution: A new host and locality record from Ascension Island*, *Journal of the Marine Biological Association of the United Kingdom*, 103e3.
289. Orrell D.L., Webber D. and Hussey N.E. (2023) *A standardised framework for the design and application of fine-scale acoustic tracking studies in aquatic environments*, *Marine Ecology Progress Series*, 706, 125-151.
290. Palacios-García E.J. and Deconinck G. (2023) *Online detection of power events using the end-user communication interface of residential smart meters*, *2023 IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids, SmartGridComm 2023 - Proceedings*.
291. Palma-Molina P., Hennessy T., Dillon E., Onakuse S., Moran B. and Shalloo L. (2023) *Evaluating the effects of grass management technologies on the physical, environmental, and financial performance of Irish pasture-based dairy farms*, *Journal of Dairy Science*, 106 (9) 6249-6262.
292. Palma-Molina P., Hennessy T., O'Connor A.H., Onakuse S., O'Leary N., Moran B. and Shalloo L. (2023) *Factors associated with intensity of technology adoption and with the adoption of 4 clusters of precision livestock farming technologies in Irish pasture-based dairy systems*, *Journal of Dairy Science*, 106 (4) 2498-2509.
293. Panos E., Glynn J., Kypreos S., Lehtilä A., Yue X., Ó Gallachóir B., Daniels D. and Dai H. (2023) *Deep decarbonisation pathways of the energy system in times of unprecedented uncertainty in the energy sector*, *Energy Policy*, 180113642.
294. Paolacci S., Jansen M.A.K., Stejskal V., Kelly T.C. and Coughlan N.E. (2023) *Metabolically active angiosperms survive passage through the digestive tract of a large-bodied waterbird*, *Royal Society Open Science*, 10 (3) 230090.
295. Pérez-Collazo C., Greaves D.M. and Iglesias G. (2023) *A Jacket-Frame Mounted Oscillating Water Column with a Variable Aperture Skirt*, *Journal of Marine Science and Engineering*, 11 (12) 2383.
296. Pérez-Llano Y., Yarzabal Rodríguez L.A., Martínez-Romero E., Dobson A.D.W., Gunde-Cimerman N., Vasconcelos V. and Batista-García R.A. (2023) *From friends to foes: fungi could be emerging marine sponge pathogens under global change scenarios*, *Frontiers in Microbiology*, 141213340.
297. Perez-Romero C.A., Mendoza-Maldonado L., Tonda A., Coz E., Tabeling P., Vanhomwegen J., MacSharry J., Szafran J., Bobadilla-Morales L., Corona-Rivera A., Claassen E., Garssen J., Kraneveld A.D. and Lopez-Rincon A. (2023) *An Innovative AI-based primer design tool for precise and accurate detection of SARS-CoV-2 variants of concern*, *Scientific Reports*, 13 (1) 15782.
298. Pettitt-Wade H., Hussey N.E., Gallagher C.P., Lea E.V., Orrell D.L. and Loseto L.L. (2023) *Contrasting intra-individual variation in size-based trophic and habitat shifts for two coastal Arctic fish species*, *Oecologia*, 202 (3) 601-616.
299. Pi J., Tang Y., Coughlan N.E., Liu L., Wang X., Liu X., Xiang J. and Li D. (2023) *Temperature drives reproductive activity in a rare trioecy population of Corbicula clams*, *Hydrobiologia*.
300. Pirota E., Ajó A.F., Bierlich K.C., Bird C.N., Buck C.L., Haver S.M., Haxel J.H., Hildebrand L., Hunt K.E., Lemos L.S., New L. and Torres L.G. (2023) *Assessing variation in faecal glucocorticoid concentrations in gray whales exposed to anthropogenic stressors*, *Conservation Physiology*, 11 (1) coad082.

301. Pirotta E., Schick R.S., Hamilton P.K., Harris C.M., Hewitt J., Knowlton A.R., Kraus S.D., Meyer-Gutbrod E., Moore M.J., Pettis H.M., Photopoulou T., Rolland R.M., Tyack P.L. and Thomas L. (2023) *Estimating the effects of stressors on the health, survival and reproduction of a critically endangered, long-lived species*, *Oikos*, 2023 (5) e09801.
302. Pizzichetti R., Reynolds K., Pablos C., Casado C., Moore E., Stanley S. and Marugán J. (2023) *Removal of diclofenac by UV-B and UV-C light-emitting diodes (LEDs) driven advanced oxidation processes (AOPs): Wavelength dependence, kinetic modelling and energy consumption*, *Chemical Engineering Journal*, 471144520.
303. Pohl V., Gilmer A., Byers V., Cassidy J., Donnelly A., Hellebust S., McGillicuddy E.J., McGovern E. and O'Connor D.J. (2023) *Ammonia Cycling and Emerging Inorganic Secondary Aerosols from Arable Agriculture*, *Air*, 1 (3) 207-221.
304. Portillo Juan N., Olalde Rodríguez J., Negro Valdecantos V. and Iglesias G. (2023) *Data-driven and physics-based approach for wave downscaling: A comparative study*, *Ocean Engineering*, 285115380.
305. Power B. and Reid G.C. (2023) *Adopting industrial designs: further IP protection for US start-ups?*, *Applied Economics Letters*, 30 (2) 136-140.
306. Power B. and Reid G.C. (2023) *Lifting the hood of supply and demand for trademarks of start-ups: Partial observability estimates*, *Managerial and Decision Economics*, 44 (1) 311-321.
307. Power M., Mackey K., Light M.E., Jones D.J. and McGlacken G.P. (2023) *Access to Electron-Rich Dibenzofurans through NBu₄OAc-Mediated Palladium Catalysis*, *European Journal of Organic Chemistry*, 26 (44) e202300790.
308. Qian M., Kalbina I., Rosenqvist E., Jansen M.A.K. and Strid Å. (2023) *Supplementary UV-A and UV-B radiation differentially regulate morphology in *Ocimum basilicum**, *Photochemical and Photobiological Sciences*, 22 (9) 2219-2230.
309. Quinlivan L. and Dunphy N. (2023) *A Mixed-Methods Approach to Climate Action Planning*, *International Journal of Qualitative Methods*, 22.
310. Ramachandran R.C., Otter A., Serraris J.J., Ridder E.J.D., Desmond C. and Murphy J. (2023) *A study of the towing characteristics of a semi-submersible floating offshore wind platform*, *Journal of Physics: Conference Series*, 2626 (1) 012043.
311. Ramakers J.J.C., Reed T.E., Harris M.P. and Gienapp P. (2023) *Probing variation in reaction norms in wild populations: the importance of reliable environmental proxies*, *Oikos*, 2023 (12) e09592.
312. Ramos A.V., Sousa-Gallagher M.J. and Oliveira J.C. (2023) *Dimensionless correlations for estimating the permeability of perforated packaging films to oxygen*, *Journal of Food Engineering*, 340111252.
313. Recouvreur A., Wheeler A.J., Strachan R., Meere P.A., Unitt R.P. and Lim A. (2023) *Large-scale bedrock outcrop mapping on the NE Atlantic Irish continental margin*, *Frontiers in Marine Science*, 101258070.
314. Reed T.E., Visser M.E. and Waples R.S. (2023) *The opportunity for selection: A slippery concept in ecology and evolution*, *Journal of Animal Ecology*, 92 (1) 7-15.
315. Revez A., Kirrane M. and Thomson F. (2023) *Greening procurement: Exploring evolving practices in an Irish university*, *Heliyon*, 9 (11) e21787.
316. Riedewald F., Povey I., Barton K., Lewis L., Santos S., O'Mahoney M. and Sousa-Gallagher M. (2023) *Tantalum Capacitor Separation from Waste Printed Circuit Boards with Molten Salt or Metal*, *Chemie-Ingenieur-Technik*, 95 (6) 944-949.
317. Riedewald F., Zuber J., Rath sack P., Duffy G., O'Mahoney M. and Sousa-Gallagher M. (2023) *Chemical Recycling of Polyolefins with the Molten Metal Reactor at 460 °C*, *Chemie-Ingenieur-Technik*, 95 (8) 1332-1338.
318. Rinaldo A., de Eyto E., Reed T., Gjelland K.Ø. and McGinnity P. (2023) *Global warming is projected to lead to increased freshwater growth potential and changes in pace of life in Atlantic salmon *Salmo salar**, *Journal of Fish Biology*.
319. Ritchie P.D.L., Alkhayyon H., Cox P.M. and Wieczorek S. (2023) *Rate-induced tipping in natural and human systems*, *Earth System Dynamics*, 14 (3) 669-683.
320. Rossetto V., Moore-Machacek A., Woods D.F., Galvão H.M., Shanahan R.M., Hickey A., O'Leary N., O'Gara F., McGlacken G.P. and Reen F.J. (2023) *Structural modification of the *Pseudomonas aeruginosa* alkylquinoline cell-cell communication signal, HHQ, leads to benzofuranquinolines with anti-virulence behaviour in ESKAPE pathogens*, *Microbiology (United Kingdom)*, 169 (3) 001303.
321. Ruane K., Soutsos M., Huynh A., Zhang Z., Nagle A., McDonald K., Gentry T.R., Leahy P. and Bank L.C. (2023) *Construction and Cost Analysis of BladeBridges Made from Decommissioned FRP Wind Turbine Blades*, *Sustainability (Switzerland)*, 15 (4) 3366.
322. Rusmanis D., Yang Y., Long A., Gray N., Martins K.C., Ó Loideáin S.Ó., Lin R., Kang X., Cusack D.Ó., Carton J.G., Monaghan R., Murphy J.D. and Wall D.M. (2023) *Electrofuels in a circular economy: A systems approach towards net zero*, *Energy Conversion and Management*, 292117367.
323. Russell E., Ruth A.A., Corbett B. and Garcia Gunning F.C. (2023) *Tunable dual optical frequency comb at 2 µm for CO₂ sensing*, *Optics Express*, 31 (4) 6304-6313.
324. Ruta S., Murray M., Kampff Z., McDonnell B., Lugli G.A., Ventura M., Todaro M., Settanni L., van Sinderen D. and Mahony J. (2023) *Microbial Ecology of Pecorino Siciliano PDO Cheese Production Systems*, *Fermentation*, 9 (7) 620.
325. Ryall Á. (2023) *A Brave New World: The Aarhus Convention in Tempestuous Times*, *Journal of Environmental Law*, 35 (1) 161-166.
326. Ryall Á. (2023) *Judicial Review and Enforcement of the Habitats Directive in Ireland*. In: M. Eliantonio, E. Lees and T. Paloniitty (Editors) *EU Environmental Principles and Scientific Uncertainty before National Courts*, Hart Publishing, Oxford, pp. 57-78.
327. Sabedotti M.E.S., O'Regan A.C. and Nyhan M.M. (2023) *Data Insights for Sustainable Cities: Associations between Google Street View-Derived Urban Greenspace and Google Air View-Derived Pollution Levels*, *Environmental Science and Technology*, 57 (48) 19637-19648.
328. Saeid Atabaki M., Bagheri M. and Aryanpur V. (2023) *Exploring the role of electrification and modal shift in decarbonizing the road passenger transport in British Columbia*, *Sustainable Energy Technologies and Assessments*, 56103070.
329. Saldanha S., Cox S.L., Militão T. and González-Solís J. (2023) *Animal behaviour on the move: the use of auxiliary information and semi-supervision to improve behavioural inferences from Hidden Markov Models applied to GPS tracking datasets*, *Movement Ecology*, 11 (1) 41.
330. Sarkis M., Minassian G., Mitri N., Rahme K., Fracasso G., El Hage R. and Ghanem E. (2023) *D2B-Functionalized Gold Nanoparticles: Promising Vehicles for Targeted Drug Delivery to Prostate Cancer*, *ACS Applied Bio Materials*, 6 (2) 819-827.
331. Sasmaz Kisioglu M. (2023) *Removal of Ag, Au, and As from acid mine water using Lemna gibba and Lemna minor—A performance analysis*, *Water (Switzerland)*, 15 (7) 1293.
332. Setti A., Hernández B., Hirst R.J., Donoghue O.A., Kenny R.A. and Newell F.N. (2023) *Susceptibility to the sound-induced flash illusion is associated with gait speed in a large sample of middle-aged and older adults*, *Experimental Gerontology*, 174112113.
333. Shinde R., Hackula A., O'Shea R., Barth S., Murphy J.D. and Wall D.M. (2023) *Demand-driven biogas production from Upflow Anaerobic Sludge Blanket (UASB) reactors to balance the power grid*, *Bioresource Technology*, 385129364.
334. Shrestha T., Chi C.V.Y., Cassarino M., Foley S. and Di Blasi Z. (2023) *Factors influencing the effectiveness of nature-based interventions (NBIs) aimed at improving mental health and wellbeing: Protocol of an umbrella review*, *PLoS ONE*, 18 (7 July) e0273139.
335. Siddiquee S.M.S., Agyeman K.A., Bruton K., Howard B. and O'Sullivan D.T. (2023) *A Data-driven Framework for Quantifying Demand Response Participation Benefit of Industrial Consumers*, *IEEE Transactions on Industry Applications*, 1-11.
336. Silva E., Viegas D., Martins A., Almeida J., Almeida C., Neves B., Madureira P., Wheeler A.J., Salavasidis G., Phillips A., Schaap A., Murton B., Berry A., Weir A., Dooly G., Omerdic E., Toal D., Collins P.C., Miranda M., ... Bahurel P. (2023) *TRIDENT - Technology based impact assessment tool foR sustainable, transparent Deep sEa miNing exploratiOn and exploitation: A project overview*, *OCEANS 2023 - Limerick*, *OCEANS Limerick* 2023.
337. Singh H., Paritosh K., Vivekanand V. and Pareek N. (2023) *Microorganism-Assisted Biohydrogen Production and Bioreactors*, *Chemical Engineering and Technology*, 46 (2) 204-217.
338. Sirr G., Power B., Ryan G., Eakins J., O'Connor E. and le Maitre J. (2023) *An analysis of the factors affecting Irish citizens' willingness to invest in wind energy projects*, *Energy Policy*, 173113364.
339. Skillington T. (2023) *Thinking beyond the ecological present: Critical theory on the self-problematization of society and its transformation*, *European Journal of Social Theory*, 26 (2) 236-257.
340. Skillington T. (2023) *Where does the true value of a frame analysis approach lie? A Reply to van Dijk*, *Discourse Studies*, 25 (2) 288-296.

341. Slater T.S., Edwards N.P., Webb S.M., Zhang F. and McNamara M.E. (2023) *Preservation of corneous β -proteins in Mesozoic feathers*, Nature Ecology and Evolution, 7 (10) 1706-1713.
342. Slater T.S., Ito S., Wakamatsu K., Zhang F., Sjövall P., Jarenmark M., Lindgren J. and McNamara M.E. (2023) *Taphonomic experiments reveal authentic molecular signals for fossil melanins and verify preservation of phaeomelanin in fossils*, Nature Communications, 14 (1) 5651.
343. Sleeman D.P. (2023) *Review: The Badgers of Wytham Woods*, Irish Naturalists' Journal 40, 167-168.
344. Sleeman D.P., Whitaker A. and Savage V. (2023) *Observations of badgers in the Burren, Co. Clare*, Irish Naturalists' Journal 40, 50-54.
345. Sleeman, D.P. and Whitaker, A. (2023) *Other mammals at setts of European Badgers (Meles meles) in a vaccination area*, Irish Naturalists' Journal 40, 34-39.
346. Slodownik M.A., Escapa I., Mays C., Jordan G.J., Carpenter R.J. and Hill R.S. (2023) *ARAUCARIOIDES: A POLAR LINEAGE OF ARAUCARIACEAE WITH NEW PALEOGENE FOSSILS FROM TASMANIA, AUSTRALIA*, International Journal of Plant Sciences, 184 (8) 640-658.
347. Somers S.E., Davidson G.L., Johnson C.N., Reichert M.S., Crane J.M.S., Ross R.P., Stanton C. and Quinn J.L. (2023) *Individual variation in the avian gut microbiota: The influence of host state and environmental heterogeneity*, Molecular Ecology, 32 (12) 3322-3339.
348. Sonawane A.D., Oliveira J.C., Weltzien C. and Mahajan P.V. (2023) *Prediction of ethylene permeance through perforated packaging films using a dimensionless correlation*, Journal of Food Engineering, 357111610.
349. Soukissian, T., O'Hagan, A. M., Azzellino, A., Boero, F., Brito e Melo, A., Comiskey, P., Gao, Z., Howell, D., Le Boulluec, M., Maisondieu, C., Scott, B. E., Tedeschi, E., Maheri, A., Pennock, S. 2023. *European offshore renewable energy: Towards a sustainable future*. Heymans, J. J., Kellett, P., Alexander, B., Muniz Piniella, A., Rodriguez Perez, A., Van Elslander, J. [Eds.] Future Science Brief No. 9 of the European Marine Board, Ostend, Belgium.
350. Steel D., Mintz-Woo K. and DesRoches C.T. (2023) *Collapse, Social Tipping Dynamics, and Framing Climate Change*, Politics, Philosophy and Economics, 0, 0.
351. Steele M. and Finucane F.M. (2023) *Philosophically, is obesity really a disease?*, Obesity Reviews, 24 (8) e13590.
352. Stitz M., Kuster D., Reinert M., Schepetilnikov M., Berthet B., Reyes-Hernández J., Janocha D., Artins A., Boix M., Henriques R., Pfeiffer A., Lohmann J., Gaquerel E. and Maizel A. (2023) *TOR acts as a metabolic gatekeeper for auxin-dependent lateral root initiation in Arabidopsis thaliana*, EMBO Journal, 42 (10) e111273.
353. Stori F., O'Hagan A.M and O'Mahony C. (2023) *National Integrated Coastal Zone Management Frameworks Need to Adapt*. In: W. Leal Filho, M. Kovaleva, F. Alves and I.R. Abubakar (Editors) Climate Change Strategies: Handling the Challenges of Adapting to a Changing Climate. Climate Change Management. Springer, Cham.
354. Summers G., Lim A. and Wheeler A.J. (2023) *Multi resolution appraisal of Cork Harbour estuary: An object based image analysis approach*, Geomorphology, 439108851.
355. Terry J., Singh K. and Mckeown M. (2023) *Lake Tagimaucia Montane Lake as a Potential Late Holocene Environmental Archive in Fiji's Volcanic Highlands*, Pacific Science, 76 (3) 289-311.
356. Todd N.R.E., Kavanagh A.S., Rogan E. and Jessopp M.J. (2023) *What the F-POD? Comparing the F-POD and C-POD for monitoring of harbor porpoise (Phocoena phocoena)*, Ecology and Evolution, 13 (6) e10186.
357. Torheim L.E., Løvhaug A.L., Huseby C.S., Henjum S., Terragni L., Poelman M., Harrington J., Vandevijvere S. and Roos G. (2023) *Evaluation and prioritization of food environment policies in Norway using the Healthy Food Environment Policy Index (Food-EPI)*, Food and Nutrition Research, 679117.
358. Troya M.D.C., Ansong J.O. and O'Hagan A.M. (2023) *Transitioning from blue growth to the sustainable blue economy: A review of Ireland's new marine governance in the aquaculture sector*, Frontiers in Marine Science, 101075803.
359. Tunwal M. and Lim A. (2023) *A Low-Cost, Repeatable Method for 3D Particle Analysis with SfM Photogrammetry*, Geosciences (Switzerland), 13 (7) 190.
360. Tzankova I.I., O'Sullivan C., Facciuto A.I., Sacchetti L., Fini F., Cicognani E. and Setti A. (2023) *Engagement with Nature and the Home Environment: Wellbeing and Proenvironmental Behavior among Irish and Italian University Students during the COVID-19 Emergency*, International Journal of Environmental Research and Public Health, 20 (14) 6432.
361. van de Langerijt T.M., O'Callaghan Y.C., Tzima K., Lucey A., O'Brien N.M., O'Mahony J.A., Rai D.K. and Crowley S.V. (2023) *The influence of milk with different compositions on the bioavailability of blackberry polyphenols in model sports nutrition beverages*, International Journal of Dairy Technology, 76 (4) 828-843.
362. Van Den Heuvel K., Quinn J.L., Kotschal A. and Van Oers K. (2023) *Artificial selection for reversal learning reveals limited repeatability and no heritability of cognitive flexibility in great tits (Parus major)*, Proceedings of the Royal Society B: Biological Sciences, 290 (2003) 20231067.
363. Velasco-Herrejón P., Lennon B. and Dunphy N.P. (2023) *The Global Face of Energy Poverty*. In: P. Velasco-Herrejón, B. Lennon and N.P. Dunphy (Editors) Living with Energy Poverty. Perspectives from the Global North and South, pp. 1-14.
364. Velasco-Herrejón P., Lennon B. and Dunphy N.P. (Editors) (2023) *Living with Energy Poverty Perspectives from the Global North and South*, Routledge, London, 288 pp.
365. Vera M., Wilmes S.B., Maroso F., Hermida M., Blanco A., Casanova A., Iglesias D., Cao A., Culloty S.C., Mahony K., Orvain F., Bouza C., Robins P.E., Malham S.K., Lynch S., Villalba A. and Martínez P. (2023) *Heterogeneous microgeographic genetic structure of the common cockle (Cerastoderma edule) in the Northeast Atlantic Ocean: Biogeographic barriers and environmental factors*, Heredity, 131 (4) 292-305.
366. Verling E., Bartilotti C., Hollatz C., Tuaty-Guerra M., Lobo-Arteaga J. and O'Higgins T. (2023) *Applying risk-based approaches to implementation of the Marine Strategy Framework Directive in the North-East Atlantic: Learning lessons and moving forward*, Marine Policy, 153105667.
367. Verreycken H., Collas F.P.L. and Coughlan N.E. (2023) *International Conference on Aquatic Invasive Species – ICAIS returned to Europe after 15 years*, Aquatic Invasions, 18 (2) 135-140.
368. Wang M., Lou S., Hu W., Wang H., Wang X., Fan F., Varma R., Venables D.S. and Chen J. (2023) *Intercomparison of NO3 under Humid Conditions with Open-Path and Extractive IBBCEAS in an Atmospheric Reaction Chamber*, Remote Sensing, 15 (3) 739.
369. Wang S., Mcnamara M.E., Wang B., Hui H. and Jiang B. (2023) *The origins of colour patterns in fossil insects revealed by maturation experiments*, Proceedings of the Royal Society B: Biological Sciences, 290 (2007) 20231333.
370. Waples R.S. and Reed T.E. (2023) *Null Models for the Opportunity for Selection*, American Naturalist, 201 (6) 779-793.
371. Wells H.B.M., Crego R.D., Alston J.M., Ndung'u S.K., Khasoha L.M., Reed C.G., Hassan A.A., Kurukura S., Ekadeli J., Namoni M., Stewart P.S., Kimuyu D.M., Wolf A.A., Young T.P., Kartzinel T.R., Palmer T.M., Goheen J.R. and Pringle R.M. (2023) *Wild herbivores enhance resistance to invasion by exotic cacti in an African savanna*, Journal of Ecology, 111 (1) 33-44.
372. Whelton E., Helen L., O'Donnell B., O'Sullivan M., Ugwah J., Messina W., Wang Y., O'Mahoney N. and Moore E. (2023) *Smart needle electrical bioimpedance to provide information on needle tip relationship to target nerve prior to local anesthetic deposition in peripheral nerve block (USgPNB) procedures*, Journal of Electrical Bioimpedance, 14 (1) 53-59.
373. White J., Fitzgerald C., Gargan P., de Eyto E., Millane M., Chaput G., Boylan P., Crozier W.W., Doherty D., Kennedy B., Lawler I., Lyons D., Marnell F., McGinnity P., O'Higgins K., Roche W.K., Maxwell H. and Maoileidigh N.Ó. (2023) *Incorporating conservation limit variability and stock risk assessment in precautionary salmon catch advice at the river scale*, ICES Journal of Marine Science, 80 (4) 803-822.
374. Wiczorek S., Xie C. and Ashwin P. (2023) *Rate-induced tipping: thresholds, edge states and connecting orbits*, Nonlinearity, 36 (6) 3238-3293.
375. Wiggin D.A., Penič B., Sulopuisto O., Setti A., Mali J., Stützel A., Kuisma R., Baptista F., Sourtzi P. and Timmons S. (2023) *Postgraduate education in healthy and active ageing: a systematic scoping review of learning needs, curricula and learning impact*, Gerontology and Geriatrics Education.
376. Wiggin D.A., Setti A., Mali J., Ströckl D.E., Sourtzi P., Nevala E., Penič B., Zymbal V., Cardadeiro G., Carnide F., Baptista F., Fitzgerald T. and Timmons S. (2023) *Learning needs in healthy and active aging according to key stakeholders: a multinational survey*, Gerontology and Geriatrics Education.
377. Wingler A. and Sandel B. (2023) *Relationships of the competitor, stress tolerator, ruderal functional strategies of grass species with lifespan, photosynthetic type, naturalization and climate*, AoB PLANTS, 15 (3) plad021.
378. Wu B., Lin R., Bose A., Huerta J.D., Kang X., Deng C. and Murphy J.D. (2023) *Economic and environmental viability of biofuel production from organic wastes: A pathway towards competitive carbon neutrality*, Energy, 285129322.

379. Wynne R., Kaufmann J., Coughlan J., Phillips K.P., Waters C., Finlay R.W., Rogan G., Poole R., McGinnity P. and Reed T.E. (2023) *Autumn outmigrants in brown trout (*Salmo trutta*) are not a demographic dead-end*, Journal of Fish Biology, 102 (6) 1327-1339.
380. Xie M., Ma X., Wang Y., Li C., Shi H., Yuan X., Hellwich O., Chen C., Zhang W., Zhang C., Ling Q., Gao R., Zhang Y., Ochege F.U., Frankl A., De Maeyer P., Buchmann N., Feigenwinter I., Olesen J.E., Juszczak R., ... Luo G. (2023) *Monitoring of carbon-water fluxes at Eurasian meteorological stations using random forest and remote sensing*, Scientific Data, 10 (1) 587.
381. Yang L., Campos-Pineda M., Hatem K. and Zhang J. (2023) *Low-pressure and nascent yields of stabilized Criegee intermediates CH₂OO and CH₃CHOO in ozonolysis of propene*, Physical Chemistry Chemical Physics, 25 (39) 26549-26556.
382. Yang Z., Jiang B., Benton M.J., Xu X., McNamara M.E. and Hone D.W.E. (2023) *Allometric wing growth links parental care to pterosaur giantism*, Proceedings of the Royal Society B: Biological Sciences, 290 (2003) 20231102.
383. Yilanci V., Gorus M.S. and Andreoni V. (2023) *Reinvestigation of the validity of the EKC hypothesis extended with energy: A time-varying analysis for the United Kingdom*, Journal of Cleaner Production, 428139284.
384. Yilanci V., Ulucak R., Zhang Y. and Andreoni V. (2023) *The role of affluence, urbanization, and human capital for sustainable forest management in China: Robust findings from a new method of Fourier cointegration*, Sustainable Development, 31 (2) 812-824.
385. Yin Y., Crowley F., Doran J., Du J. and O'Connor M. (2023) *Research and innovation and the role of competition in family owned and managed firms*, International Journal of Entrepreneurial Behaviour and Research, 29 (1) 166-194.
386. Zeng C., Tang Y., Vastrade M., Coughlan N.E., Zhang T., Cai Y., Van Doninck K. and Li D. (2023) *Salinity appears to be the main factor shaping spatial COI diversity of *Corbicula* lineages within the Chinese Yangtze River Basin*, Diversity and Distributions, 29 (3) 364-378.
387. Zhang Y., Grant A., Carroll A., Gulzar U., Ferguson M., Roy A., Nicolosi V. and O'Dwyer C. (2023) *Water-Soluble Binders That Improve Electrochemical Sodium-Ion Storage Properties in a NaTi₂(PO₄)₃ Anode*, Journal of the Electrochemical Society, 170 (5) 050529.
388. Zhu Y., Li D., Fan J., Zhang H., Eichhorn M.P., Wang X. and Yun T. (2023) *A reinterpretation of the gap fraction of tree crowns from the perspectives of computer graphics and porous media theory*, Frontiers in Plant Science, 141109443.







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