




nviron 2023

33rd Irish Environmental Researchers Colloquium

**"Evidence And Plans
Towards Transitions To A
Sustainable Future"**

 **3rd - 5th April 2023**

 **ATU Letterkenny**



Ollscoil
Teicneolaíochta
an Ailteáigh

Atlantic
Technological
University



Environmental Sciences Association of Ireland

An Campus Thuaidh North Campus



Eochair Ealaí

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ENVIRON 2023 ATU Letterkenny

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Welcome to ENVIRON 2023 Delegates

Atlantic Technological University Organising Committee Welcome to ENVIRON 2023 Delegates

Dear Delegate,

The ENVIRON 2023 Organising Committee welcomes you to the 33rd Irish Environmental Researchers' Colloquium (ENVIRON 2023), hosted by ATU Donegal. The ENVIRON colloquium is the largest gathering of environmental researchers in Ireland and at this year's event over 125 poster and oral presentations will be delivered.



The event continues to provide an excellent platform for environmentalists at different stages in their research journey to present their findings to a wide audience drawn from academia, government bodies, industry, and the public.

The theme of this year's colloquium is "Evidence and Plans Towards Transitions to a Sustainable Future" resonates the fact that the science of climate change and a global energy crisis is more widely accepted and agreed upon than ever and that timely active engagement is now required to provide us with a clear opportunity to deliver strong outcomes by investing in transition leaders and climate solutions that can help transform our world using sustainable solutions.

The colloquium will begin on Monday April 3rd with a guided tour of Glenveagh National Park, Gardens & Conservation Projects including lunch. On the opening afternoon there will be two workshops "Training Analysis and Career Development" (Dr John Bartlett, ATU Sligo) and "Getting Ready to be a Sustainability Professional" (Dr Paul Bolger, Environmental Research Institute).

Later that evening Environ 2023 will open with a public debate on the challenging issue of "The implications and solutions of future climate change actions on agriculture". The panel will include Dr Edna Curley Mountbellew Agricultural College, Dr James Moran Agro-Ecologist ATU Galway, Colm Markey MEP, Paul O'Brien Irish Farmers Association and Dr Douglas McMillan, Green Restoration Ireland.

The colloquium will be formally opened on Tuesday 4th April by Vice-President for Research and Innovation Atlantic Technological University, Dr Rick Officer, Vice-President for Research, Equality & External Affairs ATU Donegal, John Andy Bonar and ESAI Chairperson, Dr Liam McCarton. This will be followed by a plenary talk by the renowned international expert Prof Rick Relyea, Rensselaer Polytechnic Institute, New York, entitled "Understanding, predicting, and mitigating human impacts for a sustainable future". Four parallel sessions will follow of which many will include Keynote addresses by environmental experts. These parallel sessions will be interspersed with 3 poster sessions.

ENVIRON 2023 ATU Letterkenny

There will be a Drinks Reception & Live Piano Music at the Radisson Blu Hotel, Letterkenny at 7pm followed by the conference dinner in the Carnegie Ballroom of the hotel at 8pm.

Dr Orla Flynn ATU President, ATU President will deliver a welcoming address on Wed the 5th of April. This will be followed by a second plenary session "Valorisation of waste biomass" jointly delivered by Prof Vivek Ranade, University of Limerick and Prof Peter Robertson, Queens University Belfast. Four parallel sessions will again follow and finally a Prize Giving ceremony & Close of Environ 2023

We really hope that all participants will enjoy ENVIRON 2023 which we believe will deliver an exciting programme with fascinating environmental research topics coupled with networking amongst likeminded scientists. We hope that new ideas, innovative eco-friendly technologies, and solutions can be explored and made possible by bringing together a diverse group of Ireland's environmental stakeholders. We also hope that as many as possible can attend the social events or if time permits enjoy the rugged and wild Atlantic coastline of Donegal.

Denis Mc Crudden & Christopher Mc Eleney

ENVIRON 2023 Colloquium Co-Convenors,

On behalf of the ENVIRON2023 Organising Committees

Environmental Sciences Association of Ireland (ESAI) Welcome to ENVIRON 2023 Delegates

On behalf of the ESAI Council, we wish to extend a warm welcome to all delegates to our 33rd Irish Environmental Researchers Colloquium (Environ 2023). This year the ESAI are collaborating with the Atlantic Technological University (ATU) to host the event in their impressive campus in Letterkenny. Environ provides an annual platform for members to showcase their research and to engage with peers, industry partners and the general public. We look forward to meeting all our members in Donegal to focus on the theme of this year's Environ, "Evidence and Plans Towards Transitions to a Sustainable Future".



Environ 2023 will commence on the afternoon of Monday 3rd April with a series of interactive workshops and field trips. A public event will take place on Monday evening focusing on "The implications and solutions of future climate actions on agriculture". The evening will commence with a reception at 7pm followed by a panel discussion at 8pm. The panel will be chaired by Dr Edna Curley, Mountbellow Agricultural College and comprises Dr James Moran (ATU Galway), Paul O'Brien (Irish Farmers Association), Colm Markey MEP (Committee on Agriculture and Rural Development) and Dr Douglas McMillan (Green Restoration Ireland). All are welcome to participate in shaping a sustainable strategy for the future of agriculture in a post climate change Ireland.

ENVIRON 2023 ATU Letterkenny

Environ will then formally open on Tuesday 4th April with an opening address by Dr Rick Officer, Vice President for Research and Innovation, John Andy Bonar, Vice President of Research, Equality & External Affairs at ATU and ESAI Chairperson, Liam McCarton. Prof. Rick Relyea will deliver the plenary lecture on Tuesday, entitled "Understanding, predicting and mitigating human impacts for a sustainable future". The second plenary session "Valorisation of waste biomass" will be jointly delivered on Wednesday, 5th April, by several world renowned scientists in the area of sustainability. Prof Vivek Ranade will deliver a talk entitled "Valorising Waste Biomass via Hydrodynamic Cavitation and Anaerobic Digestion" and Prof Peter Robertson will deliver a talk entitled "Photocatalysis for Valorisation of Biomass and Digestate Wastes".

Several interactive events will take place over the two days, including a variety of oral and poster presentations, plenary speakers and social evenings. The ESAI are delighted to announce that this year we have over €3,250 in prizes generously donated by our sponsors. These will acknowledge scientific excellence across a range of disciplines including a prize for best overall poster and oral presentation. Environ 2023 will culminate on the afternoon of Wednesday 5th April with the prizegiving ceremony.

The ESAI wishes to sincerely thank Environ 2023 conference co-convenors Dr. Denis McCrudden, Dr. Christopher McEleney and all their team at ATU Letterkenny for hosting Environ and for assembling a very comprehensive programme. We also wish to thank Ms Sinead Macken for providing excellent administrative support to the event as always and to take this opportunity to acknowledge her support over this and many Environments. Many thanks Sinead.

We look forward to meeting you over the course of the colloquium and look forward to the new science, new technology and new modes of thought which every Environ stimulates.



Liam McCarton
ESAI Chairperson

ENVIRON 2023 ATU Letterkenny

Environ 2023 Organising Committee

Co-Chairs

Dr Denis McCrudden & Dr Christopher McEleney
Atlantic Technological University

Organizing Committee

(ATU Donegal unless
otherwise indicated)

Sinead Macken, ESAI	Liam McCarton, ESAI
John Andy Bonar	Denis McCrudden
Christopher McEleney	Maria Gallagher
Padraig Gallagher	Tara Doherty
Kim McFadden	Frances Lucy, ATU Sligo
John Bartlett, ATU Sligo	

Scientific Committee

(ATU Donegal unless
otherwise indicated)

Denis McCrudden	Christopher McEleney
Robert Coyle	Garrett Farrell
William Scott	Ciaran McLaughlin
Kim McFadden	Charles Young
Andrew McCloskey	Yansheng Hu, ATU Sligo
Heather Lally, ATU Galway	Fiona Kavanagh, ATU Galway
Joao Frias, ATU Galway	Paddy Solan
Gerard McDaid	

Event Team

(ATU Donegal unless
otherwise indicated)

Pádraig McDonagh	Laura McDaid
Matthew McCole	Wesley McCormick
Malikharjuna Rao Sakhamuri	Natasha McHugh
Catrina Rooney	Catherine Griffin
Cormac Harte	Williane Silva
Emma McDaid	Natalia Miotk
Sarah O'Reilly	Jasmine Graham
Abigail Gorman	Nicola Watson, Ulster University

Thanks to the ENVIRON 2023 Sponsors

Thanks to the ENVIRON 2023

CONFERENCE SPONSORS



National Parks & Wildlife Service of



An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

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ATU Letterkenny

3rd – 5th April 2023

33rd Irish Environmental Researchers Colloquium

**"Evidence And Plans Towards
Transitions To A Sustainable Future"**

INFORMATION FOR DELEGATES

ENVIRON 2023 ATU Letterkenny

Registration

The Colloquium Registration Desk will be at the entrance foyer of the Main Campus Building, on the ground floor of ATU Letterkenny Campus. [ATU Letterkenny campus location](#).

The registration desk will be open at the following times;

Monday 3rd April 11:30 – 17:30 and 18:30 – 20:00

Tuesday 4th April 08:15 – 17:15

Wednesday 5th April 08:45 – 12:00

Delegate Badges

Delegates are asked to wear their badges at all times during the colloquium.

Environ Assistants

There will be Environ Assistants in all rooms identified by **Environ T-shirts**. They will be able to assist you with directions, queries or issues. Members of the Organising Committee will also be available for assistance when needed.

First Aid or Emergencies

Contact numbers for emergencies are +353 (0) 74 9186999 and +353 (0) 74 9186007

Security staff are stationed at the reception area on the ground floor.

Fire Alarms

We are not aware of any Fire drills planned for the dates of the conference, so if you hear an alarm, follow the Fire Exit signs until you reach designated assembly areas outside of the building. (Please see the ATU Campus Map under car parking for assembly points.)

Access to Letterkenny Campus

Access to ATU Donegal Letterkenny campus is via Port Road entrance.

We are aiming for a Low Carbon conference and would strongly encourage all participants to come to ATU Letterkenny by public transport, cycling, walking or carpooling.

Locations

Registration	Main Entrance Foyer, ATU Letterkenny Campus
Presentation upload	Main Entrance Foyer Monday 14:00 – 17:00 Tuesday 09:00 – 17:00
Bag Drop	Main Entrance Foyer
Glenveagh Field Trip	Monday meet at the registration desk at 12:00 – Environ event team will escort delegates to the bus
Workshops	Monday Room 1161
Monday Reception	Main Dining Area – 19:00
Public Panel Session	'The implication and solutions of future climate change actions on agriculture' Lecture Theatre 1101
Monday Social Evening	From 10pm McGinleys Bar Letterkenny Town Eircode FN2EN8X
Opening session	Tues Lecture Theatre 1101
Plenary Sessions	Tues & Weds Lecture Theatre 1101
Parallel Sessions	Tues & Weds Lecture Theatre 1102, 1103, 1452, 1166
Posters & Exhibitors	Tue and Weds Main Concourse
Coffee breaks	Tue and Weds Main Concourse
Lunch	Tue and Weds – Main Dining Area & Nurses Canteen
Tuesday Reception and Conference Dinner	19:00-midnight Radisson Blu Hotel Letterkenny
ESAI AGM	Tues 17:30-18:00 Lecture Room 1101

Delegates giving oral presentations

After registering for the colloquium, delegates giving oral presentations should email their presentation to conference@esaiweb.org All presentations for oral sessions should be emailed well in advance of the session in which the presentation is being given (no later than 2 hours before the session begins). Presentation titles should start with the submitting author's surname for easy identification. Presenters are asked to introduce themselves to the session chairs in the assigned session room at least 10 minutes before the session begins.

Delegates presenting posters

The poster presentation area is located in the main concourse. When you arrive at the Registration desk please indicate that you have a poster for presentation and we will guide you to the poster area. Posters can be erected on Monday 3rd April (14:00- 17:30) or on Tuesday morning (09:00-10:30). The first poster session is at 10:45 on Tuesday 4th April. Please do not remove your poster until the end of the poster session at 11:45 on Wednesday. There will be 3 poster sessions throughout the colloquium. To ensure the colloquium delegates can meet poster presenters we would strongly encourage poster presenters to be by their posters for these sessions to answer any questions. Each presenter is assigned a unique poster ID number. Your poster must be mounted on the poster board assigned to your ID.

Wifi Access

Eduroam - Visitors who are registered in an eduroam-enabled institution, and have their devices configured correctly prior to their visit to the University do not require another account.

If you do not have Eduroam then you can request Guest access to the ATU wireless network by following the steps below;

Step1: Click on the wireless icon to reveal networks and click on "Guest"

Step 2: Password will be provided at the registration desk.

Social Media

Please use **#Environ2023**, **@atu_ie** and **@Esai_Environ** for your social media posts during and after the event if you post event material.

ATM

The ATM is located in the main corridor adjacent to the Student Union shop.

Parking

Delegates can utilise car parks P2 and P3 located off the Port Road entrance (please see directional map below).



Conference Dinner

The conference dinner will be hosted in the Radisson Blu Hotel:

Address: Radisson Blu Hotel, Letterkenny Retail Park, Paddy Harte Rd, Letterkenny, Co. Donegal

Phone: +353 (74) 9194444

Eircode: F92 FK15

Useful Taxi numbers

Letterkenny Cabs: +353 (0)74 9127000

Highroad Taxis: +353 (0)74 9127400 or +353 (0)86 2462355

Glencar Cabs: +353 (0)87 6856676

Churchill Cabs: +353 (0)86 19054330



Monday, 3 April		Tuesday, 4 April	
11:30am	Registration (Upload Presentations & Display Posters from 2pm) Main Entrance Foyer	8pm	Public Presentation and Q&A: The Implications and Solutions of Future Climate Change Actions on Agriculture Main Lecture Theatre Room 1101
12pm	Glenveagh National Park Field Trip Main Entrance Foyer	9:30pm	Ceol agus Craic - 'Upstairs at McGinleys'
2pm	Training Analysis & Career Development Lecture Room 1161	8:15am	Registration & Upload Presentations (Poster Set-Up until 10.30am) Main Entrance Foyer
4:30pm	Getting Ready to be a Sustainability Professional Lecture Room 1161	9:15am	Environ 2023 Opening Session Main Lecture Theatre Room 1101
6:30pm	Registration Main Entrance Foyer	9:45am	Plenary Lecture 1 Main Lecture Theatre Room 1101
7pm	Public Reception - Panel Debate Main Dining Area	10:45am	Networking Coffee, Poster Session & Meet the Exhibitors Main Concourse
		11:30am	Sensing Technologies for Climate Change Solutions Lecture Room 1102
			Marine & Coastal Lecture Room 1103
			Carbon Capture - Wetland Management Lecture Room 1452
			Sustainability in Education Lecture Room 1166
		1pm	Lunch Main Dining Area
		2pm	Sensing Technologies for Climate Change Solutions Lecture Room 1102
			From Policy to Practice Lecture Room 1103
			Sustainable Land Use, Agriculture & Food Lecture Room 1452
			Societal Engagement-Working Together Lecture Room 1166
		3:30pm	Networking Coffee, Poster Session & Meet the Exhibitors Main Concourse
		4:15pm	Sensing Technologies for Climate Change Solutions Lecture Room 1102
			Climate in the Balance Lecture Room 1103
			Sustainable Energy Lecture Room 1452
			Water & Wastewater Management Lecture Room 1166
		5:30pm	ESAI AGM & ESAI Postgraduate Researcher of the Year 2022 Award Winner Main Lecture Theatre Room 1101



Environ 2023 - 33rd Irish Environmental Researchers Colloquium 03 - 05 Apr 2023 *All times in IST*

Continued from **Tuesday, 4 April**

7pm

Prosecco Reception by the Piano with Avril
McNamee

Carnegie Ballroom, Radisson Blu Hotel

8pm

Conference Dinner, DJ & Dancing

Carnegie Ballroom, Radisson Blu Hotel

Wednesday, 5 April

8:45am

Registration
Main Entrance Foyer

9am

Welcome Address from ATU President Dr
Orla Flynn

Main Lecture Theatre Room 1101

9:10am

Plenary Lecture 2

Main Lecture Theatre Room 1101

9:35am

Plenary Lecture 3

Main Lecture Theatre Room 1101

10am

Circular Economy

Lecture Room 1102

Water For the Future

Lecture Room 1103

Smart Technology & The Environment

Lecture Room 1452

Flash Presentations

Lecture Room 1166

11 am

Networking Coffee, Poster Session & Meet
the Exhibitors

Main Concourse

11:45am

Circular Economy

Lecture Room 1102

Water Quality & Environmental Monitoring

Lecture Room 1103

Flash Presentations

Lecture Room 1452

Flash Presentations

Lecture Room 1166

12:45pm

Lunch
Main Dining Area

1:30pm

Prize Giving & Close of Environ 2023

Main Lecture Theatre Room 1101

nviron 2023



ATU Letterkenny

3rd – 5th April 2023

33rd Irish Environmental Researchers Colloquium

**"Evidence and Plans Towards
Transitions to a Sustainable Future"**

BIOGRAPHIES

ATU Letterkenny Co-Convenors



Dr Denis McCrudden is a lecturer in Analytical Science and Instrumentation at ATU Donegal teaching on bioscience, pharmaceutical and environment related programs. He leads the electroanalytical research group at ATU Donegal. The group is involved in collaborative projects with QUB, UL, Teagasc and DCU. His research work concentrates on the development of Electroanalytical sensing applications. Research areas include modification of electrode surfaces with metal nanoparticles for use in portable voltammetric sensors and development of screen printed and 3D printed ion selective electrodes.

Applications include; Portable and in-situ determination of heavy metals in freshwater samples, Determination of macro and micro-nutrients in soil & Portable detection in flow injection analysis manifolds. Current projects include; Development of electrochemical sensors for the monitoring of pesticides herbicides and insecticides during semiconductor based photocatalytic degradation of pollutants, Development of portable 3D printed solid state ion selective electrodes for the determination of macro and micronutrients in soil extracts and soil pore water, Development of voltammetric sensors for detection of heavy metals by immobilising ion selective membranes on the electrode surface.



Dr Christopher McEleney lectures in Chemistry and Mathematics at Atlantic Technological University Donegal. Christopher's research primarily focuses on developing low-cost portable analytical techniques. Many of the techniques involve the development of electrochemical sensors using graphitic or graphitic carbon nitride analogues and nanoparticle technology. Other analytical methods developed by Dr Mc Eleney include the automated colourimetric techniques suitable for environmental monitoring.

**Workshop at Environ:
Field Trip to Glenveagh National Park**

Monday 3rd April 2023



Lee McDaid, Conservation Ranger, Glenveagh National Park

Lee McDaid works as a Conservation Ranger in Glenveagh National Park having worked in the NPWS for 20 years. Lee has a particular interest in remote sensing and GIS and is currently working on the remote detection of invasive species such as *Rhododendron ponticum*.



**Andrew Speer, Conservation Officer,
Wild Atlantic Nature Life Project**

Andrew Speer, has been working directly with habitat and species conservation, protection and monitoring in the NW and Midlands of Ireland for 24 years. Prior to his current role in WAN, he was managing a dedicated team of National Park staff and Conservation Rangers in NPWS. He graduated with a BSc in Conservation Management in 1997 and since then with a MSc in Coastal Zone Management in 2011. He is a Donegal native and has always had a passion for the coastal and upland landscapes of NW Ireland.

Sean O' Gaoithin, Head Gardener, Glenveagh Castle

Sean O' Gaoithin has been Head Gardener at Glenveagh Castle since 1995. His training includes a H. Dip. from the National Botanic Gardens, Diploma in Botanic Garden Management from RBG Kew and a Ms AGr Masters from UCD in policy development in Plant Collection Management in Ireland. His specialisms are in Historic Development of Glenveagh, Garden Conservation and Native Flora conservation.

Workshop at Environ: Field Trip to Glenveagh National Park

Monday 3rd April 2023



Susan Callaghan, Divisional Manager, Northern Division in National Parks and Wildlife Service

Susan Callaghan is the Divisional Manager for the Northern Division in the National Parks and Wildlife Service. She has worked with NPWS over the past 25 years in various roles, and has gained a wide range of experience in environmental education, visitor management, enforcement of wildlife legislation, ecological surveys and assessment, project planning and delivery. In her current role she is focusing on the strategic development of NPWS in Donegal and Sligo and the delivery of conservation projects that are visionary, sustainable and inclusive.

The team of Education staff at the National Park will also help host the field trip, with expertise in nature communications and interpretation, science & ecology, outdoor education art and history. The team run the popular nature education programme for schools and are part of the SFI Curious Minds Network, as well as being an accredited Leave No Trace Partner and training provider.



Workshop at Environ: Training Needs Analysis and Career Development Monday 3rd April 2023



Facilitator:

Dr John Bartlett, Head of Research ATU Sligo

Dr John Bartlett is Head of Research at Atlantic Technological University Sligo (previously Institute of Technology, Sligo), responsible for developing a research culture based on scholarship, multi-disciplinarity and collaboration, including the development of policy, strategy, administrative systems, quality assurance, budgets, capital infrastructure and project initiatives with internal and external stakeholders/agencies. Dr. Bartlett was founding Director of the Centre for Sustainability and founder of the Contract Research Unit at IT, Sligo. An environmental scientist, his work has included: sustainability; ecotoxicology; environmental impact assessment; waste management technology; renewable energy technology; public access to environmental information, decision making and justice; and public services innovation. He has been Principal Investigator on a number of large-scale research programmes funded by HEA (PRTL), EPA, EU (INTERREG), and other agencies. Current research includes: support for businesses working in the area of renewable energy and sustainable building technologies; public service systems; innovation in the health and environmental areas; building research capacity in companies in the renewable energy area; and the development of regional energy security/independence. He has worked with a number of agencies to contribute to regional and national policy development in Ireland in the areas of sustainability, public services and health innovation.

**Workshop at Environ:
Getting Ready to be a Sustainability Professional Monday 3rd April 2023**



**Facilitator:
Dr Paul Bolger, Manager of Environmental Research
Institute, UCC**

Dr Paul Bolger is a Manager of the Environmental Research Institute at UCC. He has worked across academia, industry and government for over 25 years developing long term research solutions for global sustainability challenges. He is currently principal investigator on a number of research projects on climate change and the circular economy. He teaches a module on Leadership for Sustainability as part of the HDip for Sustainability in Enterprise for at UCC. He is a PI on the UCC Sustainable Futures programme which is focused on education and training for climate action, environmental sustainability, and achieving net zero in industry and enterprise, and delivers CPD training workshops to industry on sustainability leadership. Dr Bolger is a US-Ireland Fulbright Scholar and a member of the European Environment Agency EIONET Foresight Group developing knowledge, skills and methodological expertise on futures' analysis.

Public Session and Q&A Discussion: The Implications and Solutions of Future Climate Actions on Agriculture

Monday 3rd April 2023



Chairperson: Dr Edna Curley

Dr Edna Curley is the Head of Centre (Principal) at Mountbellew Agricultural College and Farms. Edna comes from a strong agricultural background and is actively involved in the management of a home farm for over 20 years. She graduated with a B.Agr.Sc.(Hons) in Agricultural Science-Animal and Crop Production in 2004 from University College Dublin. Edna followed her undergraduate studies with a MSc. (Research) in Crop Production in 2006 and a PhD (Biomass Production and Water Quality) in 2010 both from University College Dublin at Lyons Estate. From UCD, Edna moved to the National University of Ireland Galway to undertake a number of postdoctoral studies and was involved in the establishment of the MSc. Climate Change, Agriculture and Food Security programme. Edna became Principal of Mountbellew Agricultural College in 2019 with a vision to further establish Mountbellew College and Farms as a training and research facility with emphasis on biodiversity, conservation and sustainable production.



Speaker 1: Dr James Moran

Dr James Moran is a senior lecturer in Biology and Ecology in The Department of Natural Resources and the Environment at the Atlantic Technological University, Galway. He leads the Agro-ecology and Rural Development (ARD) research group which concentrates on sustainable agricultural systems with a particular focus on the Common Agriculture Policy and improving agri-environment policy and practice. He is particularly interested in the potential of innovative local partnerships to realise a sustainable future for their area. Current projects include a range of national and international

collaborations on EU LIFE Projects; EU Erasmus plus - Innovation Education for Sustainable Development in Peripheral Rural Areas; Design of agri-environment schemes both in Ireland, the UK and Europe; Farmland and Forestry Systems for Biodiversity; and collaborations with a range of European Innovation Partnership operation groups across Ireland. He is a member of the National Biodiversity Forum; a member of the Expert Advisory Group of the Citizens' Assembly on biodiversity loss; and board member of European Results Based Payments Network. He is a cofounder and executive committee member of the Farming for Nature not-for-profit initiative established in 2018.

**Public Session and Q&A Discussion:
The Implications and Solutions of
Future Climate Actions on Agriculture**

Monday 3rd April 2023

Speaker 2: Dr Douglas McMillan



Dr Douglas McMillan has a PhD in Environmental Science part of which focused on the ecology and water quality of Abbeyleix Bog before its restoration. He has over 25 years of combined experience in academic research, consultancy, environmental monitoring and training in the fields of ecology, environmental science, EHS, laboratory, carbon, energy, sustainability and quality management systems and auditing. He founded the Green Restoration Ireland cooperative in 2019 (<https://greenrestorationireland.coop>) which helps landowners restore damaged peatlands and improve other habitats in the farmed landscape. He is Project Manager of the Farm Carbon European Innovation Partnership (EIP) (<https://farmcarbon.ie>) which is working with farmers in the Midlands to find sustainable solutions to reduce the environmental impact of peat pastures which are one of Ireland's biggest sources of greenhouse gases, as well as other measures to enhance farm biodiversity and environmental performance. As part of this work, GRI are developing an Irish Peatland Code to provide a means of financing the mammoth task of restoring over 1 million hectares of degraded Irish peatlands and are setting up paludiculture trials to research crops for the sustainable wetland agriculture of the future. The findings of this research will provide policy recommendations for sustainable peat-based agriculture in Ireland.

Speaker 3: Paul O'Brien, Irish Farmers Association



Mr. Paul O'Brien is a sheep and tillage farmer based in County Kilkenny. He has held many roles within the IFA including County Secretary and County Vice Chairperson. He became the Chairperson of the Nation Environmental and Rural Affairs Committee, 2020.

The Committees workload includes environmental policy, infrastructure, rural affairs, renewables, and he is the Smart Farming Programme Leader. Other policy directions that the committee focuses on include the nitrates directive, water quality, sectoral targets on agriculture and the transition of farmers from carbon to meet climate targets.

Mr. O'Brien is Vice Chair of the Copa-Cogeca Working Party on Environment. Furthermore, within Copa-Cogeca Mr. O'Brien is the Chairperson of the Taskforce on Biodiversity, Soil and Water.

He is a delegate on An Forum Uisce and is the farmers representative on the Bord of Directors on the Irish Farm Films Producers Group.



Speaker 4: Colm Markey

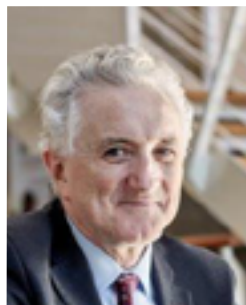
Colm Markey is a Member of the European Parliament representing the constituency of Midlands North-West. A farmer and businessman by background, Colm has a seat on the Parliament's Committee on Agriculture and Rural Development and was involved in negotiations on the new Common Agricultural Policy. As a former national president of Macra Na Feirme (2005-2007) he was responsible for negotiating on behalf of 8,000 members at both Government and European level. Colm is a believer in politics which brings accountability, minimises waste and inefficiency and seeks to bring a high level of debate to the public and is also deeply committed to ensuring that he represents his constituents and Ireland's best interests on these and other vital issues as an MEP.



**Vice-President for Research and Innovation
Atlantic Technological University
Dr Rick Officer**

Dr Rick Officer was appointed GMT's Vice President for Research and Innovation in January 2016, having joined GMT in 2008 as a Senior Lecturer in the School of Science. Dr Officer's prior experience was gained as Science Leader for the Queensland Government's Fisheries and Aquaculture Research, with responsibility for the coordinated management of the State's Research, Development and Extension Programme, and as leader of research and assessment teams for Ireland's

Marine Institute and Australian government agencies in Tasmania and Victoria. Dr Officer's research has focussed on enabling sustainability and improving productivity of harvested natural resources. He has extensive experience as Co-ordinator, Principal Investigator and Co-investigator on competitively funded national and international research projects and programmes. Dr Officer's philosophy is that excellent, innovative and high impact research is best delivered when the clients of project outcomes are at the core of research and innovation activity. Dr Officer holds Bachelor of Science and PhD degrees from the University of Melbourne, a Postgraduate Certificate in Third Level Learning and Teaching (Dublin Institute of Technology), and an MBA in Higher Education Management from University College London.



**Vice-President for Research, Equality & External Affairs ATU Donegal
John Andy Bonar**

Mr JohnAndy Bonar has almost 40 years experience in the public and private sectors having held director level positions in both sectors in the UK and Ireland. He is currently Vice President for Research, Equality and External Affairs at ATU Donegal and holds University-wide responsibility for Internationalisation. John Andy is a Director of 3 not-for-profit Community and Sporting organisations. He holds a significant number of Regional, Cross-Border and National representational roles on behalf of ATU. John Andy is a graduate of NUI Galway with an Honours Degree in Commerce

and an Honours Master's Degree in Regional Economics as well as a number of other continuing Professional Development qualifications. At ATU Donegal since 1990, John Andy was previously a Lecturer in Business and Head of School of Business before assuming his current role in 2007.

Opening Event

Tuesday 4th April 2023



Environmental Sciences Association of Ireland Chairperson
Liam McCarton

Liam McCarton is a Chartered Civil Engineer and lecturer in TU Dublin, leading the Development Technology in the Community Research Group. He previously worked in International Development managing major infrastructure projects in Ireland, Africa, South America and Asia. His current research focus is integrating Nature Based Solutions for resilient cities and communities. Liam has co-authored a number of books including "The Worth of Water", "A Technology Portfolio of Nature Based Solutions for Innovations in Water Management" and "Where There Is No Engineer - Designing for Community Resilience". Liam is a Director of Engineers Without Borders Ireland and leads their Innovation Academy and Development Education programs.

Plenary Session Keynote Speaker

Tuesday 4th April 2023



Rensselaer Polytechnic Institute, New York
Prof Rick Relyea,

Prof Rick Relyea is a Senior Endowed Professor at Rensselaer Polytechnic Institute in NY (USA). His research focuses on understanding natural and anthropogenic environmental stressors by integrating the fields of ecology, evolution, and ecotoxicology. For the past 8 years, he has served as the director of the Darrin Fresh Water Institute and the director of The Jefferson Project, which is a technologically advanced initiative using sensor networks, AI/Machine Learning, and computer models to understand and predict human impacts on aquatic ecosystems. He also communicates science to the public using popular media and collaborations with artists and of computer game designers to create virtual and augmented realities of environmental worlds. He has published more than 200 peer-reviewed journal articles and 13 textbooks in the fields of Biology, Ecology, and Environmental Science.



Sensing Technologies for Climate Change Solutions **Prof Ken Whelan**

Prof Ken Whelan has worked for several fisheries research organisations in Ireland and was a Director in the Irish Marine Institute from 1999 to 2009. He served as President of the North Atlantic Salmon Conservation Organisation (NASCO) from 2004 to 2008. As President, he helped to initiate and manage the ground-breaking SALSEA or Salmon at Sea Programme. He was Chairman of the International Atlantic Salmon Research Board from 2007 to 2011 and serves as Chairman of the Scientific Council of the Loire Basin Salmon Restoration Programme. Ken is a Vice President of the Atlantic Salmon Trust, where, until recently, he served as Research Director. He is also an Adjunct Professor in the School of Biology and Environmental Science at University College Dublin. Ken runs his own fisheries and environmental consultancy. Over the past decade he has worked extensively with a range of community and other interest groups, training them to nurture and monitor, as citizen scientists, their local water bodies. (<http://www.kenwhelan.info/>).



Marine & Coastal **Maurice Clarke, Marine Institute**

Maurice Clarke is the lead for marine ecosystems and biodiversity at the Marine Institute. He has overall responsibility for biodiversity assessments in support of Ireland's biodiversity reporting obligations under the EU Marine Strategy Framework Directive (MSFD) and the OSPAR Convention on the marine environment of the northeast Atlantic. This work encompasses assessing the impact of incidental fisheries by-catch of protected and endangered species, of fish population (commercial and non-commercial) status, marine food-webs, of pelagic and benthic biodiversity and of seafloor integrity. After completing a Ph.D. for research into fisheries impacts on deep-water sharks in 2000, he worked in population assessment and advice of commercial fish, being an advisor to national and EU government. He was Irish representative on the International Council for the Exploration of the Seas (ICES) Advisory Committee, 2009-2018. Working extensively with industry and NGO stakeholders he developed science-based management plans for several commercial fisheries. Since 2017 his focus has been on developing assessments and advisory products to support international obligations under marine biodiversity. He maintains a research interest on endangered sharks. Maurice's keynote introduces the MSFD, demonstrating how it provides an essential framework for assessing human impacts on the marine environment, encompassing biodiversity, contaminants and physiography.



Sensing Technologies for Climate Change Solutions
Dr Margaret McCaul, Dublin City University

Dr Margaret McCaul is currently an Assistant Professor in Analytical Chemistry at Dublin City University, PI at National Centre for Sensor Research and Funded Investigator at the INSIGHT Centre for Data Analytics. Margaret received her BSc in Analytical Chemistry at the Limerick Institute of Technology and her PhD in Analytical Geochemistry from Dublin City University. She has over ten years industrial experience in the area of analytical chemistry and has held post-doctoral positions in science education and geochemistry, before taking a senior position as team leader in sensor integration and microfluidics in the adaptive sensors group at DCU. Her current research focuses on novel sensor development from functional materials to innovative devices which comprises several distinct strands of research including: Analytical chemistry, environmental chemistry, 3D (micro-)fabrication technologies, materials chemistry, data analytics and remote sensing.



From Policy to Practice
Mr John Daly, Northern and Western Regional Assembly

John Daly has worked as a Senior Economist over the past decade in both the private and public sector. In 2021, John became the Economist of the Northern and Western Regional Assembly. Such a role involves undertaking economic research relating to regional development, supporting the implementation and monitoring of the Regional Spatial and Economic Strategy of the Northern and Western Region and assisting the elected members of the Assembly. Prior to his time in the Assembly, John worked as the joint Economist of the three Regional Assemblies of Ireland and as a Senior Economist in DKM Economic Consultants and EY Economic Advisory Services.



Sustainable Land Use, Agriculture and Food

Prof Fiona Doohan, University College Dublin

Prof Fiona Doohan is a Lecturer in Molecular Plant Pathology at UCD and is a Principal Investigator on several major national and international research initiatives, including CONSUS, Food Shield and Healthy Oats and the EU project INNOVAR. Fiona's expertise and research focuses on biocontrol's, crop science, fungal-pathogens, microbial disease, and plant science. As a crop scientist her research is focused on improving the sustainability of crop production systems in Ireland and globally, and enhancing the diversification, safety, and transparency of Irish food systems. She has secured over €30 million in research funding to date and is listed as one of the top 100 Irish Women in Science, Technology, Engineering and Maths. Fiona is also a recipient of the 2021 NovaUCD Innovation Award and the Enterprise Ireland Champion of Research awards.



Societal Engagement

Dr Elizabeth Burton, UCD Earth Institute

Dr Elizabeth (Liz) Bruton is Communications and Engagement Officer at the UCD Earth Institute. Liz's work has a strong societal engagement element including the newly established UCD citizen science community of practice, the Earth Institute Citizens' Observatory, and the ECOBROKER platform and programme of events. Liz has a background in science communication, public engagement and history of science. She has previously worked at the Science Museum, London, University of Manchester, University of Oxford, and University of Leeds. Liz's work bridges the gap between academia and the public, communicating academic research to different audiences and engaging new communities.



Sensing Technologies for Climate Change Solutions **Prof Diarmuid Diamond, Dublin City University**

Prof Diarmuid Diamond received his Ph.D. (Chemical Sensors) and D.Sc. (Chemical Sensor Networks) from Queen's University Belfast. He was Vice-President for Research and director of the National Centre for Sensor Research (www.ncsr.ie) at DCU and a Principal Investigator with the SFI funded Insight Centre. He was awarded the inaugural silver medal for Sensor Research by the Royal Society of Chemistry London (2002) and the Boyle Higgins Gold Medal by the Institute of Chemistry of Ireland (2015). He was admitted to Membership of the Royal Irish Academy (2014) and awarded an honorary Doctorate by Ulster University (DLitt) in 2018 for contributions to culture and heritage. In June 2019, he was appointed member of the high-level European Innovation Council (EIC) Pilot Advisory Board and was appointed chair the EIC Pathfinder Working Group.

He is currently Field Chief Editor for the journal "[Frontiers in Sensors](#)" and consulting projects manager with Siemens-Healthineers, Walpole, Massachusetts. His research has ranged from the fundamental science of stimuli responsive polymers, the development of futuristic autonomous chemical sensing platforms (environmental and health applications), and the use of analytical devices and sensors as information providers for wireless networked systems. See https://www.researchgate.net/profile/Dermot_Diamond



Sustainable Energy **Irene Ward, Sustainable Energy Authority Ireland**

Irene Ward works on the delivery of the SEAI National Energy Research, Development and Demonstration (RD&D) Funding Programme, which supports innovative energy RD&D projects that contribute to Ireland's transition to a clean and secure energy future. Irene is an experienced project manager with over twenty years' experience working in academia, industry and community development. She holds a BSc Geography, MSc Management, PGCE and is completing an MSc in Environmental Sustainability.

ESAI AGM



Guest Speaker: ESAI Postgraduate Researcher of the Year 2022

Larissa Macedo Cruz de Oliveira, University College Cork

Larissa Macedo Cruz de Oliveira is a PhD candidate at University College Cork, funded by the Irish Research Council Government of Ireland Postgraduate Scholarship and the Science Foundation of Ireland. She graduated with a Bachelor's in Geology from Universidade Federal de Sergipe and Technical Degree in Information Technology from Instituto Federal de Sergipe, Brazil. Her current research interests include Geographical Information systems (GIS), seabed habitat mapping, computer vision, machine learning, cold-water corals and deep-water habitats.

Larissa has developed her PhD project entitled "Advancing seabed mapping techniques for deep-water habitat classification in Submarine Canyons" supervised by Dr Aaron Lim (Department of Geography, UCC), Professor Andy Wheeler (School of Biological, Earth and Environmental Sciences, UCC) and Professor Luis Conti (University of Sao Paulo USP, Brazil). Larissa's PhD aimed to leverage the potential of multidisciplinary research in marine sciences, remote sensing and artificial intelligence (AI) to map CWCs habitats in vulnerable marine areas. To this end, Larissa used computer vision techniques such as Structure-from-Motion 3D photogrammetry to i) develop an unprecedented 3D imaging classification workflow for vulnerable CWC habitats ii) analyse the transferability of 2D and 3D data to represent these habitats; iii) develop new visualisation methods for 3D data of underwater environments to promote ocean literacy and iv) advance seabed mapping techniques to provide fine-scale information to environmental marine policy-makers.

Throughout her PhD, Larissa published in journals such as *Frontiers in Marine Sciences*, receiving the Delap Bronze Award for the best-peer-reviewed publication of the School of BEES and securing 11 travel and research grants. Larissa has disseminated her research at 15 national and international conferences and participated in eight marine research expeditions to the North Atlantic. Larissa has divided her time between her PhD research and being the Postgraduate Representative of the School of BEES Equality, Diversity, Inclusion and Wellbeing (EDIW) committee as well as Student Ambassador of UCC Campus Connect. She has also been part of the organising committee of the Irish Geosciences Early Career Symposium and is a member of the UCC Marine Geosciences Research Group.



Opening Welcome

Dr Orla Flynn, College President, ATU Letterkenny

Dr Orla Flynn was appointed inaugural President of Atlantic Technological University in April 2022, having served two years as President of Galway-Mayo Institute of Technology. Prior to this Dr Flynn was Vice President for External Affairs at Cork Institute of Technology (CIT) for six years, and previous academic leadership roles in CIT included Head of CIT Crawford College of Art & Design and Head of School of Humanities. Dr Flynn commenced her academic career as a Lecturer in Computer Science, holding undergraduate and postgraduate qualifications in Mathematical Physics and Computer Science from University College Cork, an MA in Management in Education from Waterford Institute of Technology, and a PhD from the Kemmy Business School at the University of Limerick. She is a current Director on the Board of HEANet and has previously held Director positions on both Cork and Galway Chambers of Commerce.



Keynote Speaker 1

Prof Peter Robertson, Queens University Belfast

Prof Peter Robertson is Professor of Energy and Environmental Engineering at Queen's University Belfast. His particular expertise is in the area of photocatalytic technology for both energy and water sustainability. This work has encompassed basic research on photocatalysis through to pilot processes development for water treatment and for solar energy conversion and storage. Prior to joining QUB in 2015 Peter spent nearly 20 years at Robert Gordon University in Aberdeen initially as a lecturer then as Chair of Energy and Environmental Engineering and ultimately as Vice-Principal and Pro Vice-Chancellor (Research and Academic Support Services). Peter is a member of the Engineering and Physical Sciences Research Council (EPSRC) Strategic Advisory Network and the SUPERGEN High Level Group. He was a member of as well as EPSRC's Scientific Advisory Committee on Energy between 2018 and 2022. Peter was also a member of sub Panel 8, Chemistry for REF2021. He is a member of the editorial board of Journal of Physics Energy, Photochem, ICE Energy and an Invited Editor of The Handbook of Environmental Chemistry Series Published by Springer Verlag, specifically co-editor of Volumes II and III on Environmental Photochemistry.



Keynote Speaker 2

Prof Vivek Ranade, University of Limerick

Prof Vivek Ranade is a Bernal Chair of Process Engineering at Bernal Institute, University of Limerick, Ireland. Vivek leads 'Multiphase Reactors and Process Intensification' group that uses experiments, modelling and reaction engineering to generate new insights in multiphase flows, reactors and process intensification. The group is developing fluidic devices, MAGIC (modular, agile, intensified and continuous) processes and 'factory in a box' platforms. These innovations and intensification strategies are being used for realising resource conservation, decarbonisation, and valorisation of waste (for prosperity of planet). Contributions in MAGIC processes, mixing, emulsions and crystallisation are being used to realise better health care and nutrition and personal care products for enhanced wellbeing (of people). Before moving to Ireland, Vivek led chemical engineering research at CSIR - National Chemical Laboratory (NCL) and developed solutions, products and processes for variety of applications. Vivek has also worked at ETH, Zurich; TU Delft and University of Twente, The Netherlands. Vivek has published more than 200 papers, more than 20 patents (granted/ filed) and 9 books. Vivek has Co-founded two technology companies: Tridiagonal Solutions (www.tridiagonal.com) and VIVIRA Process Technologies (www.vivira.in). Vivek is an Associate Editor of 'Industrial & Engineering Chemistry Research' and Deputy Editor of 'ACS Engineering Au'.



Circular Economy

Prof Michael Morris, Amber SFI

Prof Michael Morris graduated with a PhD from Liverpool University in 1982. His PhD focused on the movement of atoms on surfaces to form ordered arrangements. After a post-doctoral fellowship at Imperial College in London he moved to Strathclyde University focusing on insitu surface reaction studies. Prof. Morris took an ICI endowed lectureship at Cardiff University before moving to ICI as where he was instrumental in the development of catalysts used to promote low temperature oxidation and reduce greenhouse emissions in turbines and combustion chambers. He

was appointed to a post in Materials Chemistry at University College Cork in 1993 to develop materials science in the University. Prof. Morris moved to Trinity and the School of Chemistry in 2015 to lead the SFI funded research centre AMBER. His work has remained focused on self-assembly and phase separation in polymers and the use of polymer materials in modern society. As well as his long term interest in self-assembling systems, Prof. Morris has developed a keen interest in the circularity of modern plastic technologies and how the adverse effects of polymers can be avoided through proper use., Prof. Morris has authored over 500 peer reviewed papers and more than 20 patents. Prof. Morris is a member of the ISO 323 Committee drafting standards for the transition to a circular economy.



Smart Technologies and The Environment

Dr Nathan Skillen, Queen's University Belfast

Dr Nathan Skillen is currently a Lecturer in the School of Chemistry and Chemical Engineering at QUB, where he is the Programme Director for the MSc in Net Zero Engineering. He has previously held a fellowship with the UKRI Supergen Bioenergy Hub, which focused on the development of photocatalytic technology for biomass reforming. He received his BSc (Hons) in Molecular Biology with Biosciences from Robert Gordon University before completing his PhD in Chemical Engineering at the same institute and in collaboration with the University of St. Andrews and California

Institute of Technology. His post-doctoral work has focused on photocatalytic technology development for a range of applications centred around environmental remediation and energy production. He has published several research articles and book chapters and currently sits on the international editorial board of Biomass & Bioenergy (Elsevier). More important than all of that, however, he was part of a team of 10 researchers from across the UK that created the first graphic novel on Bioenergy.

ESAI Student Competition 2023

The ESAI will be judging all student oral and poster presentations for consideration in this years student competition. All winners will be invited to submit an article on their research project to the ESAI Website and the ESAI E-Zine 'Environews'. Results will be announced at the prize giving ceremony at the close of conference at 13:30-14:15 on Wednesday 5th April. Best of luck to everyone!

The prizes and categories this year are:

- ESAI Best Oral Presentation (€500) sponsored by Environmental Sciences Association of Ireland
- ESAI Best Poster Presentation (€250) sponsored by Environmental Sciences Association of Ireland
- Best Wastes & Resources Management Presentation (€250 & 12 month CIWM student membership) sponsored by Chartered Institution of Wastes Management (CIWM)
- Best Water Related Presentation (€250) sponsored by Chartered Institution of Water and Environmental Management (CIWEM)
- Best Ecology Presentation (€250) sponsored by Chartered Institute of Ecology and Environmental Management (CIEEM)
- Best Social Engagement Presentation (€250) sponsored by Environmental Services Ireland
- Best Natural History Presentation (€250) sponsored by Irish Naturalists' Journal
- Best Sensors Related Oral Presentation (€250) sponsored by Frontiers in Sensors Journal
- Best Organic Waste Recycling Presentation (€250) sponsored by Foster Environmental Ltd
- Best Sensors Related Poster Presentation (€250) sponsored by Frontiers in Sensors Journal
- Best Analytical Chemistry Poster (€250) sponsored by Eurachem Ireland
- Richard Fitzgerald Memorial Prize Best Aquatic Environment Poster (€250) sponsored by AquaTT

Dr. Richard D. Fitzgerald



Richard was an exemplary fisheries zoologist. He was an excellent researcher and a gifted and inspiring lecturer. A UCC graduate [BSc and PhD], Richard was involved research and development in Aquaculture for almost 30 years in a variety of roles and posts in UCC, AquaTT and NUIG. He was also extremely interested in natural freshwater and marine fish populations, with a rare and extensive knowledge in both aquatic environments developed over the span of his career. He published over thirty peer reviewed publications, which are widely cited. Until the end of 2015, he was Research Co-ordinator and manager of the NUIG aquaculture research lab at Carna.

Richard was blessed with an insatiable curiosity about all research, particularly in the aquatic environment and the highlight of his annual visit to Environ was the poster sessions. His rule of thumb for all his students and employees was that they could go to any relevant conference as long as they produced a poster! Richard sadly passed away on December 5th 2016. Thank you to AquaTT for sponsoring the Richard Fitzgerald prize for best poster in Aquatic Environment.



ESAI ANNUAL REVIEW 2022

ESAI Chairpersons Address from Liam McCarton



2022 was a busy year for the Environmental Sciences Association of Ireland (ESAI). This end of year report summarises some of the key events and activities throughout the year.

Environ 2022: The highlight of the year was our Environmental Researchers Colloquium (Environ). The 2022 Environ conference was hosted in collaboration between the ESAI and Ulster University in their impressive new state of the art Belfast city centre campus. This was our first in person conference since the Covid19 pandemic. This Environ focused on the theme of "Unlocking Sustainability". The event took place from the 20th – 22nd

June 2022. Environ 2022 commenced on the afternoon of Monday 20th June with a series of interactive workshops and field trips.

A public event on Monday evening focused on "Ireland towards the Net Zero Challenge". The aim of this public event was to foster an awareness of the links between green politics, net-zero energy technologies and bio-diversity in Ireland.



Environ was then formally opened on Tuesday 21st with an opening address by Prof Paul Seawright, Deputy Vice Chancellor of Ulster University, Tim Brundle, Directory of Research & Impact at Ulster University, Liam McCarton Chairperson of the ESAI, and Prof. Jane Stout of Trinity College Dublin. The plenary lecture on Tuesday was delivered by Prof. Jane Stout who focused on "Climate Change and Biodiversity in Ireland". The plenary lecture on Wednesday was delivered by Prof. Neill Hewitt who presented on "Emerging Technologies towards Net Zero". Several events took place over the two days, including a variety of oral and poster presentations, plenary speakers and social evenings. This year we also had two "Flash Presentation" sessions on Wednesday which were designed to be rapid dynamic sessions offering poster presenters an opportunity to bring their research to life. Environ culminated on Wednesday 22nd with our prizegiving ceremony.

Annual Review 2022

On behalf of all the team at ESAI we would like to acknowledge and sincerely thank Environ 2022 conference co-convenors Dr Pilar Fernandez-Ibanez, Prof. Tony Byrne and all the Ulster University team for hosting Environ and for assembling a very comprehensive programme. We also wish to thank Ms Sinead Macken for providing excellent administrative support to the event as always.



ESAI Prizegiving

The quality of research presented at Environ 2022 was exceptional with 83 oral presentations, 44 poster presentations, 127 abstracts and 175 delegates over the three days. The fact that the vast majority were delivered by young scientists and engineers bodes well for the future of environmental sciences in Ireland. Congratulations to all the winners in the ESAI Environ Student Presentation competition which featured nine awards this year. Special mention to Wahaj Habib, TCD who won the ESAI best oral presentation for his work entitled "Mapping vegetation communities on Irish raised bogs using PlanetScope imagery and Google Earth Engine" and Laura McDaid, ATU Donegal for her work on "Irish Faba Beans as a sustainable food source".



2022 Nominees to the ESAI Honours List

The 2022 ESAI honours list acknowledged the contribution of two members, Prof Emeritus John Breen and Prof Emeritus Richard Moles both formerly of University of Limerick. This was to acknowledge the joint contribution of both members who contributed greatly to the success of both the ESAI, Environ and indeed have been at the forefront of environmental research, debate and policy in Ireland for over 30 years.



ESAI 2022 nominees to the honours list, Prof Emeritus John Breen and Prof Emeritus Richard Moles

Annual Review 2022

ESAI Researcher Awards

At the heart of great science lies a creative and moral instinct to explore and to question in order to create a better world. ESAI continue to recognise the excellence of young researchers in this regard at both undergraduate and postgraduate level. Larissa Macedo Cruz de Oliveira from University College Cork (UCC) is the winner of the prestigious ESAI Postgraduate Researcher of the Year Award 2022. Larissa's research focused on advancing seabed mapping techniques for deep-water habitat classification in submarine canyons and cold-water coral habitats (ASMAT). Cold-water coral (CWC) reefs are complex structural habitats that represent one of the most important deep marine ecosystems. This research explored computer vision techniques to further understand CWC habitats in marine protected areas. This year the ESAI has decided to acknowledge the extremely high standard of competition by acknowledging a second researcher who was of exceptional standard but just missed out on the overall prize. Postgraduate Researcher of the Year Highly Commended 2022 is Elena Zioga, a researcher based in Trinity College Dublin (TCD). Her novel research is focused on characterising pesticide residues in floral resources for bees.

ESAI HEI Undergraduate of the Year Award 2021/2022

ESAI and our sponsors continue to recognise the excellence of young researchers through our Undergraduate of the Year Awards. This was the 6th year of the competition with 13 nominations from 11 colleges.

The 2020/2021 Winners were: Eunice Wong (Level 8, MTU Cork), Sean Og Quinn (Level 7, MTU Cork), Emma Stempel (Level 8, ATU Galway), Harry Reynolds (Level 8, ATU Sligo), Helen Burke (Level 8, DCU), Finbar McCann (Level 8, NUI Galway), Thomas Peters (Level 8, TUS Thurles), Erin Driscoll (Level 8, UCC), Grace Donald (Level 8, UCD), Jessy Fong (Level 8, SETU Waterford), Roisin Gowen (Level 8, TCD), Shane O'Neill (Level 8, SETU Carlow), Magdalena Ciuchta (Level 7, SETU Carlow).



ESAI Undergraduate of the Year Winners

Postgraduate Research Network

2022 saw the launch of our young postgraduate research network. One of the initiatives suggested by this forum was to create a newsletter to showcase the work of different researchers. The first inaugural newsletter was launched in May 2022 highlighting the inspiring research currently being carried out by 8 of our early-stage researchers including UCC's Irene O Callaghan, who had just being named ESAI Postgraduate Researcher of the Year 2021. We welcome all interested researchers to participate in this forum.

Annual Review 2022

EPA funded Grassroots Award Scheme

The grassroots award, sponsored by the Environmental Protection Agency (EPA), has funded a total of eight successful workshops since 2015. The ESAI are delighted to announce that the EPA have announced that they are to support another four workshops under this scheme. Special thanks to the EPA for their continued support. Details of the scheme can be accessed on our website www.esaiweb.org. You can also access videos from previous winners Daiti Kelleghan and Melanie O'Driscoll detailing how important this scheme was to their research careers.

ESAI Communications

ESAI members are the core of the organisation, and the communications team is lead by Dr. John Gallagher, TCD. We welcome your input and participation through our social media channels whether through our Listserver, LinkedIn, Facebook, Twitter or by subscribing to our Newsletters. At the end of 2022 the ESAI had 802 members, comprising of 170 full members and 632 student members.

Social media reach has increased on social media platforms during 2022 with increases of 3.0% (+282) LinkedIn connections, 4.2% (+137) Twitter followers, and 5.3% (+128) Facebook friends. A reduction in listserver subscribers, with a drop of 8.6% (-155) receiving emails. In 2022, the Comms Team continues to review ways to streamline communications. We have not implemented any changes this year, as we want to ensure best value before website evolution.

ESAI Council Meetings and AGM

The ESAI held a total of 3 council meetings during 2022. The AGM was convened to coincide with Environ 2022 and was held on the 21st June 2022. Prof Tasman Crowe UCD and Prof Anne Morrissey DCU stepped down with nobody new joining. Postgrad of Year 2021 Irene O'Callaghan joined us to give a short presentation on her research.

The Council wish to sincerely thank ESAI administrator, Sinead Macken, for her excellent work, dedication and support over the past year with all our diverse activities.

On a personal level, as I step down from my position as chair of the ESAI I would also like to acknowledge the passion, professionalism and commitment of the entire ESAI council during the past few years. I would like to wish the incoming chair, Niamh Power from Munster Technological University success in the role.



Liam McCarton, ESAI Chairperson

Liam is a member of the Development Technology with the Community (DTC) Research Group at TU Dublin and Director of Engineers Without Borders Ireland.

Making the most of your membership

Benefits of Membership

By becoming a member of ESAI, you will also have access to:

- Discounted rates at Environ, the annual Irish Environmental Researchers Colloquium, one of the major activities of the Association. It is now one of the largest national scientific meetings in Ireland attracting over 300 delegates each year.
- Discounted rates for selected workshops, seminars, further education courses and conferences.
- Access to ESAI listserv
- Eligibility to apply for ESAI Postgraduate Researcher of the Year Award
- Eligibility to apply for ESAI Undergraduate Researcher of the Year Award
- Eligibility to apply for ESAI Grassroots Workshop Funding
- Learn from others and absorb best practice
- Raise the profile of you and your business
- Stimulate new business opportunities
- Innovate and commercialise new products and services
- Members of ESAI will receive free-of-charge E-Newsletters, Environews.
- Sponsorship opportunities

Handy Links For Staying Informed

- Find out more about ESAI Goals and Objectives
<https://www.esaiweb.org/home/about-us/>
- Keeping in touch with the ESAI
<https://www.esaiweb.org/stay-connected/>
- Further information on ESAI Code of Ethics and Constitution
<https://www.esaiweb.org/home/our-policies/>

ENVIRON 2023 ATU Letterkenny

2022 Events

Date	Event
February 28th	ESAI Grassroots Workshop Support Scheme Sponsored by EPA – Rolling Call
April 4th	ESAI Environews Spring Edition available
April 30th	ESAI Grassroots Workshop Support Scheme Sponsored by EPA – Rolling Call
May 25th	ESAI Environews First Postgraduate Research Edition available
June	ESAI Undergraduate of Year Awards 2021/2022 Review with HEI's commences
May 25th	ESAI Environews First Postgraduate Research Edition available
June 20th – 22nd	Environ 2022 – 32nd Annual Irish Environmental Researchers Colloquium Ulster University, Belfast
June 21st	ESAI AGM 2022 (held in conjunction with Environ 2022) All members welcome
June 21st	Announcement of ESAI Honorary Members 2022 Environ 2023 Conference Dinner, Prof Richard Moles UL and Prof John Breen, UL
June 30th	ESAI Grassroots Workshop Support Scheme Sponsored by EPA – Rolling Call
August 31st	ESAI Grassroots Workshop Support Scheme Sponsored by EPA – Rolling Call
September 30th	Undergraduate Membership Offer Free Membership for all Undergraduate Members Scheme Rolled Out
October 31st	ESAI Grassroots Workshop Support Scheme Sponsored by EPA – Rolling Call
November 3rd	ESAI HEI nominated Undergraduate of Year 2021/22 Announcements and presentation of certificates (by post!)
December 31st	ESAI Grassroots Workshop Support Scheme Sponsored by EPA – Rolling Call
December 31st	ESAI Postgraduate Researcher of Year Award Closing date for applications

ENVIRON 2023 ATU Letterkenny

ESAI INCOME AND EXPENDITURE ACCOUNT 2022

ESAI Income and Expenditure Account	€	€
For the year ended 1 January 2022		22,408
Opening balance as 01/01/21		
Income	€	€
Membership	2,215	
Ew\$2022	5,432	
Environ 2022 – Delegate Fee	24,697	
Environ 2022 - Sponsorship	20,895	
Environ 2021 – Delegate Fee	1,770	
Environ 2021 - Sponsorship	1,500	
Environ 2019 - Sponsorship	500	
Environ Prizes	1,500	
Write off - Reverse	2	
Total Income	58,011	
Expenditure	€	€
Environ 2022	33,683	
Prizes	2,750	
Website Maintenance	2,059	
Administration	7,056	
Bank Charges	105	
Merchant Banking	1,062	
Postage/Stationary	122	
Postgraduate of Year Prize	500	
Grassroots	427	
Other	460	
Ew\$2022	5,255	
Total Expenditure	53,477	
Excess Income over Expenditure		4,533
Closing Balance @ 31/12/22		26,941

End of Year accounts are overseen and approved by external accountant

ENVIRON 2023 ATU Letterkenny

ESAI Council Members 2023

Chairperson	Mr Liam McCarton	chairperson@esaiweb.org
Vice Chair	Dr Niamh Power	
Honorary Secretary	Mr Philip Shine	secretary@esaiweb.org
Honorary Treasurer	Dr Niamh Power	treasurer@esaiweb.org
Communications Officer	Dr John Gallagher	communications@esaiweb.org
Editor	Ms Caroline Wynne	c.wynne@epa.ie
Conference Coordinator 2022	Dr Pilar Fernandez Ibanez	conference@esaiweb.org
Conference Coordinator 2023	Dr Denis McCrudden	ATU Donegal
Regular Members	Prof Frances Lucy – IT Sligo Dr Tom Curran - UCD Dr Thomae Kakouli-Duarte – IT Carlow Dr Dorothy Stewart - EPA Dr Jean Dwyer - UCC	
Postgraduate Representative	Sean O'Connor	ATU Sligo
Membership Officer	c/o Ms Sinead Macken - Administrator	administrator@esaiweb.org

nviron 2023



ATU Letterkenny

3rd – 5th April 2023

33rd Irish Environmental Researchers Colloquium

**"Evidence And Plans Towards
Transitions To A Sustainable Future"**

ORAL AND POSTER PRESENTATIONS SCHEDULE



Monday, 3 April

11:30am **Registration (Upload Presentations & Display Posters from 2pm)**
Main Entrance Foyer

12pm **Glenveagh National Park Field Trip**
Main Entrance Foyer

2pm **Training Analysis & Career Development**
Lecture Room 1161

4:30pm **Getting Ready to be a Sustainability Professional**
Lecture Room 1161

6:30pm **Registration**
Main Entrance Foyer

7pm **Public Reception - Panel Debate**
Main Dining Area

8pm **Public Presentation and Q&A: The Implications and Solutions of Future Climate Change Actions on Agriculture**
Main Lecture Theatre Room 1101
Chaired by: Dr. Joanne Gallagher and Dr. Edna Curley

9:30pm **Ceol agus Craic - 'Upstairs at McGinleys'**

Tuesday, 4 April

8:15am **Registration & Upload Presentations (Poster Set-Up until 10.30am)**
Main Entrance Foyer

9:15am **Environ 2023 Opening Session**
Main Lecture Theatre Room 1101

» Vice-President of Research and Innovation at ATU, Dr Rick Officer, Vice-President for Research, Equality & External Affairs ATU Donegal, John Andy Bonar, ESAI Chairperson Liam McCarton

9:45am **Plenary Lecture 1**
Main Lecture Theatre Room 1101
Chaired by: Dr. Denis Mc Crudden

Understanding, predicting, and mitigating human impacts for a sustainable future

» Prof. Rick Relyea

10:45am **Networking Coffee, Poster Session & Meet the Exhibitors**
Main Concourse

11:30am **Sensing Technologies for Climate Change Solutions**
Lecture Room 1102
Chaired by: Prof. Dermot Diamond

11:30am **Salmon - The climate change forecasters**
»[Dr. Ken Whelan](#)



Continued from Tuesday, 4 April

12:15pm **Mapping Irish habitat types using drones and machine learning**

»[Ms. Charmaine Cruz](#), Dr. John Connolly

12:30pm **Electrochemical monitoring of photocatalytic hydrogen peroxide evolution based on electrochemically deposited copper nano clusters at a 3D-printed electrode.**

»[Mr. Pádraig McDonagh](#), Dr. Nathan Skillen ,Prof. Peter Robertson ,Dr. Denis Mc Crudden

12:45pm **Environmental assessment of Starch-protein blend bioplastics with the use of sustainable starches**

»[Ms. Jade Stanley](#), Dr. David Culliton ,Dr. Antonio Jonay Jovani-Sanches ,Dr. Adriana Cunha Neves

11:30am **Marine & Coastal**

Lecture Room 1103

Chaired by: Dr. Maurice Clarke

11:30am **The EU's Marine Strategy Framework Directive: A holistic framework for marine and coastal assessment**

»[Dr. Maurice Clarke](#)

11:45am **Norovirus contamination in shellfish production areas - a challenge for water quality and food safety**

»[Dr. Sinead Keaveney](#)

12pm **How susceptible is the Celtic Sea to ecosystem overfishing?**

»[Mr. Jed Kempf](#), Prof. Emer Rogan ,Dr. Patricia Breen ,Prof. David Reid

12:15pm **Development of a Hydrodynamic Numerical Model in Galway Bay, Ireland**

»[Mr. Ramin Golmohamadi azar](#), Dr. Zeinab Bedri ,Dr. Ahmed Elssidig Nasr

12:30pm **Effects of Marine Protected Areas (MPAs) on the trophic structure and diet composition of Mediterranean fishes**

»[Mrs. Hayley Campbell](#), Dr. Deirdre Brophy ,Dr. Mikko Kiljunen ,Dr. Charlotte Sirot ,Dr. Joachim Claudet ,Ms. Ginevra Lilli ,Dr. Conor Graham

12:45pm **Development of an integrated water quality model for predicting indicators of Harmful Algal Blooms in the Belesar Reservoir in Minho River Basin (Spain)**

»[Mr. Tuan Booso](#), Dr. Ahmed Elssidig Nasr ,Dr. Zeinab Bedri ,Dr. Rufino Lanero ,Prof. Fernando Cobo

11:30am **Carbon Capture - Wetland Management**

Lecture Room 1452

Chaired by: Yuansheng Hu

11:30am **Automatic Surface Water Mapping Using Sentinel-1 to monitor rehabilitation of peatlands through rewetting**

»[Dr. Richa Marwaha](#), Dr. Matt Saunders

11:45am **Carbon sequestration of a native woodland established on a cutaway peatland site in Ireland**

»[Ms. Hannah Mealy](#), Dr. Paul Leahy ,Dr. Fiona Cawkwell

12pm **RePEAT, the Bog Commissioner Maps and Revising the Derived Irish Peat Map**

»[Dr. John Connolly](#), Dr. Louis Gilet ,Ms. Lisa Coleman ,Dr. Terry Morley



Continued from Tuesday, 4 April

- 12:15pm **Summer drought halts methane emissions from a *Spartina anglica*-invaded saltmarsh in Dublin**
 »[Ms. Lisa Jessen](#), Dr. Andrea Fuchs ,Dr. Grace Cott
- 12:30pm **Carbon balance of a restored Irish raised bog: comparing two models to estimate GHG emissions**
 »[Mrs. Elena Aitova](#), Dr. Terry Morley ,Dr. Florence Renou-Wilson ,Dr. Shane Regan ,Dr. David Wilson
- 12:45pm **Using Tellus Airborne Radiometric data to update peatlands map in Ireland.**
 »[Mr. Dave O'Leary](#), Dr. John Connolly ,Dr. Louis Gilet ,Dr. Jim Hodgson ,Dr. Eve Daly
- 11:30am **Sustainability in Education**
Lecture Room 1166
 Chaired by: Prof. Frances Lucy
- 11:30am **Sustainable Futures –a transdisciplinary summer university for international students**
 »[Prof. Frances Lucy](#), Mr. Declan Feeney ,Ms. Cathrine Gladh
- 11:45am **Climate Change Education across disciplines in Universities of Ireland**
 »[Mr. Asfand Bakht Yar](#), Dr. Ken Boyle
- 12pm **Climate Justice and the Role of Higher Education in Transformation**
 »[Prof. Jennie Stephens](#)

- 12:15pm **Young People and Climate Change Education**
 »[Ms. Bronagh Dillon](#), Dr. Kathy Reilly ,Prof. Frances Fahy
- 12:30pm **Irelands first Sustainable Tourism Observatory**
 »[Dr. James Hanrahan](#), Dr. Conor McTiernan ,Dr. John Carty
- 12:45pm **Building Carbon Literate Communities to Create a Positive Climate Future**
 »[Ms. Niamh Guiry](#), Dr. Maria Kirrane
- 1pm **Lunch**
Main Dining Area
- 2pm **Sensing Technologies for Climate Change Solutions**
Lecture Room 1102
 Chaired by: Dr. Ken Whelan
- 2pm **Novel Sensing Technologies for Environmental Applications**
 »[Prof. Margaret McCaul](#)
- 2:30pm **The Future of Drones and Smart Technologies in Sustainable Farming**
 »[Dr. Garry Lohan](#), Dr. Oliver Mulryan ,Dr. Carine Gachon ,Prof. Graham Heaslip
- 2:45pm **The development of an electroanalytical method for monitoring the photocatalytic degradation of the herbicide MCPA**
 »[Mr. Wesley McCormick](#), Prof. Peter Robertson ,Dr. Nathan Skillen



Continued from Tuesday, 4 April

3pm **Transforming Phosphate Monitoring in Irish Freshwater Systems using a Robust, Sensitive Portable Sensor**

»[Ms. Rachel Bracker](#), Dr. Lisa Cronin, Dr. Aironas Grubliauskas, Dr. Louis Free, Dr. Joyce O'Grady, Dr. Sean Power, Dr. Dave Kinahan, Dr. Karen Daly, Dr. Nigel Kent, Prof. Fiona Regan

3:15pm **Novel aptasensor for detection of Cryptosporidium in water**

»Dr. Seila Couso-Perez, Prof. Tony Byrne, [Dr. Pilar Fernandez](#)

3:20pm **The use of low-cost sensors for monitoring and modelling dynamical temporal microplastic pollution in freshwater**

»[Mr. Ismaila Abimbola](#), Dr. Marion McAfee, Dr. Leo Creedon, Dr. Salem Gharbia

2pm **From Policy to Practice**

Lecture Room 1103

Chaired by: Mr. John Daly

2pm **Infrastructure matters. EV charge points and the demand for EVs in the North West of Ireland**

»[Mr. John Daly](#)

2:15pm **Climate Obstruction in Ireland: A Nuanced Landscape**

»[Prof. Jennie Stephens](#), Prof. Orla Kelly, Dr. Brenda McNally

2:30pm **What support do fishery-to-food bank programs need to be economically and environmentally sustainable?**

»[Ms. Monica Galligan](#)

2:45pm **Science advisory bodies of the EU and their role in environmental decision-making**

»[Ms. Rhoda Jennings](#)

3pm **An investigation, assisted by Geographical Information Systems, into decarbonising Ireland's National Hub Network of remote working infrastructure within sustainability context.**

»[Mr. David Murphy](#)

3:15pm **Addressing the challenges and opportunities of green business from a youth perspective**

»[Mr. Paul McCusker](#), Ms. Una Quinn

2pm **Sustainable Land Use, Agriculture & Food**

Lecture Room 1452

Chaired by: Prof. Fiona Doohan

2pm **The Renewed Role for Plants in our Future Food Systems**

»[Prof. Fiona Doohan](#)

2:15pm **The emerging field of AgroGeophysics - A future in Ireland?**

»[Dr. Eve Daly](#)

2:30pm **Estimating surface soil moisture in Ireland at high resolution using Sentinel 2 and a modified OPTRAM model**

»[Mrs. Rumia Basu](#), Prof. Colin Brown, Dr. Patrick Tuohy, Dr. Eve Daly

2:45pm **Assessment of techno-functional properties and health-enhancing benefits of protein and its associated hydrolysates from brewers' spent grain**

»[Ms. Jiao Zhang](#), Dr. Ariane Perez-Gavila, Dr. Adriana Cunha Neves



Continued from Tuesday, 4 April

3pm **Moisture limits to maintain grassland soil physical quality over repeated machine trafficking**

»[Ms. Emanuela Lepore](#), Prof. Olaf Schmidt ,Dr. Giulia Bondi ,Dr. Owen Fenton ,Dr. Saoirse Tracy ,Dr. David Wall

3:15pm **Farmers' attitudes towards agricultural plastics - Management and disposal, awareness and perceptions of the environmental impacts.**

»[Ms. Clodagh King](#), Dr. Caroline Stephens ,Dr. Joseph P. Lynch ,Dr. Siobhán N. Jordan

2pm **Societal Engagement-Working Together**

Lecture Room 1166

Chaired by: Dr. Elizabeth Bruton

2pm **UCD Earth Institute societal engagement projects**

»[Dr. Elizabeth Bruton](#)

2:15pm **Title: Accessible education to support action towards the Sustainable Development Goals (SDGs): moving from policy & enabling practice.**

»Dr. John Scahill ,[Dr. Carmel Heaney](#), Ms. Frances O'Donnell ,Mr. David Chernick ,Dr. Mark Garavan ,Dr. Mark Kelly

2:30pm **What is Wildlife Security?**

»[Dr. Emma Fletcher-Barnes](#)

2:45pm **Towards Developing Accessible and Inclusive Field Based Marine and Freshwater Teaching**

»[Ms. Sheena Fennell](#), Ms. Aedin McAleer ,Dr. Rachel Cave ,Dr. Mary Dempsey ,Mr. Liam Grimes

3pm **Can green innovation impact firms' competitiveness and environmental performance? A simultaneous analysis**

»[Ms. Maria del Pilar Cespedes Davalos](#), Dr. Bernadette Power ,Dr. Geraldine Ryan ,Dr. John Eakins ,Prof. Eleanor Doyle

3:15pm **Time for a Nappy Change: beliefs and attitudes towards modern cloth nappies.**

»[Mrs. Nicola Watson](#), Dr. Sara Benetti ,Dr. Suzanne Beech

3:30pm **Networking Coffee, Poster Session & Meet the Exhibitors**
Main Concourse

4:15pm **Sensing Technologies for Climate Change Solutions**

Lecture Room 1102

Chaired by: Prof. Margaret McCaul

4:15pm **In-Situ Monitoring of Key Water Quality Parameters**

»[Prof. Dermot Diamond](#)

4:45pm **The Electronic and Optical Properties of Metal Organic Framework: MIL-101(Fe), and MIL-101(Fe)/graphene Nanocomposite**

»[Mr. Qusai Ibrahim](#), Dr. Salem Gharbia

5pm **Development of a low-cost portable system for the simultaneous detection of soil pH and potassium.**

»[Mr. Matthew McCole](#), Dr. Denis McCrudden ,Mr. Martin Bradley

4:15pm **Climate in the Balance**

Lecture Room 1103

Chaired by: Dr. Caitriona Strain



Continued from Tuesday, 4 April	
4:15pm	<p>A business case for climate neutrality in pasture-based dairy production systems in Ireland: Evidence from Farm Zero C project</p> <p>»Dr. Theresa Rubhara, Mr. Luis Alejandro Vergara ,Mr. James Gaffey</p>
4:30pm	<p>Clean energy futures - community visioning process</p> <p>»Ms. Nuala Carr, Ms. Emily Gray ,Prof. Frances Fahy</p>
4:45pm	<p>Carbon capture and Direct Air Capture in Ireland: a pathway to a clean future</p> <p>»Mr. Daniel Casaban, Mr. Sean Ritchie ,Dr. Elena Tsalaporta</p>
4:15pm	<p>Sustainable Energy <i>Lecture Room 1452</i> Chaired by: Ms. Irene Ward</p>
4:15pm	<p>SEAI Energy Research Supports: An overview of SEAI research funding supports and opportunities, and an insight into the current 2023 SEAI National Energy Research, Development & demonstration (RDD) Funding Programme Call.</p> <p>»Ms. Irene Ward</p>
4:30pm	<p>Ex-post and Simulation Modelling to inform low carbon policy</p> <p>»Ms. Vera O'Riordan</p>
4:45pm	<p>Where we live: How settlement patterns impact energy service demands and climate mitigation options</p> <p>»Ms. Ankita Gaur, Prof. Hannah Daly</p>
5pm	<p>Machine Learning and Supply Chain Management</p> <p>»Dr. Garry Lohan</p>
4:15pm	<p>Water & Wastewater Management <i>Lecture Room 1166</i> Chaired by: Dr. Fiona Kavanagh</p>
4:15pm	<p>New Technologies – New WWTP Platform: Mainstream Anaerobic Wastewater Treatment for Sewage available now</p> <p>»Mr. Conor Beegan ,Ms. Tracey Giles ,Dr. Conall Holohan</p>
4:30pm	<p>Novel Psychrophilic Anaerobic Treatment of Malting Wastewater</p> <p>»Mr. Conor Beegan, Ms. Tracey Giles ,Dr. Conall Holohan</p>
4:45pm	<p>Using geographically weighted ordinal regression (GWOR) methodology to investigate the spatially varying relationship between nutrient emission loads and water quality statuses - an Irish case study</p> <p>»Dr. Yuting Meng, Prof. Cathal O'Donoghue ,Dr. Mary Ryan</p>
5pm	<p>Willingness to pay for improved water quality and services: A case study of Group Water Schemes in the Republic of Ireland.</p> <p>»Mr. Sarpong Hammond Antwi, Dr. Suzanne Linnane ,Dr. Alec Rolston ,Dr. David Getty</p>
5:30pm	<p>ESAI AGM & ESAI Postgraduate Researcher of the Year 2022 Award Winner <i>Main Lecture Theatre Room 1101</i></p>
7pm	<p>Prosecco Reception by the Piano with Avril McNamee <i>Carnegie Ballroom, Radisson Blu Hotel</i></p>
8pm	<p>Conference Dinner, DJ & Dancing <i>Carnegie Ballroom, Radisson Blu Hotel</i></p>



Wednesday, 5 April

8:45am **Registration**
Main Entrance Foyer

9am **Welcome Address from ATU President Dr Orla Flynn**
Main Lecture Theatre Room 1101

Welcome Address

» President of Atlantic Technological University, Dr Orla Flynn

9:10am **Plenary Lecture 2**
Main Lecture Theatre Room 1101
Chaired by: Dr. Denis Mc Crudden

Valorising Waste Biomass via Hydrodynamic Cavitation and Anaerobic Digestion

» Prof. Vivek Ranade

9:35am **Plenary Lecture 3**
Main Lecture Theatre Room 1101
Chaired by: Dr. Denis Mc Crudden

Photocatalysis for Valorisation of Biomass and Digestate Wastes

» Prof Peter Robertson

10am **Circular Economy**
Lecture Room 1102
Chaired by: Prof. Michael Morris

10am **Can the circular economy positively impact climate change?**
»[Prof. Michael Morris](#)

10:15am **A Downscaled Economic Model for Assessing Benefits from Sediment Management Projects**

»[Mr. Brano Batel](#), Dr. Joe Harrington

10:30am **Sustainable Management Solutions for La Rance Sediment and an Evaluation of Ecosystem Services**

»[Ms. Iqra Rehman](#), Mr. Branislav Batel, Dr. Joe Harrington

10:45am **Recovery of cutin from tomato peels waste and valorisation of this by-product for improvement of hydrophobic properties of biomass-based bioplastic.**

»[Ms. Marta Mroczkowska](#), Dr. Kieran Germaine, Dr. David Culliton, Dr. Adriana Cunha Neves

10am **Water For the Future**
Lecture Room 1103
Chaired by: Dr. John Bartlett

10am **Photoelectrocatalytic inactivation of E. coli and MS-2 in synthetic wastewater**

»Dr. Stuart McMichael, [Prof. Tony Byrne](#), Dr. Pilar Fernandez

10:15am **Quantifying the future potential of rainwater harvesting**

»[Dr. Ruth Quinn](#)

10:30am **Sources, Pathways and Environmental Fate of Microplastics in Freshwater Ecosystems**

»[Dr. Roisin Nash](#), Dr. John O'Sullivan, Dr. Sinead Murphy, Dr. Michael Bruen, Dr. Ann Marie Mahon, Dr. Heather Lally, Ms. Linda Heerey, Dr. James O'Connor, Ms. Xiaodi Wang, Dr. Ian O'Connor



Continued from Wednesday, 5 April			
10:45am	<p>Bacterial community composition in a pilot-scale wastewater treatment plant</p> <p>»Ms. Shabila Perveen ,Prof. Javier Marugan ,Dr. Cristina Pablos ,Dr. Ken Reynolds ,Dr. Simon Stanley</p>	10am	<p>Development of regional bioeconomy demonstration blueprint with a peatland transitional focus</p> <p>»Prof. Neil Rowan ,Dr. Emer O'Neill ,Mr. Martin Tighe ,Prof. Marcel Jansen ,Prof. Markus Helfert ,Dr. Seamus Hoyne ,Ms. Michelle McKeon Bennett</p>
10am	<p>Smart Technology & The Environment <i>Lecture Room 1452</i> Chaired by: Dr. Nathan Skillen</p>	10:05am	<p>A pathway towards a net zero smart energy system for Ireland's Border, Midland & West region</p> <p>»Dr. Caitriona Strain</p>
10am	<p>Photocatalytic Biomass Reforming: steps towards advancing the technology</p> <p>»Dr. Nathan Skillen</p>	10:10am	<p>Recent Advances in Plasmonic Luminescent Solar Concentrators for Building Integration</p> <p>»Mr. Aaron Glenn ,Dr. Sarah McCormack ,Dr. Subhash Chandra</p>
10:15am	<p>Nanowood: Fully renewable, biodegradable, environmentally friendly, natural material for the next generation thermoelectrics</p> <p>»Dr. Ievgen Nedrygailov ,Dr. Kamil Rahme ,Dr. Scott Monaghan ,Dr. Subhajit Biswas ,Prof. Paul Hurley ,Prof. Justin D. Holmes</p>	10:15am	<p>Carbon Flux Dynamics Across Three Contrasting Forest Types</p> <p>»Mr. Stephen Byrne ,Dr. Matt Saunders ,Dr. Brian Tobin</p>
10:30am	<p>Developing novel eDNA metabarcoding tools for in situ fisheries and megafauna biodiversity monitoring</p> <p>»Ms. Maddalena Tibone ,Dr. Sergio Stefanni ,Dr. Bernadette O'Neill ,Dr. Jacopo Aguzzi ,Dr. Luca Mirimin</p>	10:20am	<p>Evaluation of the performance, profitability and greenhouse gas emissions of dairy-bred AAx steers finished at pasture or indoors: a whole-farm modelling approach</p> <p>»Mr. Andrew Mc Namee ,Dr. Edward O Riordan ,Dr. Paul Crosson ,Dr. Mark Mc Gee ,Dr. Denis Mc Crudden</p>
10:45am	<p>The role of carbonate minerals and the behaviour of rare earth elements in the formation of bastnasite.</p> <p>»Ms. Adrienn Maria Szucs ,Ms. Melanie Maddin ,Mr. Daniel Brien ,Dr. Alexandra Stavropoulou ,Ms. Claire O'Donnell ,Ms. Seana Davis ,Dr. Paul Guyett ,Dr. Remi Rateau ,Dr. Juan Diego Rodriguez-Blanco</p>	10:25am	<p>Devising a Digital Twinning Framework to Assist the Development of Next Generation Integrated Heat Pump and Heat Recovery Ventilation Technology</p> <p>»Mr. Ewan Berry ,Dr. Laurentiu Dimache ,Dr. John Lohan ,Mr. David Hunt</p>
10am	<p>Flash Presentations <i>Lecture Room 1166</i> Chaired by: Mr. Paul McCusker</p>	10:30am	<p>Smart Heat in Smart Energy Systems</p> <p>»Mr. Christoph Schellenberg ,Dr. Laurentiu Dimache ,Dr. John Lohan</p>



Continued from Wednesday, 5 April	
10:35am	<p>Mobile Plant Electric Track Drives</p> <p>»Mr. Hugh Coyle, Dr. Charles Young ,Mr. David Gibson ,Dr. Nicola Anderson</p>
11am	<p>Networking Coffee, Poster Session & Meet the Exhibitors</p> <p><i>Main Concourse</i></p>
11:45am	<p>Circular Economy</p> <p><i>Lecture Room 1102</i></p> <p>Chaired by: Prof. Michael Morris</p>
11:45am	<p>Supply Chain issues in Industry 4.0 and the Circular Economy</p> <p>»Mr. Tomas Kenny ,Dr. Garry Lohan ,Dr. Leonard Taylor</p>
12pm	<p>An Engineering Approach to Designing Pilot-Scale Outdoor Duckweed Cultivation Systems</p> <p>»Ms. Grace O' Sullivan</p>
12:15pm	<p>European Furniture Product Design in the Circular Economy: What are the Circular Design Considerations?</p> <p>»Mr. John Hewer ,Dr. Kate Dunne ,Mr. Sean Garvey</p>
12:30pm	<p>Biomass with Carbon Capture and Storage in Ireland: A techno-economic review</p> <p>»Mr. Daniel Casaban ,Mr. Sean Ritchie ,Dr. Elena Tsalaporta</p>
11:45am	<p>Water Quality & Environmental Monitoring</p> <p><i>Lecture Room 1103</i></p> <p>Chaired by: Dr. Joao Frias</p>
11:45am	<p>Investigating the Environmental Quality of Urban Parks: A case-study of Fitzwilliam Square Park, Dublin, Ireland.</p> <p>»Mr. Kiran Apsunde ,Ms. Mengyi Jin ,Prof. Brian M. Broderick ,Dr. John Gallagher</p>
12pm	<p>The effects of an offline Runoff Attenuation Feature (RAF) on peak stream flows, water quality and pasture health</p> <p>»Mr. Darragh Murphy ,Dr. Simon Harrison ,Dr. John Weatherill</p>
12:15pm	<p>Occurrence of AMR Enterobacterales in soil and spinach in the presence and absence of zinc amendment</p> <p>»Ms. Elena Anedda ,Mr. Daniel Ekhlās ,Dr. Elena Alexa ,Dr. Michael Gaffney ,Dr. Gillian Madigan ,Dr. Catherine Burgess ,Dr. Dearbhaile Morris</p>
12:30pm	<p>Estimation of input flow variables to the water quality model of Chlorophyll-a in Claregalway River Catchment</p> <p>»Mr. Moayad M. Dawoud ,Dr. Ahmed Elssidig Nasr ,Dr. Zeinab Bedri</p>
11:45am	<p>Flash Presentations</p> <p><i>Lecture Room 1452</i></p> <p>Chaired by: Mr. Pádraig McDonagh</p>
11:45am	<p>Downscaling ocean models for the Celtic Sea – generating science for stakeholders</p> <p>»Dr. Rachel Cave ,Dr. Tomasz Dabrowski ,Dr. Joe McGovern ,Dr. Janina V. Buescher ,Ms. Aedin McAleer ,Ms. Sheena Fennell</p>
11:50am	<p>Qualitative decision support tool for evaluating potential microbial hazards for ready-to-eat fresh produce using water re-use systems</p> <p>»Mr. Vaibhav Bhatia ,Dr. Rajat Nag ,Dr. Enda Cummins</p>



Continued from Wednesday, 5 April

- 11:55am **Development of a feeding assay as a phenotypic measure for ecotoxicology in daphnids**
 »[Ms. Maria Giannouli](#), Dr. Konstantinos Panagiotidis ,Prof. Konstantinos Grintzalis
- 12pm **Investigation of solar irradiance databases for PV system design**
 »[Mr. Jamal Alfaraj](#), Dr. Paul Leahy ,Dr. Emanuel Popovici
- 12:05pm **Can existing models be combined in new ways to improve our understanding of barrier island and headland-controlled bay evolution?**
 »[Ms. Abbie Nugent](#), Prof. Iris Moeller
- 12:10pm **Understanding Carbon Sequestration Potential of Irish Organic and Organo-Mineral Soils Under Grassland Management: A Study of Drainage and Re-wetting Effects.**
 »[Mr. Ian Clancy](#), Dr. Matt Saunders ,Prof. Gary Lanigan
- 12:15pm **Associations between pro-environmental food purchasing behaviour, socio-economic profiles and health characteristics in Ireland**
 »[Mr. Daniel Burke](#), Dr. Paul Hynds ,Dr. Anushree Priyadarshini
- 12:20pm **The Association between Disinfectant Use & Antimicrobial Susceptibility of Wild-type Bacterium in Livestock Agriculture: A Laboratory Study**
 »[Ms. Meabh Dowler](#), Dr. Paul Hynds

- 12:25pm **Doom and Bloom: past, present and future perspectives of Harmful Algal Blooms in Irish waters**
 »[Mrs. Nicolè Caputo](#), Mr. Dave Clarke ,Dr. Fiona Kavanagh ,Dr. Luca Mirimin
- 11:45am **Flash Presentations**
Lecture Room 1166
 Chaired by: Mr. Matthew Mc Cole
- 11:45am **Greenhouse gas emissions from food system activities in Ireland 1990-2018.**
 »[Ms. Isobel Stanley](#)
- 11:50am **Modification of willow evapotranspiration on-site wastewater treatment system designs following multi-annual monitoring programme of full-scale systems.**
 »[Mr. Aaron Coyle](#), Prof. Laurence Gill ,Dr. Sean Curneen
- 11:55am **Clothing Circularity, Sufficiency & Sustainable Maximum Use - Everyday Practices For Transformative Sustainability Transitions.**
 »[Ms. Helen Maguire](#)
- 12pm **Life Cycle Assessment of Dimensional Stone; a Hot-spot Analysis**
 »[Mrs. Christeen Saparamadu](#), Prof. Aidan Duffy ,Dr. Aidan Forde
- 12:05pm **Are the drivers of discarding of unwanted catch by the demersal bottom trawl fishery in the Celtic Seas ecoregion predominantly regulatory in nature?**
 »[Ms. Maria Browne](#), Dr. Deirdre Brophy ,Dr. Julia Calderwood ,Dr. C  il  n Minto



Continued from Wednesday, 5 April

12:10pm **Microplastics in fresh- and wastewater are potential contributors to antibiotic resistance**

»[Ms. Shabila Perveen](#), Prof. Javier Marugan, Dr. Cristina Pablos, Dr. Ken Reynolds, Dr. Simon Stanley

12:15pm **Rights of Nature Perspectives in Ireland**

»[Mr. Julian Suarez](#)

12:20pm **Evaluating quality and shelf life of silicon enriched fresh produce using novel sustainable packaging solutions**

»[Ms. Lorraine Foley](#), Mr. Francesco Saverio Giordano, Prof. Jesus Frias, Dr. Andrew Reynolds, Dr. Lael Walsh, Dr. Shivani Pathania

12:25pm **Short-Term Carbon Flux of Cereal Cropland based on Peat Soil**

»[Mr. Richard Slevin](#), Dr. Matt Saunders

12:45pm **Lunch**

Main Dining Area

1:30pm **Prize Giving & Close of Environ 2023**

Main Lecture Theatre Room 1101

3pm **POSTERS (only) list**

Main Concourse

Force Analysis for Conversion of Hydraulic Track Drive Machines to Electrification

»[Mr. Jamie Farren](#), Dr. Charles Young, Mr. Hugh Coyle, Mr. Dean Harron

Understanding the potential to regulate our biological clock through enhanced daylighting in buildings using luminescent solar concentrators

»[Mr. Wai Qian Tham](#), Mr. Tianren Chen, Dr. Subhash Chandra, Dr. Brian Norton, Dr. Sarah McCormack

Lignin Oxidative Depolymerization and Simultaneous Hydrogen Production – Utilization of a Photoelectrochemical Cell (PEC).

»[Mr. Junhong Liu](#), Dr. Kathryn Ralphs, Dr. Nathan Skillen, Prof. Peter Robertson

Catalysts synthesis by mechanochemistry and their applications

»[Dr. Kathryn Ralphs](#), Prof. Stuart James, Dr. Nathan Skillen, Prof. Peter Robertson

Carbon stocks, dynamics, and processes in Irish seagrass systems

»[Ms. L. Saige Alloway](#), Dr. Pedro Beca-Carretero, Dr. Dagmar B. Stengel

Food Waste in Ireland - Assessment, Environmental & Economic Burden, and Mitigation Strategies (FORWARD)

»[Ms. Talia Moonsamy](#), Dr. Gaurav Rajauria, Dr. Anushree Priyadarshini, Prof. Marcel Jansen

Eco-ing the Curriculum: A Pilot Study of one Irish Transition Year Programme Centred on Global Citizenship Education and Sustainability Education

»[Dr. Roisin Nash](#), Mr. Micheal Walsh, Mr. Dearcan O'Donnghaile, Mr. Michael Faney, Dr. Pauline Logue

An experimental protocol for assessing overland flow producing zones and soil boundaries derived from the Soil Topographic Index

»[Mr. Kevin Atcheson](#), Prof. Phil Jordan, Dr. Rachel Cassidy



Continued from Wednesday, 5 April

Agri-environmental scheme and source water quality – are there benefits for water treatment processes?

»[Mr. Kevin Atcheson](#), Prof. Phil Jordan, Dr. Rachel Cassidy

Farm Zero C: Quantifying natural capital and ecosystem services of a dairy farm in the west of Ireland

»[Mr. Fabio Delle Grazie](#), Dr. Jane Stout, Mr. Cian White, Dr. LARS Hein

Smarter Energy Communities in Northern Periphery and Arctic Regions

»[Dr. Cairiona Strain](#)

In-situ design of molecularly imprinted polymer interfaces for electrochemical sensing of contaminants in water

»[Ms. Aicha Tasfaout](#), Dr. Farah Ibrahim, Dr. Aoife Morrin, Prof. Fiona Regan, Dr. Catherine Branger, Prof. Hugues Brisset

Seaweeds of the Waterford Estuary: A DNA-based approach to improve the understanding of heavy metal bioremediation by seaweed.

»[Dr. David O'Neill](#)

A GEOVISUALISATION OF INFECTION, AGRICULTURAL AND INFRASTRUCTURAL RISK CRITERIA ASSOCIATED WITH PRIMARY VEROTOXIGENIC E. COLI (VTEC) INFECTION IN IRELAND

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Assessing the spatial variation of carbon storage in managed and unmanaged saltmarshes: An Irish case study

»[Ms. Juliet Rounce](#), Prof. Iris Moeller

Coastal Dune Vulnerability Assessment for Nature-based Solution in Ireland

»[Ms. Silvia Cascone](#), Dr. Kevin Lynch, Dr. Terry Morley

Mimicking Past Atmospheres to Study the Effect of Plant Evolution on Weathering

»[Ms. Katie O'Dea](#), Dr. Christos Chondrogiannis, Prof. Jennifer McElwain

Nano-Enabled Sensor Development for Arsenic Detection & Determination in Drinking Water

»[Mr. Abhijnan Bhat](#), Dr. Furong Tian, Dr. Baljit SINGH

Updated GHG emissions factors for Irish peatlands: a review

»[Mrs. Elena Aitova](#), Dr. Terry Morley, Dr. David Wilson, Dr. Florence Renou-Wilson

Soil nematode community response to the field application of recycling derived fertilisers (RDFs) in Irish grassland

»[Ms. Anna Karpinska](#), Mrs. Thomais Kakouli-Duarte

Rehabilitation progress of two degraded peatland sites in the Republic of Ireland

»[Dr. Magdalena Matysek](#)

nviron 2023



ATU Letterkenny

3rd – 5th April 2023

33rd Irish Environmental Researchers Colloquium

**"Evidence And Plans Towards
Transitions To A Sustainable Future"**

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Oral

Salmon – The climate change forecasters

Sensing Technologies for Climate Change Solutions - Oral

Dr. Ken Whelan ¹

1. Atlantic Salmon Trust

Prof Ken Whelan has worked for several fisheries research organisations in Ireland and was a Director in the Irish Marine Institute from 1999 to 2009. He served as President of the North Atlantic Salmon Conservation Organisation (NASCO) from 2004 to 2008. As President, he helped to initiate and manage the ground-breaking SALSEA or Salmon at Sea Programme. He was Chairman of the International Atlantic Salmon Research Board from 2007 to 2011 and serves as Chairman of the Scientific Council of the Loire Basin Salmon Restoration Programme. Ken is a Vice President of the Atlantic Salmon Trust, where, until recently, he served as Research Director. He is also an Adjunct Professor in the School of Biology and Environmental Science at University College Dublin. Ken runs his own fisheries and environmental consultancy. Over the past decade he has worked extensively with a range of community and other interest groups, training them to nurture and monitor, as citizen scientists, their local water bodies.

Mapping Irish habitat types using drones and machine learning

Sensing Technologies for Climate Change Solutions - Oral

Ms. Charmaine Cruz¹, Dr. John Connolly¹

1. Department of Geography, School of Natural Sciences, Trinity College Dublin, Ireland

Under the Habitats Directive (HD), the European Union requires its Member States, including Ireland, to monitor the conservation status of threatened habitats (those listed in Annex I of HD) within their territories. Habitat mapping is fundamental for generating the data required for monitoring habitats under the HD. It involves recording valuable information, including the location and condition of habitats, the area they cover at a particular location, and where change occurs. Recent advancements in remote sensing platforms and sensors, such as the development of Unoccupied Aerial Vehicles (UAVs), facilitate the flexible acquisition of high-resolution imagery for identifying detailed spatial distributions of different habitat types. This study aimed to assess the effectiveness of UAV remote sensing for mapping three Annex I habitat types—grasslands, coastal dunes and uplands. To do this, we conducted UAV surveys over a coastal dune and upland sites in Kerry and a grassland site in Dublin. For each UAV survey data, a five-band raster orthophoto and a single-band Digital Surface Model were generated using the Structure from Motion-based method. Different raster layers (e.g., vegetation indices and slope) were calculated to highlight the spectral and topographic characteristics of each habitat type. Extensive ecological field surveys were also carried out by experienced ecologists to collect ground truth data (i.e., reference points representing the actual location of a habitat type). Then, we combined spectral and topographic layers with field data and used the Random Forest (RF) machine learning algorithm to classify the three Annex I habitat types. Results showed that RF models had a good predictive performance with an overall accuracy of 82% for upland, 84% for grassland and 94% for coastal dunes habitat types. The high accuracies obtained in this study highlight the application of the methodology in other habitats to aid the spatiotemporal monitoring of Annex I habitats.

Electrochemical monitoring of photocatalytic hydrogen peroxide evolution based on electrochemically deposited copper nano clusters at a 3D-printed electrode.

Sensing Technologies for Climate Change Solutions - Oral

***Mr. Pádraig McDonagh*¹, *Dr. Nathan Skillen*², *Prof. Peter Robertson*², *Dr. Denis Mc Crudden*¹**

1. Atlantic Technological University - Donegal, 2. Queens University Belfast

As an environmentally benign oxidant and an emerging energy carrier, hydrogen peroxide (H₂O₂) has demonstrated its applicability in many fields, including synthetic chemistry, environmental remediation and fuel cells. The traditional anthraquinone process for H₂O₂ production is a complex and energy consuming method involving harmful organic media, thus, producing unwanted solid waste materials. Encouragingly, alternative processes have been developed in recent years towards the photocatalytic production of H₂O₂. This presents as a greener, more energy efficient and sustainable technique. As this approach continuously develops, so too will the need for improved methods to monitor the reaction process. Currently, the most commonly reported monitoring of this reaction involves costly and complicated spectroscopic and chromatographic techniques. Electrochemical sensors have demonstrated great promise in H₂O₂ detection in biological and food samples. However, their use in monitoring the photocatalytic generation of H₂O₂ has not been widely reported. Herein, a facile in-situ electroanalytical method for monitoring H₂O₂ from a photocatalytic reaction is reported. The developed sensor, based on copper clusters at a 3D-printed electrode was used for robust, rapid and selective determination of H₂O₂ in a photocatalytic reaction.

Environmental assessment of Starch-protein blend bioplastics with the use of sustainable starches

Sensing Technologies for Climate Change Solutions - Oral

Ms. Jade Stanley¹, **Dr. David Culliton**², **Dr. Antonio Jonay Jovani-Sanches**³, **Dr. Adriana Cunha Neves**²

1. Department of Applied Science, South East Technological University, Kilkenny Rd, Moanacurragh, Carlow, R93 V960, 2. South East Technological University - Carlow, 3. School of Biosciences, University of Nottingham, Sutton Bonington, Loughborough, LE12 5RD

Commodity plastics have increased significantly over the last few years worldwide, single-use plastics are produced with non-renewable materials, and aren't usually recyclable. They're disposed into the environment, which is detrimental to animal and human health. Recently, there's been an effort to generate different bioplastics, such as starch-protein blend thermo bioplastics (SPBB) to combat this environmental challenge. Current SPBBs use non-sustainable starches, such as potato which compete with food production. This study aims to assess how the SPBBs generated with different, sustainable, starches impact the environment. The environmental assessment covers both land and water with microalgae toxicity being used to gather data on how the SPBB's impact marine environments. The degradation of the bioplastics has been assessed using oxitop chambers. The toxicity of the SPBB's was conducted using phytotoxicity of monocot and dicot plants. Worm toxicity and preference were used to determine the ecotoxicity of adult worms and the effect they have on juveniles, also viewing if the worms liked soil with a particular bioplastic. Results showed that all starches caused the algae population to increase. As for the degradation via the oxitops, all bioplastics were completely degraded in under 90 days. The phytotoxicity revealed that bioplastics negatively affected the growth of plants. In terms of worm ecotoxicity, the number of adult worms was the same at the end, and the number of juveniles produced varied with each bioplastic. The soil preference using the worms correlates to the juvenile data gathered. In conclusion, the environmental assessment performed indicates that the SPBB's can be used to create SPBB's that can aid in tackling the environmental challenge of plastic pollution while remaining sustainable. Further studies are needed to identify the potential applications of these results by conducting activities like focus groups.

Keywords: Thermo Bioplastic, Starch, Environmental Challenges, Sustainable Land Use, Agriculture & Food

The EU's Marine Strategy Framework Directive: A holistic framework for marine and coastal assessment

Marine & Coastal - Oral

Dr. Maurice Clarke¹

1. Marine Institute

Dr Maurice Clarke is the lead for marine ecosystems and biodiversity at the Marine Institute. He has overall responsibility for biodiversity assessments in support of Ireland's biodiversity reporting obligations under the EU Marine Strategy Framework Directive (MSFD) and the OSPAR Convention on the marine environment of the northeast Atlantic. This work encompasses assessing the impact of incidental fisheries by-catch of protected and endangered species, of fish population (commercial and non-commercial) status, marine food-webs, of pelagic and benthic biodiversity and of seafloor integrity. After completing a Ph.D. for research into fisheries impacts on deep-water sharks in 2000, he worked in population assessment and advice of commercial fish, being an advisor to national and EU government. He was Irish representative on the International Council for the Exploration of the Seas (ICES) Advisory Committee, 2009-2018. Working extensively with industry and eNGO stakeholders he developed science-based management plans for several commercial fisheries. Since 2017 his focus has been on developing assessments and advisory products to support international obligations under marine biodiversity. He maintains a research interest on endangered sharks. Maurice's keynote introduces the MSFD, demonstrating how it provides an essential framework for assessing human impacts on the marine environment, encompassing biodiversity, contaminants and physiography.

Norovirus contamination in shellfish production areas - a challenge for water quality and food safety

Marine & Coastal - Oral

Dr. Sinead Keaveney¹

1. Marine Institute

Norovirus, sometimes referred to as “winter vomiting disease” is the most common cause of acute gastroenteritis in Ireland and worldwide. This virus group are transmitted primarily through the faecal-oral route, either through the consumption of contaminated food or by person-to-person spread. Filter-feeding bivalve shellfish can concentrate norovirus particles in their tissues when grown in areas impacted by human wastewater discharges and therefore are recognised internationally as an important health risk. Contaminated oysters pose a particular risk to human health as they are routinely consumed raw. Current controls to limit the health risks associated with faecal contamination in production areas rely on monitoring shellfish for *E. coli*. Despite this, oyster-related outbreaks associated with norovirus still occur, even in shellfish from areas in compliance with *E. coli* limits. Recently a full standard method for the quantification of norovirus in foodstuffs, including bivalve molluscs, by real-time RT-qPCR, has been published (ISO 15216-1:2017). This method is proving to be a valuable tool in terms of understanding norovirus contamination in shellfish production areas. Results of a two-year (2016 - 2018) baseline survey of norovirus in oyster production areas in Ireland demonstrated that 58.7% of samples were positive for norovirus, however, there was a significant difference between the levels detected during the winter months (78.6% positive) compared to the summer months (38.2% positive). This and further surveillance studies carried out between 2017 and 2022 have highlighted the relative prevalence of norovirus in production areas in Ireland. The scale of contamination can differ significantly between production areas and can be directly related to specific risk factors. The information generated from these studies is a key step toward identifying shellfish waters that require water quality improvements.

How susceptible is the Celtic Sea to ecosystem overfishing?

Marine & Coastal - Oral

Mr. Jed Kempf¹, Prof. Emer Rogan², Dr. Patricia Breen³, Prof. David Reid³

1. University College Cork/Marine Institute, 2. University College Cork, 3. Marine Institute

Overfishing is usually identified at the single-stock level but can also be assessed at an ecosystem level. Ecosystem overfishing occurs when capture fisheries remove more 'fish carbon' than primary production can replace. Ecosystem overfishing indicators and thresholds have great utility because they are founded on well-established trophic theory, are relatively simple to calculate and can be applied to data-limited ecosystems. Furthermore, unknown properties may emerge when perceptions shift from a reductionist (e.g., single-stocks) to a holistic (e.g., ecosystem) approach. We partitioned the Celtic Sea using the 200m isobath into the 'shelf' (<200m) and 'off-shelf' (>200m) regions and then applied the Ryther and Fogarty indicators to test for ecosystem overfishing between 2003-2020. We used landings and taxa composition reported by the fisheries sector, trophic levels from a food-web model and three different primary production datasets to account for uncertainties in primary productivity. We found evidence of ecosystem overfishing on the shelf and more markedly, the off-shelf region. However, the severity and timing of ecosystem overfishing depended on the indicator and the primary production data product used in the analysis. The development of the boarfish fishery resulted in the Ryther index exceeding the lower ecosystem overfishing threshold in both regions in the early 2010s. We found that the Fogarty index was more sensitive to changes in landings of high trophic level taxa, particularly monkfish, hake, whiting and megrim. According to the Fogarty index, only the off-shelf region experienced ecosystem overfishing. We conclude that the Celtic Sea is susceptible to ecosystem overfishing when new fisheries emerge and, as stocks recover, the increased landings of high trophic level (and high value) fish.

Development of a Hydrodynamic Numerical Model in Galway Bay, Ireland

Marine & Coastal - Oral

Mr. Ramin Golmohamadi azar¹, Dr. Zeinab Bedri¹, Dr. Ahmed Elssidig Nasr¹

1. School of Transport and Civil Engineering, TU Dublin, City Campus

Galway Bay, located is an area of significant recreational and environmental value. The Bay has a diverse range of maritime activities and a complex ecological environment, with several habitats and protected species. The occurrence of algal blooms constitutes a major threat to the Bay and therefore there is an urgent need to mitigate the problem.

In this study, a numerical model is developed to simulate the hydrodynamics of Galway Bay. The results of this hydrodynamic model will form the basis of a water quality model that will be used to simulate the fate and transport of the water quality constituents that cause the occurrence of algal blooms. This study will be conducted as part of the Artificial Intelligence-powered Forecast for Harmful Algal Blooms (AIHABs) project (<https://www.jpamr.eu/projects/aihabs/>).

This paper presents the development of Galway Bay model as well as results of the hydrodynamic model of the bay. The model development entailed: (i) construction of the model mesh, in which the model domain was discretised using bathymetric and coastline data (obtained from INFOMAR and the Ordnance Survey Ireland) to form a triangular mesh of 37580 Nodes and 61914 elements. The size of the elements of the flexible mesh varied from 2000m in the inner Bay to 40m in the vicinity of the open sea boundaries, (ii) hydrodynamic simulations using MIKE 21 FM in which tidal boundary conditions at the outer sea boundaries were obtained from the DHI Global model. These are spatially- and temporally-varying water levels necessary to drive the tidal flow into the model domain, (iii) hydrodynamic model calibration and validation, in which simulated tidal levels, current speed and direction were compared with measurements obtained from tidal gauges and Acoustic Doppler Current Profilers (ADCPs) within the domain. The model results showed good agreement with the measured data.

Effects of Marine Protected Areas (MPAs) on the trophic structure and diet composition of Mediterranean fishes

Marine & Coastal - Oral

***Mrs. Hayley Campbell*¹, *Dr. Deirdre Brophy*¹, *Dr. Mikko Kiljunen*², *Dr. Charlotte Siro*¹, *Dr. Joachim Claudet*³, *Ms. Ginevra Lilli*⁴, *Dr. Conor Graham*¹**

1. Atlantic Technological University - Galway, 2. University of Jyväskylä, 3. Le Centre National de la Recherche Scientifique (CNRS) France, 4. Université Libre de Bruxelles, Belgium

The target to protect at least 30% of the global ocean by 2030, through area-based conservation measures reflects the key role that MPAs play in safeguarding ecosystems and improving the sustainability of fisheries. Effects of Marine Protected Areas (MPAs) on species abundance and diversity has been widely researched, however the effects of protection on ecosystem functioning and trophic structure is not well understood. Indicators of trophic dynamics can help to identify well-functioning ecosystems. The presence of higher trophic level individuals and top predators signifies a productive ecosystem. This study uses analysis of stable-isotopes ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{34}\text{S}$) and stomach-contents to investigate how protection affects the structure and functioning of marine food webs. Mediterranean fishes and their prey were sampled within and outside of three MPAs; Cerbère-Banyuls, Côte Bleue and Bonifacio, along the south coast of France and Corsica from July to September of 2021. The study species included the relatively sedentary benthic *Scorpaena notata* and the more mobile pelagic *Diplodus vulgaris*. Bayesian mixing models are used to determine the relative contribution of prey to the diet of each species across a gradient of protection. The influence of protection on mean trophic position is examined. The research aims to improve understanding of the benefits of MPAs for marine ecosystems and inform MPA design and management.

Development of an integrated water quality model for predicting indicators of Harmful Algal Blooms in the Belesar Reservoir in Minho River Basin (Spain)

Marine & Coastal - Oral

***Mr. Tuan Booso*¹, *Dr. Ahmed Elssidig Nasr*², *Dr. Zeinab Bedri*², *Dr. Rufino Lanero*³, *Prof. Fernando Cobo*³**

1. Technological University Dublin, 2. Technological University Dublin (TU Dublin), 3. University of Santiago de Compostela

The significant increase in environmental pollution due to human and natural causes has resulted in frequent occurrence of Harmful Algal Blooms (HABs) in many water bodies around the world. The Belesar Reservoir in the Minho River Basin (Spain) is one of these water bodies where HABs and its associated cyanotoxins have adversely affected significant ecosystem services including aquaculture, recreational activities, tourism, agriculture, wastewater treatment, water supply and power generation. Therefore predicting the occurrence, spread and fate of emerging cyanotoxins caused by HABs will inform decisions on taking necessary mitigation measures to address their consequent impacts. The AI-powered Forecast for Harmful Algal Blooms (AIHABs) project aims at producing HABs prediction tool by integrating recent advances in mathematical modelling, remote sensing, hyperspectral imaging, and toxin sensors. The current paper describes in detail development of the hydrodynamic component of a catchment water quality model which will be used to simulate water quality indicators (Flow, Phosphorus, Nitrogen, Chlorophyll-a) of the HABs in the Belesar Reservoir. The MIKE SHE model is used to build the catchment model of this reservoir and utilise it to simulate the catchment flow dynamics which provide the required input data to the water quality model. Flow simulation results from this model were compared against the actual flow measurements at the catchment outlet using visual inspection and statistical methods to assess the reliability of the model. Reasonable matching between the modelled and the actual flows was obtained indicating to a good performance of the developed model in simulating the flow dynamics in the catchment.

Automatic Surface Water Mapping Using Sentinel-1 to monitor rehabilitation of peatlands through rewetting

Carbon Capture - Wetland Management - Oral

Dr. Richa Marwaha¹, ***Dr. Matt Saunders***¹

1. Trinity College Dublin, The University of Dublin

Peatlands cover approximately 3% of the Earth's surface and store approximately 30% of the world's soil carbon. The carbon in these ecosystems is sequestered when the systems are wet and the water table is close to the surface, therefore accurate mapping of surface water in peatlands is essential to both better understand their hydrological dynamics and also to develop climate-smart rehabilitation strategies. Surface water in peatlands is dynamic and varies spatially and temporally in response to precipitation, evapotranspiration, and vegetation cover, all of which can influence the carbon balance of these systems. This study was conducted on Ummeras bog in County Offaly, which was an industrial peat extraction site until 2019, and the majority of the area of the bog is bare peat. The site has been undergoing enhanced rehabilitation since November 2021 by creating individual cells to hold water as the system rewets. One of the criteria for rehabilitation is rewetting of the bog which will lead to the development of wetland habitats in the future. Mapping of surface water will help to monitor the various stages of rehabilitation and fluctuations in water levels due to climatic variability.

Google Earth Engine (GEE) is a cloud-based platform that provides access to a vast collection of satellite imagery. We used Sentinel-1 data in GEE for 2022, this sensor can penetrate clouds and can map surface water at 10 m resolution. In this study, we used a dynamic histogram-based thresholding surface water mapping algorithm known as the Otsu algorithm. The results were validated using the field data and 4-m resolution Planet Scope images. The overall accuracy was 80% to 90%. Surface water maps are critical to the rehabilitation of peatlands, thus results from this study can help inform our understanding of peatland hydrology as these systems undergo new and novel rehabilitation strategies.

Carbon sequestration of a native woodland established on a cutaway peatland site in Ireland

Carbon Capture - Wetland Management - Oral

***Ms. Hannah Mealy*¹, *Dr. Paul Leahy*², *Dr. Fiona Cawkwell*³**

1. University College Cork, 2. School of Engineering, University College Cork, 3. School of Geography, University College Cork

Peatlands in their natural state have the capacity to store vast amounts of atmospheric carbon, accounting for a third of the global soil carbon stocks on just 3% of the land surface. When the hydrological and physical properties of peatlands are altered due to exploitation, they become a strong source of carbon dioxide to the atmosphere. In Ireland all industrial peat extraction has ceased, leading to an abundance of degraded peatlands. Although there have been many degraded peatland sites restored to re-establish their natural ability to absorb carbon, there have also been sites that were unsuccessfully restored. Some sites that were rewetted for restoration have also been shown to emit methane emissions. Therefore, there is an urgent need to understand optimal management practices for severely degraded peatlands to remediate their carbon sink (absorb) function. This research project monitors carbon dioxide (CO₂) and methane (CH₄) emissions from a severely degraded (cutaway) peatland site located in Lullymore, County Kildare. Harvesting peat ceased over two decades ago from the site and has since naturally established a native woodland dominated with Birch and Scots pine tree species. The Eddy Covariance technique is implemented on a tower structure extending above the tree canopy. CO₂ and CH₄ emissions from the site are monitored continuously using a sonic anemometer and an open-path gas analyser. In conjunction with these, several meteorological instruments are installed to monitor environmental parameters from the site. A static chamber is also used to estimate the below canopy contribution to the net ecosystem exchange of CO₂. It is hoped on analysis of data, an annual estimation of the carbon absorbed from the ecosystem will be more than is released establishing that the site is a carbon sink. And that it may be a sustainable management strategy to implement on unsuccessfully restored peatland sites.

RePEAT, the Bog Commissioner Maps and Revising the Derived Irish Peat Map

Carbon Capture - Wetland Management - Oral

***Dr. John Connolly*¹, *Dr. Louis Gilet*², *Ms. Lisa Coleman*³, *Dr. Terry Morley*³**

1. Department of Geography, School of Natural Sciences, Trinity College Dublin, Ireland, 2. Department of Geology, School of Natural Sciences, Trinity College Dublin, Ireland, 3. Department of Geography, University of Galway

The RePEAT project is funded by DAFM and aims to identify agricultural areas on former peatlands that may be suitable for restoration. The project aims to refine our knowledge of the spatial extent of Irish peatlands and to assess peatland land use change over the last 200+ years. Several geospatial data sources are used to revise the Derived Irish Peat Map (DIPMv2) and facilitate the mapping of peatlands in Ireland. This includes peatlands that have been converted to other land cover types such as forests and grasslands. The refinement of the national peatland maps enables a more detailed examination of how and where peatlands have been converted. This will contribute to the Ireland's targets for meeting its national and international commitments to mitigate climate change and biodiversity loss.

Two approaches are used to assess the spatial extent of these peatlands. In RePEAT, the Bog Commissioner (BC) Maps from the early 19th century have been digitized. These maps show the extent of peatlands, mainly in the midlands and some parts of the west before their widespread degradation. The BC map boundaries are compared to current peatland boundaries to detect change in those areas. The second approach refines and updates the DIPMv2. In this approach, GIS was used to cross-reference several data sources, derived from 1. an existing peatlands map; 2. Geological soil and sediment maps and 3. the CORINE (2018) land cover map. A preliminary peat map was produced with an overall accuracy of 89% (assessed from a validation dataset consisting of >15,000 data points from across Ireland. In the process, the "Peat associated landcover class" (PALCs) were identified and used to enhance the technique of finding the hidden peatlands. While the work is in progress an amalgamation of both approaches has identified the location of unmapped peat soils.

Summer drought halts methane emissions from a *Spartina anglica*-invaded saltmarsh in Dublin

Carbon Capture - Wetland Management - Oral

***Ms. Lisa Jessen*¹, *Dr. Andrea Fuchs*¹, *Dr. Grace Cott*¹**

1. University College Dublin

Saltmarsh ecosystems are known for their high carbon storage capabilities and low greenhouse gas emissions. North Bull Island (NBI) is an estuarine saltmarsh that formed as a result of a sea wall construction in North Dublin and was awarded Special Area of Conservation status. Large parts of NBI are dominated by *Spartina anglica*, which is an invasive, tall cordgrass species in Ireland that settles on natural mudflat habitats. It is a fast-growing species that formed as a hybrid of native *S. maritima* and invasive *S. alterniflora*. Methane (CH₄) fluxes have been found to be higher from *S. anglica* compared to the smaller, native vegetation, because of its abundance of aerenchyma (gas transport cells that allow the direct passage of gases from root-to-tip).

We investigated the magnitude of CH₄ emissions from *S. anglica* swards from NBI, and their seasonal variation. Gas samples were taken at low tide twice per month over the course of 7 months, using static flux chambers. Flux chambers were placed in triplicates at two different sites. Gas samples were stored in exetainers and analysed by gas chromatography.

Preliminary results from July to September 2022 showed, that CH₄ fluxes varied between -22.66 to 19.07 mg CH₄ m⁻² min⁻¹. CH₄ uptake was seen in August despite high temperatures (average chamber temperature 29.2°C), while CH₄ was emitted in July and September. These negative CH₄ fluxes may be due to very little rainfall in the month of August, lowering water levels during low tide and thus reducing anaerobic conditions as well as allowing methane oxidation in the upper soil layers. The results indicate, that the increasing occurrence of summer droughts due to Climate Change might reduce CH₄ emissions from coastal wetlands. This work aids our understanding of the seasonal carbon dynamics in saltmarsh ecosystems.

Carbon balance of a restored Irish raised bog: comparing two models to estimate GHG emissions

Carbon Capture - Wetland Management - Oral

***Mrs. Elena Aitova*¹, *Dr. Terry Morley*¹, *Dr. Florence Renou-Wilson*², *Dr. Shane Regan*³, *Dr. David Wilson*⁴**

1. University of Galway, 2. University College Dublin, 3. National Parks and Wildlife Service, 4. Earthy Matters Environmental Consultants

Peatlands are unique and important ecosystems, as they are one of the largest natural terrestrial carbon storage. However, anthropogenic activities such as extensive draining and land use change are causing them to emit greenhouse gases (GHGs) back into the atmosphere. According to the latest research, national emissions from Irish peatlands (excluding horticulture and combustion) amount to 2.3 Mt C y⁻¹. Considering that peatlands cover around 20% of the land surface in the Republic of Ireland, restoring their carbon storing, and if possible sequestering capacity should be at the heart of national climate policy. The principal aim of this study is to determine the effect of rewetting on GHG emissions in an Irish raised bog. We measured CO₂ and CH₄ fluxes and associated environmental parameters using the closed chamber method at Cloncrow bog (Co. Westmeath) over a 2-year period as a part of the INTERREG NWE 'Care-Peat' project. Restoration works led by the NPWS commenced in late 2020 and included the installation of peat dams in drains and bunding techniques in the cutover area. We identified and measured GHG fluxes from four distinct ecotypes (areas with unique eco-hydrological characteristics) in both drained and rewetted areas. Based on the measured GHG fluxes and environmental data, we estimated annual GHG emissions and therefore a carbon balance. Here we wish to compare our empirical model with the Care-Peat-developed process-based model RTM (Reactive-Transport model based on Hydrus-1D). The RTM requires only water table level due to a requirement to be applicable to a wide range of peatland types in the project. The results of this comparison will be valuable for helping to improve the understanding of the mechanisms driving GHG emissions from peatlands, as well as informing the design of future models and therefore more accurate reporting of national GHG emissions/sinks.

Using Tellus Airborne Radiometric data to update peatlands map in Ireland.

Carbon Capture - Wetland Management - Oral

***Mr. Dave O'Leary*¹, *Dr. John Connolly*², *Dr. Louis Gilet*², *Dr. Jim Hodgson*³, *Dr. Eve Daly*¹**

1. University of Galway, 2. Department of Geography, School of Natural Sciences, Trinity College Dublin, Ireland, 3. Geological Survey, Ireland

Historically, peatlands have acted as globally important carbon sequestration habitats via the storage of organic material. Drained peatlands emit this carbon as CO₂ via decomposition of the stored organic material. National climate action plans require a knowledge of peatland spatial distribution across large geographic areas. Globally, peatland maps are created in a variety of ways including optical satellite remote sensing or traditional mapping techniques. However, remote sensing cannot detect peatlands under landcover such as forest or grassland. Traditional maps are often created from sparse in-situ data which rarely measure peatland boundaries. Radiometrics, a geophysical method that measures natural environmental radiation, is suited to peatland studies. Modelling of radiometric attenuation shows that a statistical difference in data recorded over peat, compared to a non-peat soil. Mineral soils contain geological material which acts as a source radiation, whereas peat is generally does not. Peat also tends to be saturated and water acts to attenuate radiation also. These effects combined means that peatlands appear as a “low” radiometric signal in the landscape. In Ireland, the Tellus survey, acquired by the Geological Survey, Ireland (GSI) aims to acquire airborne radiometric data, consistently across the country. This study uses Tellus airborne radiometric data in combination with machine learning classification, to identify peatlands under modified landcover, and to update peatland maps. The methodology is robust and can be applied in all areas where these data exist. The results may update national and international inventories of peatlands geographic distribution and inform European policy.

Sustainable Futures –a transdisciplinary summer university for international students

Sustainability in Education - Oral

Prof. Frances Lucy¹, Mr. Declan Feeney¹, Ms. Cathrine Gladh²

1. Department of Environmental Science, Atlantic Technological University, Ash Lane, Sligo, Ireland, 2. Mid Sweden University, Holmgatan 10, 85170 Sundsvall, Sweden

Since 2015 Atlantic Technological University, Sligo has been a partner in the Sustainable Futures summer university, which was established by Mid Sweden University in 2012. Each August approximately 40 students from Atlantic Technological University, Amsterdam University of Applied Sciences, Mid Sweden University, Osnabrück University of Applied Sciences and Lucerne University of Applied Sciences and Arts spend two weeks on one of these partner campuses.

Lecturers from each university also attend this summer school providing lectures on various sustainability themes while also supervising one or more of the 6-8 projects tasked to student groups. Over the course of the two weeks approx. 20 lecturers are involved via Erasmus mobilities.

Each group is composed of approximately 6 students undertaking a transdisciplinary projects with students from different countries and disciplines including, Environmental Science, Gaming, Visualization, Electronics, Computer Science, Information Systems, Human Centered Design, Economics, Social Science, Media and Journalism/Design.

Student skills increase by listening, learning and interpreting each other's ideas. They work together daily to research and solve problems and face the complex challenges around sustainability. An emphasis is placed on the annual location and field work is part of the process. At the end of the two-week summer school each group presents their project's findings to the entire summer school.

Since 2022 the summer university, which was held at ATU Sligo, has been rolled out as an Erasmus Blended Intensive Programme (BIP). The students begin the programme as a virtual mobility with some initial online lectures and group work from April onwards. Student feedback from the 2022 summer university indicate that the virtual element helps establish base knowledge and trust in staff and student groups. This can increase engagement when they arrive for their two week summer school. In 2023 Sustainable Futures will take place in Amsterdam.

Climate Change Education across disciplines in Universities of Ireland

Sustainability in Education - Oral

***Mr. Asfand Bakht Yar*¹, *Dr. Ken Boyle*¹**

1. Technological University Dublin

Climate Change (CC) will continue to alter habitats, environments, economies, and the ability of people to live healthy and safe life for many years into the future. Hence, developing Climate Change literacy is critical to providing future generations with the skills to live in this transforming world. Climate Change Education (CCE) is one of the most important strategies for the worldwide threat of global warming and has been accentuated by the UNESCO Global Education Monitoring Report 2020. More recently, they launched a worldwide survey at COP27 on youth demand for CC literacy (Greening Education Initiative). Thus, universities have a key role to play in this regard. To date, the sciences have been central in identifying the causes and trajectory of this threat. It is a global issue that necessitates a multidisciplinary approach. Thus, the generally limited contribution of the humanities to the Climate Change issue is a reason for an incomplete impact.

Irish universities currently host about 245,000 students including 32,000 international students in multidisciplinary degree programs. Therefore, it is crucial to evaluate how universities handle Climate Change as a part of their taught programmes and ongoing research projects, the types of disciplines offered related to the subject and the impact it has on students.

This study examines degree programmes and modules across disciplines in several Irish universities as advertised. It establishes that CCE is mostly found/studied in the sciences. CCE is also found in humanities but to a limited extent. Skills and awareness in CC are becoming increasingly important to employers and society in general in the current situation. There is an opportunity to create Climate Change Education relevant across a broader range of disciplines.

Climate Justice and the Role of Higher Education in Transformation

Sustainability in Education - Oral

Prof. Jennie Stephens¹

1. Northeastern University

Moving beyond technocratic approaches to climate action, climate justice articulates a paradigm shift in how organizations think about their response to the climate crisis. This paper makes a conceptual contribution by exploring the potential of this paradigm shift in higher education. Through a commitment to advancing transformative climate justice, colleges and universities around the world could realign and redefine their priorities in teaching, research, and community engagement to shape a more just, stable, and healthy future. As inequitable climate vulnerabilities increase, higher education has multiple emerging opportunities to resist, reverse, and repair climate injustices and related socioeconomic and health disparities. Rather than continuing to perpetuate the concentration of wealth and power by promoting climate isolationism's narrow focus on technological innovation and by prioritizing the financial success of alumni and the institution, colleges and universities have an opportunity to leverage their unique role as powerful anchor institutions to demonstrate climate justice innovations and catalyze social change toward a more equitable, renewable-based future. This paper explores how higher education can advance societal transformation toward climate justice, by teaching climate engagement, supporting impactful justice-centered research, focusing on fossil fuel phaseout, embracing non-extractive hiring and purchasing practices, and integrating community-engaged climate justice innovations across campus operations. Two climate justice frameworks, Green New Deal-type policies and energy democracy, structure recommendations for implementing transformational climate justice in higher education.

Young People and Climate Change Education

Sustainability in Education - Oral

***Ms. Bronagh Dillon*¹, *Dr. Kathy Reilly*¹, *Prof. Frances Fahy*¹**

1. University of Galway

There is emerging consensus that the lack of effective climate leadership, combined with institutional inertia and confused governance mechanisms, is resulting in widespread climate indifference or extremism. Responding to calls for the adoption of sustainable climate change education lens to the climate crisis, this paper presents emerging research and results from a European project (CCC-CATAPULT) examining young people's experiences of, and learning around, the climate crisis. The Challenging Climate Crisis: Children's Agency to Tackle Policy Underpinned by Learning for Transformation (CCC-CATAPULT) project includes four case study sites across Europe, including Bristol (United Kingdom), Galway (Ireland - the focus of this paper), Tampere (Finland), and Genova (Italy). Responding to calls for a geographic research agenda that recentres perspectives towards the voice of the young person, this paper incorporates a multi-method approach premised on principles of co-production. Over the course of three years, the CATAPULT project aims to co-create new and nuanced understandings of climate crisis through the voice of young people. Drawing on the principle of co-production CATAPULT draws together the views of young people, teachers and other learning supports to examine how they situate and make sense of their lives in relation to climate complexity.

This paper will present the innovative youth-led methodology adopted for this cross national European project, highlighting cutting edge results from a survey (n >2000) and Focus Groups (n>120) of 15-18 years olds from Ireland, Italy, Finland and the UK. From a sustainable climate change education perspective, the results provide valuable insight to existing (and potentially new) social norms, worldviews, possible tensions and eco-anxieties, providing a roadmap towards co-creating a vision for transformed sustainable climate-focused education.

Keywords (5): Young people, climate crisis, sustainable climate change education, education, Europe

Ireland's first Sustainable Tourism Observatory

Sustainability in Education - Oral

***Dr. James Hanrahan*¹, *Dr. Conor McTiernan*², *Dr. John Carty*³**

1. ATU Sligo, 2. ATU Donegal, 3. atu galway

The Sustainable Tourism Observatory at ATU (STORY@ATU) research group aims to help tackle the social, cultural, economic, and environmental challenges facing the tourism industry across the island of Ireland. STORY@ATU is a collaboration between the three ATU campuses. It aims to build on new and existing partnerships with key stakeholders in local authorities, state agencies, tourism industry, enterprises and communities across the island and internationally to address local challenges and collaborate with national and international researchers on global solutions. Two in press publications on Sustainable tourism literacy in Ireland will be highlighted which is the combined work of postgrad researcher Anita Confrey ATU Sligo and PIs Dr James Hanrahan ATU Sligo, Dr Conor Mc Tiernan ATU Donegal, Dr John Carty ATU Galway, Dr Deirdre Byrne.

The articles focus on the area of sustainable literacy and the role in providing skilled enterprise managers and graduates to facilitate the transition towards a Net-Zero tourism destination. Taking a knowledge management perspective, tourism enterprises and tourism HE curricula are assessed based on their adherence to four pre-determined explicit and tacit knowledge stocks identified as key elements of sustainable literacy. Desk-based research was conducted to inform the development of a quantitative research analysis tool. A case study approach was applied to the Republic of Ireland, to assess the third-level education providers provision in sustainable literacy and decarbonisation practices.

From the findings, it is evident that tourism enterprises and third-level tourism degrees have a significant knowledge gap in the area of sustainable literacy specifically decarbonisation skills, particularly in the area of measuring and monitoring emissions to facilitate the transition towards a Net-Zero tourism destination by 2050.

Building Carbon Literate Communities to Create a Positive Climate Future

Sustainability in Education - Oral

*Ms. Niamh Guiry*¹, *Dr. Maria Kirrane*¹

1. University College Cork

Higher Education Institutes (HEIs) are key drivers of Sustainability in Education and play an integral role in facilitating a transition to a just and sustainable society. This paper illustrates the opportunity for HEIs to create Carbon Literate citizens who are capable of understanding the severity of climate change and what individual and systemic transformations are needed on a local and global level. This paper uses the UCC Carbon Literacy Project (UCLP) as a case study to demonstrate how Sustainability in Education can be designed as an interactive and engaging learning experience with action-based outcomes.

Developed by UCC Green Campus in conjunction with the Carbon Literacy Project, the UCLP is a digital badge course designed to equip learners with a core understanding of climate science, environmental justice, mitigation, adaptation, and climate solutions. Participants will gain insights into how Sustainability in Education can be customised to the institutional and local context to enhance the relevance of learning material, and how to facilitate critical learner reflection on the complex social injustice issues associated with just transitions.

This paper illustrates the importance of communicating the co-benefits of climate action and empowering learners to envision a positive climate future through the creation of climate actions that can be implemented on a personal, institutional, and local level. Carbon Literacy can be used to build proactive communities of interdisciplinary learners who are capable of making informed decisions to help achieve the shared vision of a transition to a sustainable societal model. The UCLP is particularly relevant given the publication of Ireland's 2nd National Strategy on Education for Sustainable Development. Sustainability in Education can act as a positive catalyst for change and HEIs have a significant opportunity to use Carbon Literacy to enhance learning and teaching experiences and embed sustainability into individual, group, and institutional practices.

Novel Sensing Technologies for Environmental Applications

Sensing Technologies for Climate Change Solutions - Oral

Prof. Margaret McCaul¹

1. Dublin City University

Dr Margaret McCaul is currently an Assistant Professor in Analytical Chemistry at Dublin City University, PI at National Centre for Sensor Research and Funded Investigator at the INSIGHT Centre for Data Analytics. Margaret received her BSc in Analytical Chemistry at the Limerick Institute of Technology and her PhD in Analytical Geochemistry from Dublin City University. She has over ten years industrial experience in the area of analytical chemistry and has held post-doctoral positions in science education and geochemistry, before taking a senior position as team leader in sensor integration and microfluidics in the adaptive sensors group at DCU. Her current research focuses on novel sensor development from functional materials to innovative devices which comprises several distinct strands of research including: Analytical chemistry, environmental chemistry, 3D (micro-)fabrication technologies, materials chemistry, data analytics and remote sensing.

The Future of Drones and Smart Technologies in Sustainable Farming

Sensing Technologies for Climate Change Solutions - Oral

Dr. Garry Lohan¹, Dr. Oliver Mulryan¹, Dr. Carine Gachon¹, Prof. Graham Heaslip¹

1. atu galway

The agricultural community all over the world are facing significant challenges and are under ever increasing pressure to modernise farming methods in a bid to align them with worldwide food and environmental sustainability goals. Modern technology aims to help alleviate these pressures by providing the means for farmers to reduce chemicals and waste from their farms encountered during the growing season. For example, one particular way technology can help to do this is to provide a greater return on investment for every kilogram of fertiliser used to produce crops. Fertiliser rates can be adjusted to factor in the current levels of chemicals in both the soil and the crop and with accurate distribution through variable fertiliser spreaders have been shown to return a 20% savings on fertiliser costs and use while keeping the same yield. Soil and crop chemical content measures can be calculated using normalised difference vegetation indices or some of the many other indices available. This data can be collected using hand sensors, satellite data and now using infra-red cameras attached to drones. By running statistical packages, we can use real-time drone data to determine the nitrogen content of crops and produce an accurate fertiliser prescription map which can be used to accurately spread the fertiliser where it's needed. Using localized treatment plans rather than blanket spreading a product has been proven to be more effective at boosting yields whilst cutting costs and protecting the local environment. As farming technologies improve, we expect their use within the farming community to increase and this project aims to provide real-world use cases and evidence of the time and resource savings the use of such technologies can achieve.

The development of an electroanalytical method for monitoring the photocatalytic degradation of the herbicide MCPA

Sensing Technologies for Climate Change Solutions - Oral

***Mr. Wesley McCormick*¹, *Prof. Peter Robertson*², *Dr. Nathan Skillen*²**

1. ATU Donegal, 2. Queens University Belfast

The electrochemical behaviour of the herbicide MCPA was investigated for the first time using a cathodically pretreated boron doped diamond electrode. This electrode type enabled enhanced detection with reduced background current, wide potential window allowing fast, simple, and accurate quantification of MCPA. Optimised electroanalytical methodologies were developed for the detection and quantification of MCPA in supporting electrolyte and river water samples. A linear range from 0.03 mg L⁻¹ to 125 mg L⁻¹ was achieved using the electrode with a limit of detection and limit of quantification of 0.0072 and 0.02167 mg L⁻¹, respectively. Possible interfering species commonly found in river water had a negligible effect of the MCPA signal. The outlined electroanalytical technique can be easily and conveniently applied as a routine detection method with low-cost instrumentation in a laboratory setting or in the field. Use of portable, in situ techniques, such as this, overcomes many of these problems and can be beneficial in studies where the concentration of a pollutant is known to fluctuate widely. Using the developed sensing method, the photocatalytic degradation of the herbicide in aqueous solution by UV-irradiation in the presence of TiO₂ and ZnO was studied. The electroanalytical technique of square wave voltammetry was employed as a detection method for monitoring the degradation of MCPA and the subsequent formation and breakdown of the intermediate product CMP. At specified time intervals, a single voltammetric scan allowed for simultaneous monitoring of both MCPA and CMP. Electroanalytical monitoring offers advantages over the more conventional detection methods such as chromatographic and spectroscopic techniques. These advantages include inexpensive instrumentation, no sample preparation, small sample size, rapid analysis, and instrument portability.

Transforming Phosphate Monitoring in Irish Freshwater Systems using a Robust, Sensitive Portable Sensor

Sensing Technologies for Climate Change Solutions - Oral

***Ms. Rachel Bracker*¹, *Dr. Lisa Cronin*¹, *Dr. Aironas Grubliauskas*², *Dr. Louis Free*¹, *Dr. Joyce O'Grady*¹, *Dr. Sean Power*¹, *Dr. Dave Kinahan*¹, *Dr. Karen Daly*¹, *Dr. Nigel Kent*¹, *Prof. Fiona Regan*¹**

1. Dublin City University, 2. Atlantic Technological University - Sligo

The discharge of phosphorus associated with wastewater has decreased significantly in Europe over the past 25 years, however, the problem of diffuse pollution persists. Studies have shown that regulatory monitoring can miss elevated spikes in phosphorus concentrations, meaning that high frequency monitoring is required. Such programmes are resource intensive, requiring effective tools which enable appropriate water quality data collection and quality assurance.

A low cost, portable, and rapid phosphate detection system is needed to enable the quick detection of phosphate in areas affected by high phosphate levels. A new system is being developed by evolving a colorimetric detection system using microfluidic lab-on-a-disc technology which has previously been demonstrated. It utilizes a micro-spectrometer, the molybdenum blue method, and has been built with the intent of requiring limited training for in-situ analysis. The analytical range of the system is 5-400 µg/L, which encompasses the threshold value of 35 µg/L P for Irish rivers and groundwaters. The system is extremely portable due to its compact size and weighing less than 2 kg. With a run time of 15 minutes per ten samples, it enables the in-situ detection of phosphate for rapid on-site monitoring. To demonstrate the sensor, rivers in the northwest of Ireland were identified where phosphorus has been previously detected. Three of these rivers have historical orthophosphate readings in the range of 5 - 47 µg/L and two others were reported considerably higher at 84 µg/L. With this microfluidic phosphate detection system, rapid in-situ detection and reliable, real-time monitoring of phosphorus in freshwater systems can be achieved.

Infrastructure matters. EV charge points and the demand for EVs in the North West of Ireland

From Policy to Practice - Oral

Mr. John Daly¹

1. Northern and Western Regional Assembly

John Daly has worked as a Senior Economist over the past decade in both the private and public sector. In 2021, John became the Economist of the Northern and Western Regional Assembly. Such a role involves undertaking economic research relating to regional development, supporting the implementation and monitoring of the Regional Spatial and Economic Strategy of the Northern and Western Region and assisting the elected members of the Assembly. Prior to his time in the Assembly, John worked as the joint Economist of the three Regional Assemblies of Ireland and as a Senior Economist in DKM Economic Consultants and EY Economic Advisory Services.

Climate Obstruction in Ireland: A Nuanced Landscape

From Policy to Practice - Oral

***Prof. Jennie Stephens*¹, *Prof. Orla Kelly*², *Dr. Brenda McNally*³**

1. Northeastern University, 2. University College Dublin, 3. Dublin City University

The Republic of Ireland's record on climate policy is a mixed and dynamic one. It is both a recent climate leader, having passed ambitious climate policy including the Climate Action Act (2015) and the Fossil Fuel Divestment Act (2018), and is also considered a climate laggard, as these policies have not yet resulted in significant emissions reductions. Acknowledging this complexity, this research reviews the nuanced landscape of climate obstruction in Ireland. Ireland has a comparatively small fossil fuel industry, but a strong cultural tradition and economy based on agriculture and the burning of high-carbon-emitting peat for home heating in rural areas. The presentation will first explain the concept of climate obstructionism in different contexts around the world, and then describe the history of climate policy debates in Ireland and outline the development of a climate obstruction apparatus in this small EU state. Then it will identify the major actors including corporate interests, lobby groups, political parties, and the Irish Climate Science Forum (a climate denial organization). It will also cover the range of tactics used by different actors to delay climate action, including a review of how the news media has been leveraged to amplify and legitimize messages of delay, providing a sectoral analysis of funding for countermovement campaigns. Finally, it will apply a typology of climate delay discourses to identify the discursive strategies used by vested interests in Ireland to obstruct, deny, delay and distract climate action.

What support do fishery-to-food bank programs need to be economically and environmentally sustainable?

From Policy to Practice - Oral

Ms. Monica Galligan¹

1. Monterey Bay Fisheries Trust

The COVID pandemic brought devastation, disruption, and also opportunity to the seafood industry. Seemingly overnight, seafood producers saw their markets evaporate, while food banks faced an urgent upsurge in demand. In some fishing communities, innovators seized the moment, addressing these challenges by forging inspired connections. While a few fishery-to-food bank programs had existed for decades, many fresh endeavors emerged amid great enthusiasm, providing local seafood to hungry new fans. These programs, and the circumstances surrounding them, continue to evolve. Some programs are becoming comfortably institutionalized while others require additional support.

I am working with some of these fishery-to-food bank programs to assess their economic and environmental sustainability, considering the programs' history, current status, challenges, and future prospects. Through this investigation, I intend to identify endogenous and exogenous factors that have promoted (or indeed, hindered) the programs' success, then share the findings to support related efforts worldwide.

Science advisory bodies of the EU and their role in environmental decision-making

From Policy to Practice - Oral

Ms. Rhoda Jennings¹

1. University College Cork

Scientific evidence is an intrinsic element of environmental law. At an EU level, there is a wealth of scientific advice and science advisory bodies feeding into law and policy formation.

This paper will examine the science advisory bodies of the EU and their influence on legislative and policy decisions in environmental law. The earliest form of advisory bodies developed in line with agricultural policy, and the demand for detailed technical input. Risk assessment agencies were created in response to growing concerns over product safety, while scientific agencies were often established in response to a particular crisis. Designated knowledge services such as the Joint Research Centre and the recent, Science Advice Mechanism, provide science advice directly to the Commission.

There is an abundance of high quality science advice at an EU level. How these bodies input into the regulatory process varies greatly. There is no uniform protocol setting out how scientific evidence is to be used in the decision-making process. The responsibilities of such bodies are restrained within strict legal boundaries, and when the bodies demonstrate increasing powers, they are criticised in terms of accountability and legitimacy. The input of these bodies, however, is essential in order to ensure more effective policies and to support the democratic process by providing the facts to support democratic debate. A framework is required in order to consolidate the work of the various scientific bodies of the EU. A defined methodology for the use of scientific data in the regulatory process is also needed, which would lead to greater transparency and trust in regulatory decision-making, enhancing the legitimacy of environmental law.

An investigation, assisted by Geographical Information Systems, into decarbonising Ireland's National Hub Network of remote working infrastructure within sustainability context.

From Policy to Practice - Oral

Mr. David Murphy¹

1. Western Development Commission & National Hub Network | (ConnectedHubs.ie)

A thesis to be submitted in partial fulfilment of the requirements for the award of:
Master of Science in Project Management

Atlantic Technological University
ATU Sligo - Online & Flexible Learning
2020 ~ 2023

The National Hub Network (NHN) was launched on 31st May 2021 as a Government of Ireland (GoI) supported and funded nationwide initiative.

It brings together privately and publicly owned remote working hubs, that wish to participate, under one network, identity, brand and online platform connectedhubs.ie.

National climate objectives require the Public Sector under Climate Action Plans (CAP's) (Ireland; Department of the Environment, Climate and Communications, 2022) to be a key leader by example and a driver of change. Deep retrofitting and enabling roll-out of energy efficiency measures to existing buildings and facilities within NHN would contribute well to priority areas within climate action objectives, cross-pollinating NDP, CAP's, Ireland's Long-Term Renovation Strategy and National Deep Retrofit Programme.

Whilst high-quality datasets about the National Hub Network are emerging and evolving since February 2021, the pre-existing data collection does not capture anything about the objective hub buildings themselves in areas of energy efficiency, renewable energy technologies, deep retrofitting, and/or sustainability.

The research intention is a 3-way information mash up about National Hub Network, GIS, and built environment Sustainability.

New primary data, collected in February 2023, will be merged with existing GIS datasets for detailed analysis plus decarbonising recommendations

GIS solutions for mapping, visualisation, data management, monitoring, analytics, design, planning, decision support, sharing and collaboration are crucial building blocks to create repositories for delivering authoritative open datasets.

GIS analysis will assist research topic with identifying clusters of opportunities to improve building comfort, operational performance, renewable energy technologies and hub building lifecycles, enabling data-driven positive decisions around future national & international targeted sustainability funding.

David Murphy - LinkedIn (Connected Hubs): <https://ie.linkedin.com/in/david-murphy-2021>

Addressing the challenges and opportunities of green business from a youth perspective

From Policy to Practice - Oral

Mr. Paul McCusker¹, Ms. Una Quinn¹

1. Atlantic Technological University - Donegal

Currently, the depletion and use of our natural resources poses a great risk to our natural environment. Especially through actions being undertaken which directly contribute to climate change.

The impact of these actions is resulting in disastrous consequences for many communities as they impact on the basic human right to a clean environment and can have a significant impact on human health. The sectors which are dependent on natural resources, such as agriculture, fisheries, energy and tourism, are facing new and increasing risks as a result.

Young GREENtrepreneurs aims to address this risk by promoting green entrepreneurship among young people. By doing so, the project aims to promote the use and development of green entrepreneurship as a practical means of addressing environmental challenges.

The objectives of the project are the following:

- To equip young people with innovative digital tools that will support them in setting up green enterprises through the provision of new skills, competences and practical knowledge.
- To develop training modules on green product development that will help young people to develop necessary competences.
- To promote green entrepreneurship among aspiring young entrepreneurs.
- To promote the use of digital tools at an EU level to encourage green entrepreneurship among young people.

Engagement with young people through education and awareness-raising is vital to encourage young people to become green entrepreneurs. The Young GREENtrepreneurs education frameworks, created in partnership with educational institutions and youth workers, are designed so as to provide a guided introduction on green entrepreneurship, from the initial ideation through to implementation. The project encourages young people to realise the full impact that green enterprises can have in wider society and to explore the possible opportunities available.

The Renewed Role for Plants in our Future Food Systems

Sustainable Land Use, Agriculture & Food - Oral

Prof. Fiona Doohan¹

1. University College Dublin

Professor Fiona Doohan is a Lecturer in Molecular Plant Pathology at UCD and is a Principal Investigator on several major national and international research initiatives, including CONSUS, Food Shield and Healthy Oats and the EU project INNOVAR. Fiona's expertise and research focuses on biocontrol's, crop science, fungal-pathogens, microbial disease, and plant science. As a crop scientist her research is focused on improving the sustainability of crop production systems in Ireland and globally, and enhancing the diversification, safety, and transparency of Irish food systems. She has secured over €30 million in research funding to date and is listed as one of the top 100 Irish Women in Science, Technology, Engineering and Maths. Fiona is also a recipient of the 2021 NovaUCD Innovation Award and the Enterprise Ireland Champion of Research awards.

The emerging field of AgroGeophysics – A future in Ireland?

Sustainable Land Use, Agriculture & Food - Oral

Dr. Eve Daly¹

1. National University of Ireland Galway

Soil is a vital non-renewable resource with the capacity to deliver food production, nutrient retention and cycling, carbon storage, filtration of water and a habitat for biodiversity. Global food demand is expected to increase by 100% by 2050. This results in the need to use less water and fertilizer, and to harness soil quality. Key to achieving this goal is improving the understanding of processes and interactions governing the soil–plant–atmosphere continuum of agricultural ecosystems

Increasingly, geophysics is used to provide a multidimensional suite of tools to image the subsurface (depth <2-5m), and monitor fluid dynamics and biogeochemical processes across multiple spatial scales noninvasively. The emerging research field of AgroGeophysics and the availability of high spatial and temporal resolution Earth Observation data products is helping to 1) fill the scale gap from in-situ field measurements to landscape scale mapping, and 2) in characterization of soil structure directly or indirectly by measurement of proxy variables. Ongoing research in Ireland includes integrating Tellus Airborne Geophysical radiometric datasets (measuring the amount of Uranium, Thorium and Potassium being emitted from the earth) with Satellite optical remote sensing data products via machine learning techniques to improve soil characterisation and soil moisture monitoring. Field based projects include the identification of soil drainage status and monitoring compaction from cattle grazing with mobile electromagnetic induction methods which measures variations in the electrical conductivity of the soil which can be related to water content.

Estimating surface soil moisture in Ireland at high resolution using Sentinel 2 and a modified OPTRAM model

Sustainable Land Use, Agriculture & Food - Oral

***Mrs. Rumia Basu*¹, *Prof. Colin Brown*², *Dr. Patrick Tuohy*³, *Dr. Eve Daly*²**

1. National University of Ireland Galway & VistaMilk SFI Research Centre, Teagasc, 2. National University of Ireland Galway, 3. VistaMilk SFI Research Centre, Teagasc

Soil drainage capacity is the degree and frequency at which the soil is free of saturation. Accurate information on drainage conditions, which in turn is governed by soil moisture, is crucial for crop production and management and fundamental in developing strategies to achieve environmental sustainability goals. This is particularly important in Ireland where a high proportional of soils are poorly drained, that negatively impacts plant growth and productivity.

We develop a modified OPTRAM model to derive normalized surface soil moisture estimates on two sites dominated by soils with low hydraulic conductivity. The OPTRAM model incorporates a physical relation between soil moisture and Short Wave Infrared (SWIR) reflectance and is traditionally formed by the distribution of the shortwave infrared transformed reflectance (STR) and Normalized Difference Vegetation Index (NDVI) to define wet and dry edge curves. Normalized surface soil moisture (nSSM) is then estimated by measuring the vertical distance between the curves. Along with NDVI, we test other vegetation indices such as the Enhanced Vegetation Index (EVI) and Modified Soil Adjusted Vegetation Index (MSAVI) and estimate nSSM for each of the indices. Sentinel 2 images for the time period 2015-2022 is used in the model for the two sites. The results obtained from remote sensing data have been validated using in situ soil moisture sensors.

We show that at a spatial resolution of 10m, our model is able to distinguish between different degree of wetness in soils for wet (high rainfall) and dry (low rainfall) conditions. Based on correlations with STR, EVI is identified to be the best vegetation Index for estimating soil moisture. This study could pave way for producing high resolution national level soil moisture maps.

Assessment of techno-functional properties and health-enhancing benefits of protein and its associated hydrolysates from brewers' spent grain

Sustainable Land Use, Agriculture & Food - Oral

Ms. Jiao Zhang¹, Dr. Ariane Perez-Gavila¹, Dr. Adriana Cunha Neves¹

1. South East Technological University - Carlow

Brewers' spent grain (BSG) is the most abundant co-product of the brewing industry, constituting approximately 85% (w/w) of the total waste generated during beer production. This by-product has been shown to contain a high content of protein (20%–30%) with valuable nutritional benefits. It is estimated that over 40 million tons of BSG are produced globally every year, with approximately 160000 tons generated in Ireland alone. However, as the largest waste by volume, around 70% of this protein-rich BSG is simply used as animal feed. Furthermore, due to the high moisture content (75%) and microbial load, its shelf life is extremely short, resulting in approximately 10% of spent grain being converted into biogas and the remaining 20% being landfilled. Every tonne of BSG disposed of in a landfill emits 513 kg of CO₂-equivalent greenhouse gases, which violate sustainability principles and trigger serious environmental problems. Therefore, the aim of this work is to exploit the potential of BSG as a source of valuable proteins and nutritional peptides while reducing waste from the brewing industry. Our current results have indicated that not only is it possible to extract good-quality proteins from BSG, but also those proteins and associated hydrolysates have health-enhancing bioactivities and valuable functional properties (Max ACE inhibition of $73.95 \pm 0.01\%$, and Max antioxidant of $844.63 \pm 11.12 \mu\text{M}$). Currently, more industrially relevant and inexpensive techniques for obtaining BSG bioactive peptides are being studied. In addition, special emphasis will be placed on value-added food development as well as the techno-functional characterizations of the generated food products.

Thus, this project aims to broaden the potential applications of BSG by developing protein-enriched food products with green and clean technologies, achieving great economic benefits for industrial production, and alleviating the current food insecurity issues.

Moisture limits to maintain grassland soil physical quality over repeated machine trafficking

Sustainable Land Use, Agriculture & Food - Oral

*Ms. Emanuela Lepore*¹, *Prof. Olaf Schmidt*², *Dr. Giulia Bondi*¹, *Dr. Owen Fenton*¹, *Dr. Saoirse Tracy*²,
*Dr. David Wall*¹

1. Teagasc Reseach, Johnstown Castle, 2. University College Dublin

Soil moisture significantly affects the level of soil compaction caused by machinery trafficking. Although soil compaction is a major threat to soil degradation in Europe, data to guide grassland farmers in avoiding traffic-induced soil compaction is limited. A moderately drained field study at Johnstown Castle Dairy Farm (Wexford, Ireland) investigates how soil physical quality changes across different induced traffic compaction events imposed at targeted soil moisture deficit (SMD). A tractor and a fully loaded slurry tanker trafficked plots at targeted SMD of 10 (dry (D)), 0 (moist (M)) and – 10 (wet (W)) mm. Compaction events simulated four passes across one year of grassland management: in April, in June, in October, and in January. Soil bulk density (BD) samples and water stable aggregate samples (WSA) were taken in the middle of the tyre marks at different depths (0-10, 10-20 and 20-30 cm). Results showed that the progressive increase in the number of trafficking events occurring above SMD 0 mm leads to major compaction, which significantly increased ($p < 0.05$) compared to trafficking at SMD 10 mm. The cumulative effect of the four passes showed a significant difference from M to D and W, with M's BD increasing by 22.2% compared to the control. Both D and W BDs remained similar, ranging between 1.10 and 1.11 gr cm³, indicative of very poor (i.e. degraded; $S < .035$) quality in M only. In contrast, WSA only remained in the safe range for D. Results suggest that the relatively low BDs of M and W (1.25 and 1.11 gr cm³, respectively) refer to a structural loss of the soil; hence, soil moisture forecast is valuable to protect soil physical quality and enable farmers to traffic soils appropriately.

Keywords: soil compaction, grasslands, soil moisture, field traffic, soil physical quality indicators

Farmers' attitudes towards agricultural plastics – Management and disposal, awareness and perceptions of the environmental impacts.

Sustainable Land Use, Agriculture & Food - Oral

Ms. Clodagh King¹, Dr. Caroline Stephens¹, Dr. Joseph P. Lynch¹, Dr. Siobhán N. Jordan¹

1. Dundalk Institute of Technology

The amount of plastic waste resulting from agricultural practices is increasing and this trend is expected to continue. Although plastics are essential for certain farming tasks, their impact on the environment is becoming a major issue of concern. Mismanaged larger plastics can disintegrate into microplastics and make their way into soils, surface and groundwater sources. Microplastics are extremely persistent and have the potential to facilitate the transfer of contaminants through the environment, potentially affecting terrestrial and aquatic wildlife. A descriptive survey was conducted on a sample of farmers ($n = 430$) in Ireland to assess their attitudes on agricultural plastic waste management and their awareness and perceptions of the impacts of microplastics and plastics on the environment. This study found that most farmers (88.2%) are concerned about the amount of plastic waste generated by farming activities. Agricultural plastic disposal methods vary and recycling rates mostly depend on the type of plastic, the cost of recycling and access to facilities. Most farmers view agricultural plastics negatively due to their impact on the environment but also because of the monetary and logistical burdens associated with them. Farmers were relatively aware of microplastics (57.5%), but overall more farmers felt they knew more about plastic pollution than microplastic pollution and these issues in aquatic systems. This was also evident when it came to their perception of the risks plastics pose on the environment with more farmers believing that aquatic environments are at greater risk than the terrestrial environments. Future research efforts must focus on plastic and microplastic pollutions in soils to inform policy-makers and to create greater public awareness. In addition to this, several developments are needed in a collective effort by governments, policy-makers and other stakeholders to reduce plastic and microplastic problems in agriculture.

UCD Earth Institute societal engagement projects

Societal Engagement-Working Together - Oral

Dr. Elizabeth Bruton¹

1. University College Dublin

Dr Elizabeth (Liz) Bruton is Communications and Engagement Officer at the UCD Earth Institute. Liz's work has a strong societal engagement element including the newly established UCD citizen science community of practice, the Earth Institute Citizens' Observatory, and the ECOBROKER platform and programme of events. Liz has a background in science communication, public engagement and history of science. She has previously worked at the Science Museum, London, University of Manchester, University of Oxford, and University of Leeds. Liz's work bridges the gap between academia and the public, communicating academic research to different audiences and engaging new communities.

Title: Accessible education to support action towards the Sustainable Development Goals (SDGs): moving from policy & enabling practice.

Societal Engagement-Working Together - Oral

Dr. John Scahill ¹, Dr. Carmel Heaney ¹, Ms. Frances O Donnell ¹, Mr. David Chernick ², Dr. Mark Garavan ¹, Dr. Mark Kelly ¹

1. Atlantic Technological University - Galway Mayo, 2. Atlantic Technological University

Background: Education for Sustainable Development is a key element of the 2030 UN Agenda for Sustainable Development. Education is both a specifically identified Goal (SDG 4. Quality Education) and is considered an integral driver for the achievements of all 17 SDGs. The Agenda calls for a trans-, inter-, and multidisciplinary approach. Hence, it is considered that discipline-oriented programming will often deliver incomplete solutions. Aim: To develop an accessible and sustainable educational introduction to the theory and application of the UN SDGs with a particular focus on national and regional impact.

Objective: to apply a trans-disciplinary approach to developing a certified learning pathway that will:

1. support the national, sectoral, and institutional commitment in achieving the SDGs
2. develop a student and staff body across all disciplines of study that understand the concept of SDGs and have insight into their personal role as a global citizen
4. showcase examples of approaches to SDG engagement within a local context
5. generate teaching and learning resources that can be offered to all partners of the ATU, fostering partnerships focused on SDG realisation within the region

Results: Drawing on cross-disciplinary expertise within the ATU, *Certificate in The Sustainable Development Goals, Partnership, People, Planet & Prosperity* was developed. The L6 programme consists of 4x 5-credit modules with digital badges embedded. This HigherEd 4.0 funded, online, asynchronous, self-paced programme inducted its first intake in February 2023 (n=19; 53% female; previous educational attainment L10 5%, L9 40%, L8 30%, L6 20%; Private sector 45%).

Conclusion: Development and rollout of this programme proffers an accessible and sustainable solution to introduce education on the SDGs and on how the SDG framework can be applied in a local context to encourage the implementation of environmentally sustainable, living and working practices that support a just transition to more equitable society.

What is Wildlife Security?

Societal Engagement-Working Together - Oral

Dr. Emma Fletcher-Barnes¹

1. University College Dublin

The need to protect and conserve Earth's biodiversity is more imminent than ever. Human-wildlife conflict plays a role in increasing the vulnerability of already fragile species populations in some of the most volatile socio-political environments. One crisis that has persisted over the last decade is the poaching crisis on the continent of Africa, with South African wildlife populations in particular being decimated as targets of wildlife crime. Over the last decade, urgent and at times novel measures have emerged to deter and prevent poaching in the region, some of which has contributed to the development of the term *militarized conservation*.

This paper; which is based on my PhD research; understands wildlife security as a space where conservation and security intersect, but argues that securing biodiversity differs from human security and other approaches within environmental security that focus on wildlife solely as a resource. Building on emergent literature on the social science of conservation, this paper calls for a new ontology of security that reconsiders how we approach the security and protection of wildlife, thinking beyond the boundaries of militarized approaches. Additionally, focusing on the case study of South Africa, this paper shall explore the current state of the poaching crisis and the responses and actions taken to prevent this form of human-wildlife conflict, questioning the limitations of militarized approaches and exploring how the concept of wildlife security contributes to an improved understanding of the interconnectedness between humans and non-human nature.

Towards Developing Accessible and Inclusive Field Based Marine and Freshwater Teaching

Societal Engagement-Working Together - Oral

***Ms. Sheena Fennell*¹, *Ms. Aedin McAleer*¹, *Dr. Rachel Cave*¹, *Dr. Mary Dempsey*¹, *Mr. Liam Grimes*²**

1. University of Galway, 2. Lough Ree Access for All

In embracing all the talents of our society, now more than ever we need to practice participatory design for societal engagement and inclusion. This will enrich research and teaching in marine science with a purpose to protect our marine and freshwater environments. Field based teaching is a core element of earth and marine degree programmes and it can provide a barrier for people with disabilities. A pilot project was set up in an Irish HEI to investigate through participatory design what methodologies can be employed to reduce barriers to learning.

The Lough Ree 'Access for All' charity is based in Lanesborough, Co. Roscommon. It provides a boat, which is the only boat accessible for wheelchair users in Ireland and the United Kingdom. This enables disabled users to travel out by boat on Lough Ree for both fishing and pleasure trips. Supported by the College of Science and Engineering from the University of Galway, two staff met with Lough Ree staff and volunteers on the 16th of September 2022. The purpose of the day aboard the boat was to explore alternative teaching and learning methodologies to accommodate students or staff with a physical disability. In collaboration with the team and volunteers, the learnings attest that it was possible to adjust sampling methodologies and enable someone with restricted mobility to be trained to deploy instrumentation regularly used for marine and freshwater sampling.

Can green innovation impact firms' competitiveness and environmental performance? A simultaneous analysis

Societal Engagement-Working Together - Oral

*Ms. Maria del Pilar Cespedes Davalos*¹, *Dr. Bernadette Power*¹, *Dr. Geraldine Ryan*¹, *Dr. John Eakins*¹, *Prof. Eleanor Doyle*¹

1. University College Cork

According to the Porter hypothesis, strict environmental regulations can create efficiencies and encourage innovations that help improve companies' competitiveness. This suggests that firms' environmental and business performance can be driven by green innovations. Empirical evidence supports that green innovation positively impacts environmental and business performance; however, there is also support for the positive effects of business performance on the development of green innovation activities. Suggesting a reinforcing relationship between green innovation and business performance.

No study that we are aware of examines whether increases in environmental performance raise green innovation. This is likely to be the case to counteract the increase in consumption of resources after introducing green innovations (Jevons paradox). Therefore, this research is novel because we examine whether the relation between green innovation and business performance is reinforcing, and analyse the type of relation between green innovation and environmental performance. The analysis is conducted for the highly innovative pharmaceutical sector and the less innovative food and beverages sector.

The research brings green innovation, business, and environmental performance measures together by using facility and firm-level time series data between 2007 and 2019 from different sources (European Patent Office, European Pollutant Release and Transfer Register, and Fame Database) to empirically test the reinforcing effects of green innovation. Using a simultaneous equations analysis to jointly identify, model and estimate the relations using iterative three-stage least squares estimation, we seek to comprehensively examine the impact of green innovation for these two sectors.

Preliminary results show that firms' competitiveness has a positive and significant effect on the development of green innovation activities. Also, we find that it takes at least one year for green innovation activities to have positive effects on business and environmental performance. Hence, policy supports in this area have a dual effect and should be encouraged.

Time for a Nappy Change: beliefs and attitudes towards modern cloth nappies.

Societal Engagement-Working Together - Oral

***Mrs. Nicola Watson*¹, *Dr. Sara Benetti*¹, *Dr. Suzanne Beech*¹**

1. School of Geography and Environmental Science, Ulster University.

The United Nations Environment Programme highlights how the use of disposable nappies has become unsustainable, yet the practice of using modern cloth nappies (MCN) is niche. This study uses mixed methods of survey, story completion and focus group methods to explore how behaviour beliefs and attitudes to behaviour contribute to families' decision making regarding the nappy system they use for their children. 1588 responded to the survey; 38 completed story completion activity; 24 participated in groups. This study finds that beliefs about the performance as a nappy, environmental credentials, financial considerations, laundry, effort, and hygiene differ according to the level of personal experience of using MCN. While beliefs about the environmental credentials of MCN create powerful drivers for the intention to use MCN, other beliefs about the upfront costs, laundry and effort contribute a negative attitude to MCN overall if their support network of other MCN users is not established. Current MCN users found using cloth nappy retailer websites, nappy libraries, and social media groups, including pre-loved and-sell groups, to be beneficial in improving attitude to MCN. This study concludes that interventions that simultaneously reduce or remove perceived barriers such as upfront costs, financial risks and too much effort, paired with campaigns which increase the likelihood of finding support, are more likely, than individual interventions, to be effective in increasing the number of families using MCN. Further study is needed to investigate the potential of interventions which reduce the financial risks such as, easy to access hire kits, spread the cost of MCN and pre-natal and newborn public services such as midwives and health visitors being well informed and encouraging of the use of MCN.

In-Situ Monitoring of Key Water Quality Parameters

Sensing Technologies for Climate Change Solutions - Oral

Prof. Dermot Diamond¹

1. Dublin City University

Prof Diarmuid Diamond received his Ph.D. (Chemical Sensors) and D.Sc. (Chemical Sensor Networks) from Queen's University Belfast. He was Vice-President for Research and director of the National Centre for Sensor Research (www.ncsr.ie) at DCU and a Principal Investigator with the SFI funded Insight Centre. He was awarded the inaugural silver medal for Sensor Research by the Royal Society of Chemistry London (2002) and the Boyle Higgins Gold Medal by the Institute of Chemistry of Ireland (2015). He was admitted to Membership of the Royal Irish Academy (2014 and awarded an honorary Doctorate by Ulster University (DLitt) in 2018 for contributions to culture and heritage. In June 2019, he was appointed member of the high-level European Innovation Council (EIC) Pilot Advisory Board and was appointed chair the EIC Pathfinder Working Group.

He is currently Field Chief Editor for the journal "Frontiers in Sensors" (<https://www.frontiersin.org/journals/sensors#editorial-board>) and consulting projects manager with Siemens-Healthineers, Walpole, Massachusetts . His research has ranged from the fundamental science of stimuli responsive polymers, the development of futuristic autonomous chemical sensing platforms (environmental and health applications), and the use of analytical devices and sensors as information providers for wireless networked systems.

The Electronic and Optical Properties of Metal Organic Framework: MIL-101(Fe), and MIL-101(Fe)/graphene Nanocomposite

Sensing Technologies for Climate Change Solutions - Oral

***Mr. Qusai Ibrahim*¹, *Dr. Salem Gharbia*¹**

1. Atlantic Technological University - Sligo

Metal-organic frameworks (MOFs) such as MIL-101(Fe) has received more attention by researchers in recent years due to their potential applications in photocatalysis and wastewater treatment. In this study, we simulated the molecular structure, electronic structure, and optical properties including dielectric function, and UV/Vis absorption spectrum of MIL-101(Fe) and MIL-101(Fe)/graphene nanocomposite. The molecular structure has been created and optimized using a geometry optimization task which is the initial stage of the simulation process by using the ReaxFF code with a maximum number of iterations equal to 100. The electronic properties simulated by using Density-Functional based Tight-Binding (DFTB) and BAND codes. The band gap was calculated for all synthesized nanocomposite materials, and the difference in electronic structure was further explained by extracting the density of state and projected density of state (PDOS). The results showed that the energy of formation of MIL-101(Fe) was equaled to 1945.6 E.V. (endothermic), while the band gap was equaled zero. For MIL-101(Fe)/graphene nanocomposite, the energy of formation decreased to 1730.88 E.V. (endothermic), while the band gap was equaled zero. The decrease in the energy of formation has increased the stability of MIL-101(Fe) after the combination with graphene.

Development of a low-cost portable system for the simultaneous detection of soil pH and potassium.

Sensing Technologies for Climate Change Solutions - Oral

***Mr. Matthew McCole*¹, *Dr. Denis Mc Crudden*², *Mr. Martin Bradley*¹**

1. ATU Donegal, 2. Atlantic Technological University - Donegal

Soil pH plays a significant role in soil biogeochemical processes responsible for plant growth and biomass yield. It is a reliable predictor of soil properties as it's considered a major element that influences other soil properties. The natural soil pH is reflective of the combination of the effects of soil forming factors which include minerals in parent soil material, time, topography, and organisms

Potassium is the 3rd major essential macronutrient and most abundantly absorbed cation that plays a significant role in the growth, metabolism, and development of plants. However, unlike other essential nutrients, potassium doesn't become a part of the plants chemical structure and so its mobility within the plant allows it to impact nearly all aspects of plant growth. Every year agricultural land that has been harvested needs to have its potassium levels replenished by adding potassium-based fertilizers. Therefore, to reduce to use of excessive fertilisers, on-site detection of potassium levels can aid in the application of sufficient amounts of fertilisers.

Large-scale monitoring of soils has advanced in recent years, creating opportunities to transform our scientific understanding of pollution. Conventional analytical techniques provide traceability, precision, and accuracy, but in many cases, they demand expensive and complex instrumentation, but more importantly only provide low analysis frequency.

Advancements in electronic instrumentation and the miniaturisation of systems has made the possibility of much more frequent portable in-situ measurements more realistic. This work has developed a miniaturised ISE platform consisting of 3D printed sensors for potassium and pH. The design of these arrays is novel in soil analysis as they will allow the determination of the analytes in extremely small volumes samples without the requirement of sample preparation. This system can be used for the routine analysis of potassium and soil pH in soil pore water.

A business case for climate neutrality in pasture-based dairy production systems in Ireland: Evidence from Farm Zero C project

Climate in the Balance - Oral

***Dr. Theresa Rubhara*¹, *Mr. Luis Alejandro Vergara*², *Mr. James Gaffey*¹**

1. Munster Technological University - Kerry, 2. University College Dublin

Irish agriculture dominated by a large bovine population faces the challenge of reducing Greenhouse Gas (GHG) emissions to reach climate neutrality by 2050. The Farm Zero C project uses a holistic approach to change a conventional dairy farm to a climate-neutral farm. An interdisciplinary program is being applied on a commercial dairy farm to reduce emissions by targeting soil and grassland management, animal diets and renewable energy. The objective was to model the environmental and economic impact of simultaneously applying farm-level climate change mitigation strategies for a conventional grass-based dairy farm in Ireland. An average farm of 66ha, 93 spring calving herd was used as a case study to create a business case. Fifteen strategies were modelled simultaneously for two scenarios to see the overall impacts of emission reduction and farm profit. Partial budgeting was used to get net annual savings/costs. Cradle to grave Life Cycle Assessment (LCA) was used to model reduction in GHG emissions which was expressed as kg Carbon dioxide equivalent per kilogram of Fat and Protein Corrected milk (kg CO₂-eq /kg FPCM). The baseline for average emissions was 0.932kg CO₂-eq /kg FPCM. An average conventional farm would reduce its annual emissions by 15% to 0.79kg CO₂-eq /kg FPCM in scenario 1 where climate change mitigation strategies were applied on a minimal scale. For scenario 2, the emissions are reduced by 28% to 0.67kg CO₂-eq /kg FPCM. In terms of annual savings on cash income, an increase of €3688 and €18630 in net savings are realised in Scenarios 1 and 2 respectively. Major savings were realised from fertiliser and the major costs were slurry and anti-methane additives.

Clean energy futures - community visioning process

Climate in the Balance - Oral

Ms. Nuala Carr¹, Ms. Emily Gray¹, Prof. Frances Fahy¹

1. University of Galway

The societal adaptations necessary to decarbonise our energy systems require urgent collective engagement and action across all levels of society: government, industry and communities. Collectively envisioning our desired future energy systems enables strategic planning towards transitions to a sustainable future.

This paper presents research on a community visioning process for clean energy futures, currently underway as part of the Shared Green Deal (SGD) project, led by researchers at the University of Galway. This five-year European project spans all EU Green Deal policy areas and involves undertaking 6 streams of social experiments (each in 4 different EU or H2020-Associated countries), in partnership with civil society and municipality organisations to conduct socio-cultural comparisons of collective practices and individual behaviours (and influences), across different European contexts.

Creating a link between the macro-level of climate change and the under-theorised local or micro-level reality of community life underpins the chosen approach of our SGD Clean Energy experiment, namely, meso-level socio-technical imaginaries. Our Clean Energy experiment aims to explore the meso-level units and processes involved in the co-creation of community-based visions of a just energy transition and to understand how local recommendations imagine transition pathways towards those visions.

The co-creation visioning processes that will be carried out by a diverse range of participants and perspectives will focus on three key stages: 1) identifying the most promising opportunities and the main challenges; 2) developing a shared vision for the future; and 3) outlining a set of recommendations to achieve the vision and future actions, tailored to each specific region. The anticipated outcomes from the experiment include, the generation of an energy futures vision document specific to each region; cross-national knowledge exchange, capacity-building and the formation of new networks; as well as recommendations to foster and highlight communities' capacities for planning for their own energy futures.

Carbon capture and Direct Air Capture in Ireland: a pathway to a clean future

Climate in the Balance - Oral

Mr. Daniel Casaban¹, Mr. Sean Ritchie¹, Dr. Elena Tsalaporta¹

1. University College Cork

Global temperature will surpass the threshold of 1.5 °C in the next decade. As well as other technologies, the implementation and the development of Carbon Dioxide Removals (CDRs), such as carbon capture and Direct Air Capture (DAC) will play a key role in mitigating climate change. This article provides information on the development of carbon capture and DAC and how these technologies can help Ireland tackle climate change and meet its carbon goals. The study highlights the methods to remove permanently CO₂ from the atmosphere and the decarbonisation of the industry sector. Ireland set an ambitious plan to finish its dependence on fossil fuels while there is a strong reliance on fossil fuels, despite the strong reliance of specific sectors on fossil fuels and while there is no reliable alternative. Carbon capture and DAC have been strongly supportive by countries such as Germany, France and the United States while Ireland has not considered this bridge technology for its conversion to a sustainable future. The time scheduled to switch towards a free carbon economy is tight and carbon capture and DAC have to be implemented so Ireland can meet its climate goals in the next decade. In conclusion, the transition from fossil fuels to renewables or alternative forms of energy, requires bridge technologies such as carbon capture and DAC in order to ensure the smooth transition to a new energy era. The future of carbon capture and DAC in Ireland has to start now, so the country will meet its climate targets while maintaining the high standards of societal needs, habits and culture.

SEAI Energy Research Supports: An overview of SEAI research funding supports and opportunities, and an insight into the current 2023 SEAI National Energy Research, Development & demonstration (RDD) Funding Programme Call.

Sustainable Energy - Oral

Ms. Irene Ward¹

1. SEAI

Irene Ward works on the delivery of the SEAI National Energy Research, Development and Demonstration (RD&D) Funding Programme, which supports innovative energy RD&D projects that contribute to Ireland's transition to a clean and secure energy future. Irene is an experienced project manager with over twenty years' experience working in academia, industry and community development. She holds a BSc Geography, MSc Management, PGCE and is completing an MSc in Environmental Sustainability.

Ex-post and Simulation Modelling to inform low carbon policy

Sustainable Energy - Oral

Ms. Vera O’Riordan ¹

1. University College Cork

This presentation explores the modelling methods used to provide a strong evidence base for deep decarbonization and climate policy planning in Ireland. First, the development of sector specific transport models is explored. Building on the Irish Car Stock Model, information from the Irish National Travel Survey, and public transport annual reports, a model of passenger transport demand and emissions from 2008 – 2018, by mode type and trip purpose is developed. The resulting Irish Passenger Transport Emissions and Mobility (IPTeM) model is then applied to an energy systems wide model, the LEAP Ireland model, to inform simulations of future passenger transport emissions, and scenarios for deep decarbonization. Adapting the IPCC’s “Avoid-Shift-Improve” framework for passenger transport deep decarbonization, it is possible to investigate the potential of demand reduction (“Avoid”), modal shift (“Shift”), and electrification and biofuel mixing (“Improve”) with exploratory scenarios for policy makers. Then, we look at the LEAP Ireland model which includes multi-sector sources of emissions - from transport, residential, industry, services, land use and agriculture sectors. This enables us to explore scenarios and calculate sectoral emissions for Ireland’s carbon budget. We investigate the emissions from the many GHG emitting sectors in Ireland and the current weak spots in Ireland’s Climate Action Plan. We also highlight how we can model and provide evidence to support decision making on progress towards meeting our legal obligations under the Climate Action Bill.

Where we live: How settlement patterns impact energy service demands and climate mitigation options

Sustainable Energy - Oral

***Ms. Ankita Gaur*¹, *Prof. Hannah Daly*¹**

1. University College Cork

Spatial settlement patterns determine the demand for transport, housing, and services. For example, how spaced-out people live determines the length of transport trips, the feasibility of walking/cycling, and the effectiveness of public transport provision. Settlement density also influences the size of buildings and material intensity of built environment.

It is increasingly apparent that reducing energy demand is beneficial for meeting climate goals. Energy systems modelling analysis are focussing on developing low energy demand (LED) pathways to illustrate futures pathways which decouple energy service demands with economic development. However, the socioeconomic and policy drivers of these LED pathways typically lack a strong empirical basis and granularity. Here, we address this gap by examining the role of spatial settlement patterns on the drivers of transport demand, and residential energy consumption, focusing on Ireland.

Ireland has a history of dispersed settlement pattern, with about quarter of the dwellings being one-off [1] (Census 2016). These dwellings are general large, have low occupancy and often situated in remote/rural areas. The housing stock in Ireland is expected to grow significantly in the next decade, locking-in infrastructure that will be responsible for emissions for the coming century. In this context, we present exploratory data analysis of Census data to estimate the mathematical relationship between population density and energy service demands. This will be used to determine future energy demand pathways for Ireland.

Results shows that in densely populated areas, share of small and compact dwellings is higher than detached. Further, people living in high density areas are more likely to use public transport and walk/cycle to work than those living in rural areas. Distance to public transport stops is lower and frequency of bus services is higher in densely populated areas, indicating density enables infrastructure.

[1] One-off houses are defined as detached houses with individual sewerage system

Machine Learning and Supply Chain Management

Sustainable Energy - Oral

Dr. Garry Lohan ¹

1. atu galway

Recent advancements in Artificial Intelligence (AI) and machine learning have led to major improvements in supply chain management processes. We discuss the three broad categories of machine learning, supervised, unsupervised and reinforcement learning. The paper discusses some of the more common AI tools and techniques currently available including linear regression, classification, clustering, decision tree and neural networks as well as the how to use Python and TensorFlow to run the algorithms. It outlines a pathway to use these tools for both academia and industry. In particular, it looks at deep learning problems and the utilisation of hidden neural network layers to make predictions and classification decisions within supply chain domains. We examine the process through which big data is prepared and the pre-processing required for machine learning plus explore how we build the machine learning model and how to work with the forward propagation equations including the general activation formula and the SoftMax method. We also look at the cost function and how to set the parameters and hyper parameters of a model to maximise the objectives.

Many practitioners view AI technology as akin to the electricity of our time. Gaining an understanding of how this technology works and how it can be of use is critical to optimising modern, sustainable and competitive supply chains.

New Technologies – New WWTP Platform: Mainstream Anaerobic Wastewater Treatment for Sewage available now

Water & Wastewater Management - Oral

Mr. Conor Beegan¹, Ms. Tracey Giles¹, Dr. Conall Holohan¹

1. NVP Energy

Municipal wastewater, sewage, is the largest wastewater stream produced globally, simultaneously representing a huge sustainability challenge and resource recovery opportunity, with over 24,747 GWh/yr⁻¹ within the wastewater in Europe alone (Ganora et al., 2019). There is the potential to recover this energy and potentially finite resources such as N and P from sewage using anaerobic technologies at the core of the wastewater treatment plant of the future. This work focuses on the use of a seminal anaerobic technology that operates at ambient temperatures, Ambirobic®.

The Ambirobic® technology converts BOD within sewage directly to biogas within the psychrophilic temperature range (4 – 15°C), which has not been proven possible utilising traditional anaerobic systems. Furthermore, it offers key benefits, over other aerobic treatment of sewage primarily the significant reduction in both sludge production (BOD conversion to biogas not aerobic sludge) and the reduction in energy input (no aeration required). Anaerobic treatments have shown up to 50% energy reduction compared to aerobic systems (Chernicharo et al., 2015). The widespread utilization of this style of system is proposed as a potentially attractive option for the mitigation of energy usage on site, while bolstering the circular economy with renewable resource production in the form of biogas.

The full-scale demonstration of such anaerobic treatment utilizing the Ambirobic® technology treated up to 705 m³/d of post-primary wastewater for over 305 days. The successful BOD removal of up to 85% occurred under temperature ranges of 2-18 °C. The influent concentration varied from 3-200 BOD mg/L with removal efficiencies of < 85% and notably, still saw removal efficiencies of 40-60% at BOD levels of 2-20mg/L. While challenges such as integration into existing wastewater treatment plants (WWTP) and efficient resource recovery exist, we outline here the platform to change to mainstream anaerobic systems which will allow for net-zero carbon WWTPs.

Novel Psychrophilic Anaerobic Treatment of Malting Wastewater

Water & Wastewater Management - Oral

Mr. Conor Beegan¹, Ms. Tracey Giles¹, Dr. Conall Holohan¹

1. NVP Energy

The malting industry is a heavy water user, with water being used in the key process to germinate grain and produce malt. Large volumes of dilute wastewater is produced at temperatures of 5-18 °C. To date anaerobic treatment has not been utilized to treat this wastewater, due to the inability previously to operate systems at high-rate/at psychrophilic temperatures and as a result sites have resorted to expensive aerobic treatments. This in turn significantly raises operating costs and carbon emissions due to the significant energy and sludge treatment costs associated with aerobic wastewater treatment processes.

The primary benefit of the psychrophilic wastewater treatment system is the reduced operational costs by circumvention of the heating requirements of classical operating systems. Additionally, as an anaerobic process, it still offers high treatment efficiencies, even for low strength wastewaters while recovering biogas with more positive carbon and operational cost levels.

Here we outline, to our knowledge, the first global implementation of psychrophilic anaerobic wastewater treatment for malting wastewater using the AMBIROBIC® technology. This system, a granular based up-flow system with an anaerobic filter, has been successful in treating malting wastewater a psychrophilic temperatures. The system has been operational at full scale (500m³/day) with low strength influent of typically >300mg_{BOD}/l but up to 500mg_{BOD}/l and treatment efficiency have reached up to 80% removal for BOD. Additionally, TSS and VSS removal efficiencies have also reached up to 85%, with peak concentrations of >~1000mg/L.

Proving the success of the technology represents a next step for anaerobic treatment. The Ambirobic® systems successful treatment of malting wastewater is further proof that there is a misconception regarding the need to invest energy into anaerobic systems to achieve effective treatment efficiencies. Psychrophilic anaerobic treatment, used appropriately, allows for more sustainable and cost effective low-strength wastewater treatment.

Using geographically weighted ordinal regression (GWOR) methodology to investigate the spatially varying relationship between nutrient emission loads and water quality statuses - an Irish case study

Water & Wastewater Management - Oral

Dr. Yuting Meng¹, Prof. Cathal O'Donoghue², Dr. Mary Ryan¹

1. Teagasc, 2. University of Galway

Excessive nutrients mainly from agriculture and waste-water discharge are a major pressure on river water quality status. However the relationship between nutrient load and water quality is difficult to determine as this relationship can vary with different activities, soil, geology, topography and weather conditions. Thus it is not efficient to use traditional regression techniques which assume the relationships are constant across a study area. Geographical weighted regressions (GWR) are increasingly use to weight the local context in examining continuous or interval response variables. Until recently however, as overall ecological status is classified in terms of ordinal category (high, good, moderate, poor, bad). Therefore, a recently developed technique, geographically weighted ordinal regression (GWOR), is applied in this paper to examine the spatially different relationships of the impact of nutrient loads on water quality across Ireland. This new modelling approach proves to be more robust than global models, illustrating the capacity of GWOR to highlight great spatial variations at local scale (river water body scale). The GWOR model results show that total nitrogen load had significantly negative associations with water quality status in the central area of the country, characterized by high density of low-lying peatlands, while total phosphorus had significantly negative associations in the east and southwest coast areas. Some areas showed positive associations which noted a lot of location-related factors influencing the relationship, for instances meteorology (rainfall), soil characteristics (permeability/well or poorly drained), hydrology (GW), etc. This study is an important development in the area of modelling capacity of the impacts of a range of activities on water quality and for policy makers, researchers and extension agents tasked with designing incentives for water quality improvement to meet WFD targets.

Willingness to pay for improved water quality and services: A case study of Group Water Schemes in the Republic of Ireland.

Water & Wastewater Management - Oral

*Mr. Sarpong Hammond Antwi*¹, *Dr. Suzanne Linnane*¹, *Dr. Alec Rolston*², *Dr. David Getty*¹

1. Dundalk Institute of Technology, 2. Goyder Institute for Water Research

The Group Water Scheme (GWS) sector in the Republic of Ireland has gained recognition for its efforts in bridging water equity gaps, providing water services to rural Irish communities and offering key learning for other countries. However, the sector faces re-current challenges with agricultural run-off and the presence of nutrients from farming activities, excessive water usage, underinvestment and infrastructural issues. These challenges impact water quality and services schemes provide, yet, empirical studies on scheme members' willingness to pay (WTP) for improved water quality and service have been limited to date. This study is one of the first attempts to address the research need by assessing GWS members' willingness to pay (WTP) using Contingency Valuation Method with data collected from scheme representatives (n=33) and scheme members (n=104). Binary linear regression analysis of data gathered indicates scheme members desire to pay for improved water quality and services at a WTP rate of €25 and €50 per annum. Holding all variables constant, female members are more likely to pay these rates than males. Households size of ≤ 4 , with unemployed members, are less willing to pay €50 per annum compared to a household size of >4 and employed. The study also discusses water conservation measures, biodiversity action and efforts towards reducing significant pressures on water resources. These findings imply that schemes can generate additional revenue to improve water quality services and the administrative cost of managing GWS while providing policymakers with baseline information towards cost-benefit analysis for improved water service delivery.

Keywords: Binary logistic model, contingent valuation, Group Water Schemes, water quality, Willingness to Pay (WTP)

Can the circular economy positively impact climate change?

Circular Economy - Oral

Prof. Michael Morris¹

1. Trinity College Dublin, The University of Dublin

Prof Michael Morris graduated with a PhD from Liverpool University in 1982. His PhD focused on the movement of atoms on surfaces to form ordered arrangements. After a post-doctoral fellowship at Imperial College in London, he moved to Strathclyde University, focusing on *in situ* surface reaction studies. Prof. Morris took an ICI endowed lectureship at Cardiff University before moving to ICI as where he was instrumental in the development of catalysts used to promote low-temperature oxidation and reduce greenhouse emissions in turbines and combustion chambers. He was appointed to a post in Materials Chemistry at University College Cork in 1993 to develop materials science in the University. Prof. Morris moved to Trinity and the School of Chemistry in 2015 to lead the SFI funded research centre AMBER. His work has remained focused on self-assembly and phase separation in polymers and the use of polymer materials in modern society. As well as his long-term interest in self-assembling systems, Prof. Morris has developed a keen interest in the circularity of modern plastic technologies and how the adverse effects of polymers can be avoided through proper use. Prof. Morris has authored over 500 peer-reviewed papers and more than 20 patents. Prof. Morris is a member of the ISO 323 Committee drafting standards for the transition to a circular economy.

A Downscaled Economic Model for Assessing Benefits from Sediment Management Projects

Circular Economy - Oral

***Mr. Brano Batel*¹, *Dr. Joe Harrington*¹**

1. Munster Technological University - Cork

Dredging involves the removal and relocation of sediments including from harbour navigation channels, berthing areas, marinas and river and lake environments. Sediment management is a major challenge globally for the ports and waterways sector and dredged sediments form one of the largest solid waste streams. There are a wide range of different sediment management options that may be implemented; these include onshore or offshore disposal, environmental applications, engineering applications or agricultural/product applications. This paper is based on work undertaken on the EU Interreg-funded SURICATES project which focuses on the application of sediment management techniques for erosion and flood protection. The SURICATES project has a range of different sediment management aspects including the development of a range of tools or models. This paper focuses on an economic modelling tool developed to assess the economic benefits associated with dredged sediment management. The model developed is a new and innovative contribution to sediment management and allows analysis of the financial costs and benefits associated with the use of sediment in terms of the direct, indirect and induced effects on GDP and also the direct, indirect and induced jobs created. The tool downscales the economic effects from a National level to a regional NUTS3 level using the Simple Location Quotient approach for the SURICATES Partner Countries of Ireland, Scotland, The Netherlands and France. The model has previously been applied and satisfactorily validated using real site data from a number of recently completed dredged sediment management projects in Ireland (Castletownbere Harbour Project) and Scotland (Falkirk Canal, Scottish Canal Network). This paper focuses on further applications of the tool to assess the full range of economic impacts and benefits associated with a number of recently completed dredge sediment management projects in Ireland (Alexandra Basin, Port of Dublin) and in France (Port of Calais Development Project).

Sustainable Management Solutions for La Rance Sediment and an Evaluation of Ecosystem Services

Circular Economy - Oral

***Ms. Iqra Rehman*¹, *Mr. Branislav Batel*¹, *Dr. Joe Harrington*¹**

1. Munster Technological University - Cork

Sediments are an essential part of aquatic systems, the foundation of habitats, and a fundamental element of many ecosystem services. The EU Interreg-funded SURICATES project aims to increase sediment reuse for erosion and flood protection in North West Europe with application to a number of pilot sites. One key pilot site is at the La Rance estuary, France, which is a multifunctional coastal area (navigation, biodiversity, landscape attractiveness, fishing and aquaculture) with a tidal power plant. The infrastructure upstream of the power plant (installed in the 1960s) has increased sediment siltation in the estuary. Therefore, maintenance dredging has to be carried out. The main way of reusing sediments has been through agricultural development so far; however, it lacks the long-term economic perspective due to which work is to be undertaken with local stakeholders to improve sediment reuse strategy. In the context of sustainable management of sediments, SURICATES is developing new sediment applications likely to meet the needs of the La Rance region (cycle paths, dyke, etc.) including an agricultural soil beneficial use.

This study focuses on the evaluation of the ecosystem services approach (Provisioning, Regulatory, and Cultural) for the different potential sediment management scenarios that are being developed for the La Rance estuary. The ecosystem service model assesses the economic value that humans derive from ecosystems by the contribution of unit cost and change in land use. A number of different beneficial use scenarios are modelled for the La Rance estuary including agricultural soil beneficial use, dike construction, and construction of cycle path. The practical implementation for the agricultural application (spreading of 30,000 m³ of sediments on agricultural lands) has been completed and the initial results of the ecosystem services model shows the positive monetary value, in addition, the dike and concrete application work is anticipated to be completed soon.

Recovery of cutin from tomato peels waste and valorisation of this by-product for improvement of hydrophobic properties of biomass-based bioplastic.

Circular Economy - Oral

Ms. Marta Mroczkowska¹, Dr. Kieran Germaine¹, Dr. David Culliton¹, Dr. Adriana Cunha Neves¹

1. South East Technological University - Carlow

Valorisation of food by-products is an important step towards sustainability in food production. Tomatoes are the most processed crop in the world; 160 million tonnes of tomatoes are processed every year, of which 4% is waste. This translates to 6.4 million tonnes of tomato skins and seeds. Currently, this waste is composted or used as low value animal feed, but higher value could be achieved if this waste stream is re-appropriated. Plant cuticle is a membrane structure found on leaves and fruits, including tomatoes. The main function of plant cuticle is to prevent excessive water loss from the internal tissue of the plant. Plant cuticle is mainly composed of cutin, which can be recovered from the tomato peels by pH shift extraction. Due to cutin's water repellent properties, it is an ideal raw material for the production of a water-resistant coating. In this study a cutin-based coating has been formulated and applied on biomass-based bioplastic (made from starch and gelatin blend) with poor hydrophobic properties, to improve them. The biomass-based bioplastics have good mechanical properties but their hydrophilic nature results in poor water barrier properties. The aim of this study is to mitigate this by incorporating a hydrophobic surface treatment, derived from cutin extracted from tomato peels. Preliminary studies have shown improved water vapour permeability rates of the bioplastics by 74% and percentage swelling of the bioplastic by 84%, when treated with the cutin coating. Using ingredients generated from by-products from food processing (circular economy) has great potential for the generation of bioplastics with physio-chemical properties that can compete with petroleum-based plastics. These bioplastics have the potential to address the growing market demand for sustainable alternatives for food packaging.

Photoelectrocatalytic inactivation of *E. coli* and MS-2 in synthetic wastewater

Water For the Future - Oral

***Dr. Stuart McMichael*¹, *Prof. Tony Byrne*¹, *Dr. Pilar Fernandez*¹**

1. Ulster University

The emergence of new pollutants, as well as the increase in microorganisms that are resistant to traditional treatment methods, will result in increased challenges for wastewater technologies. To address these challenges, new water treatment technologies such as advanced oxidation processes (AOPs) have been investigated. AOPs included a wide range of technologies including ozone, electrochemical, Fenton-like process, combined UV with peroxide and/or ozone, photocatalysis and photoelectrocatalysis (PEC). Each of these AOPs has its own advantages and disadvantages. In particular, PEC is effective against a wide range of contaminants including microorganisms, and organic & inorganic compounds, without the need for additional chemicals or post-treatment and is more effective than photocatalysis. In this work, a scaled-up recirculating PEC reactor was designed and manufactured, treating a total volume of 250 ml. The electrodes used were a WO₃ photoanode produced by in situ hydrothermal synthesis and immobilised on FTO and carbon paper as the cathode. The reactor was tested in the lab under solar simulated irradiation for the inactivation of antibiotic resistance *E. coli* and MS-2 in synthetic wastewater, achieving a 5-log and 7-log respectively in 30 min with an applied cell potential of 2.5 V. With real solar experiments due to be conducted in March 2023 in India prior to the conference.

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Quantifying the future potential of rainwater harvesting

Water For the Future - Oral

Dr. Ruth Quinn¹

1. Atlantic Technological University - Sligo

Rainwater harvesting (RWH) systems in urban settings are increasingly relied upon to mitigate pluvial flooding and provide an additional water supply. They are part of a family of holistic water management approaches known as sustainable drainage systems. These are included in Draft River Basin Management Plan for Ireland 2022 – 2027 as methods to reduce urban runoff pressures. This presentation examines the multiple benefits of RWH under the growing pressures of climate change, identifies barriers to their implementation and provides a policy roadmap to increase usage of these systems.

In terms of water supply, it was found that a 210-litre rain tank could supply 15% of a household's total annual water consumption. In wetter areas, up to 26% of a household's annual water consumption could be met. In contrast, this drops to 5% in Dublin during the driest months. Although this seems low, it equates to 14 litres of water per household daily.

RWH can prevent flooding and pollution by retaining and detaining water during significant rainfall events; typically, these systems are designed to manage runoff from 1 in 100-year design storms, which results in recommendations for large tank sizes. A framework is proposed for evaluating six metrics for RWH stormwater management capacity based on continuous simulation to suitably balance size with performance.

Finally, RWH provides an opportunity to engage in the co-design of public spaces to retain water with the broader community increasing systems resilience through maintenance schemes and offering a chance to raise awareness of other water-related schemes, such as flood warnings. Guidance is introduced to enable practitioners to engage with the public regarding these systems meaningfully.

By addressing these benefits in tandem, policies can be developed to ensure that professionals make informed decisions that reflect the dynamics of their specific catchment and the preferences of local communities.

Sources, Pathways and Environmental Fate of Microplastics in Freshwater Ecosystems

Water For the Future - Oral

***Dr. Roisin Nash*¹, *Dr. John O'Sullivan*², *Dr. Sinead Murphy*¹, *Dr. Michael Bruen*², *Dr. Ann Marie Mahon*¹, *Dr. Heather Lally*¹, *Ms. Linda Heerey*², *Dr. James O'Connor*¹, *Ms. Xiaodi Wang*², *Dr. Ian O'Connor*¹**

1. ATU Galway City, 2. University College Dublin

Plastic waste enters rivers through several natural processes influenced by wind or rain-induced surface runoff, or via direct dumping or disposal. In this regard the identification of all the microplastic (MP) sources in river catchments is key to facilitate management efforts to reduce their presence in freshwater and marine environments. The research explores a number of potential sources, pathways and fate of MPs in freshwater systems in Ireland.

Research results confirm wastewater as a conduit of MPs to rivers, however in concurrence previous research into the partitioning of MPs via the various stages in treatment plants, up to 97% of MPs can be successfully retained in the sludge (biosolids) following primary treatment. These treated biosolids, along with the captured MPs, are often spread onto agricultural land to enrich the soil. Agriculture is one of the most important economic sectors globally, and in order to ensure food security land must remain productive, however research indicates agricultural land as a potential MP pathway to rivers. Furthermore, artificial pitches, through wear and tear, are now confirmed sources of MPs with smaller MPs having the potential to be transported offsite via wind, surface runoff, or footwear in the case of pitches.

Spatial and temporal changes are seen to play an important role in the concentration and bioavailability of floating MP in rivers as pathways to the ocean. After periods of high rainfall, the concentrations of MPs can be lower due to dilution factors. Within the river, MPs were present in all of the riverine macroinvertebrate families, providing a site-specific assessment of MP abundance due to limited migration patterns.

Research results presented here, together with recommendations will work towards helping to mitigate and reduce microplastics through the identification of sources and pathways within riverine systems.

Bacterial community composition in a pilot-scale wastewater treatment plant

Water For the Future - Oral

***Ms. Shabila Perveen*¹, *Prof. Javier Marugan*², *Dr. Cristina Pablos*², *Dr. Ken Reynolds*³, *Dr. Simon Stanley*³**

1. Universidad Rey Juan Carlos / ProPhotonix Ltd. / ERI University College Cork, 2. Universidad Rey Juan Carlos, 3. ProPhotonix Limited

Wastewater treatment plants (WWTPs) contain a diverse bacterial community composed of environmental and enteric species. A complete removal of pathogenic species, antibiotic resistant bacteria (ARB), antibiotic resistant genes (ARGs) and microplastics (MP) is not achieved by conventional-WWTPs. This study aimed at characterizing the bacterial communities, as well as measuring selected ARB/ ARGs in samples collected from WWTP (influent, secondary effluent, tertiary effluent) and in MP biofilms deployed in the WWTP samples for a period of 3 days. 16srDNA amplicon sequencing was used to analyse the bacterial community composition. Standard plate counting method and real-time polymerase chain reaction (qPCR) were used to quantify the ARB and ARGs, respectively. In the samples collected on day 0, Proteobacteria was the dominant phylum in the influent (32 %) and secondary effluent (44 %). The highest species alpha-diversity was observed on day 0 (Shannon 4.99 – 4.18). MP biofilm had lowest species diversity (Shannon 1.57 – 2.72) as compared to the surrounding water (Shannon 3 – 4.16). ARB quantified on day 1 and 3 were highest in the influent and lowest in the final effluent, both in the MP biofilm and surrounding waters. The relative abundances of *sul1*, *vanA* and *intl1* (Class 1 integron-integrase gene) were highest in the secondary effluent on day 0 while lower in the influent and final effluent. The relative abundance of *vanA* appeared higher in secondary effluent only while *sul1* and *intl1* had higher relative abundance both in the MP biofilm and surrounding waters. This indicated a redistribution of ARGs on day 3. Change in bacterial community composition and diversity was observed across WWTP. Low species diversity in MP might indicate towards attachment of selective species on MP surface.

Photocatalytic Biomass Reforming: steps towards advancing the technology

Smart Technology & The Environment - Oral

Dr. Nathan Skillen¹

1. Queens University Belfast

Dr Nathan Skillen is currently a Lecturer in the School of Chemistry and Chemical Engineering at QUB, where he is the Programme Director for the MSc in Net Zero Engineering. He has previously held a fellowship with the UKRI Supergen Bioenergy Hub, which focused on the development of photocatalytic technology for biomass reforming. He received his BSc (Hons) in Molecular Biology with Biosciences from Robert Gordon University before completing his PhD in Chemical Engineering at the same institute and in collaboration with the University of St. Andrews and California Institute of Technology. His post-doctoral work has focused on photocatalytic technology development for a range of applications centred around environmental remediation and energy production. He has published several research articles and book chapters and currently sits on the international editorial board of Biomass & Bioenergy (Elsevier). More important than all of that, however, he was part of a team of 10 researchers from across the UK that created the first graphic novel on Bioenergy.

Nanowood: Fully renewable, biodegradable, environmentally friendly, natural material for the next generation thermoelectrics

Smart Technology & The Environment - Oral

Dr. Ievgen Nedrygailov¹, Dr. Kamil Rahme¹, Dr. Scott Monaghan¹, Dr. Subhajit Biswas¹, Prof. Paul Hurley¹, Prof. Justin D. Holmes¹

1. AMBER Centre, Environmental Research Institute, School of Chemistry & Tyndall National Institute, University College Cork

The rapid increase in the temperature of the Earth's atmosphere, caused by man-made factors, is one of the most serious threats of our time. The most important measure to mitigate this threat is to reduce carbon emissions through an energy transition, *i.e.* switching from fossil fuel energy sources to renewable energy sources that produce very limited, if not zero, carbon emissions. However, the transition to a low-carbon economy also means a significant increase in demand for the introduction of completely new "green" technologies for the production of various materials. These new materials should replace existing ones that require too much energy to produce, or are not environmentally friendly in nature. In this work, we discuss the production process for one of such environmentally friendly material - nanowood. As a basis for obtaining nanowood, natural hardwood is used, which is a waste by-product from the timber industry. As a result of a low temperature chemical process, the hierarchical cellulose base of wood is separated from other components (such as lignin and hemicellulose) to form nanowood. As an inexpensive, fully renewable, biodegradable, environmentally friendly and natural material, nanowood can form the basis for producing a range of materials for electronics, sensors, energy production and storage. I will describe technologies related to the extraction and functionalisation of the hierarchical structure, as well as to the practical use of nanowood for the production of next generation thermoelectric materials.

Developing novel eDNA metabarcoding tools for in situ fisheries and megafauna biodiversity monitoring

Smart Technology & The Environment - Oral

Ms. Maddalena Tibone¹, **Dr. Sergio Stefanni**², **Dr. Bernadette O'Neill**¹, **Dr. Jacopo Aguzzi**³,
Dr. Luca Mirimin¹

1. Atlantic Technological University - Galway, 2. Stazione Zoologica Anton Dohrn, 3. ICM-CSIC

Environmental DNA (eDNA) comprises intra- and extra-cellular DNA molecules that can be traced back to the source organism by analysing an environmental sample, such as water or sediment. The analysis of eDNA is an increasingly applied approach in environmental monitoring and fisheries science. In particular, the application of metabarcoding, a genetic technique that relies on DNA sequencing to taxonomically identify species, can provide a profile of an ecosystem's community. In addition, emerging technologies are enabling the development of protocols for near real-time in situ applications of eDNA analysis.

We are developing and implementing a fish-targeting eDNA metabarcoding workflow for use in remote conditions to provide near real-time data in support of fisheries and megafauna monitoring programs. Results to date showed moderate to high throughput with successful generation of fish community profiles from eDNA samples collected both in a controlled mesocosm setting (Galway Atlantaquaria) and in a field environment (Atlantic continental shelf). Additionally, progress on developing a protocol allowing processing of environmental samples, from collection to High Throughput Sequencing (HTS) and bioinformatic analysis, in situ on mobile and fixed marine infrastructures (i.e. research vessels and oceanographic platforms) will be illustrated. Finally, applications of this workflow will be discussed in the context of (i) investigating the community composition of deep-sea mesopelagic fish layer, and (ii) combining multidisciplinary monitoring methods by integrating acoustic and imaging data from underwater cameras with eDNA analysis.

The inclusion of eDNA in the monitoring and assessment of commercially and ecologically important species is showing significant potential to increase the level of detail obtained and reduce the need for costly and destructive assessment techniques. The proposed methodological developments and applications will make eDNA metabarcoding a more accessible tool to researchers and stakeholders, enabling near real-time data acquisition for augmented biodiversity monitoring and evidence-based fisheries surveys.

The role of carbonate minerals and the behaviour of rare earth elements in the formation of bastnasite.

Smart Technology & The Environment - Oral

***Ms. Adrienn Maria Szucs*¹, *Ms. Melanie Maddin*¹, *Mr. Daniel Brien*¹, *Dr. Alexandra Stavropoulou*¹,
*Ms. Claire O'Donnell*¹, *Ms. Seana Davis*¹, *Dr. Paul Guyett*², *Dr. Remi Rateau*¹, *Dr. Juan Diego
Rodriguez-Blanco*²**

1. Department of Geology, School of Natural Sciences, Trinity College Dublin, Ireland, 2. iCRAG, Department of Geology, School of Natural Sciences, Trinity College Dublin, Ireland

Rare earth elements (REEs) are essential parts of renewable technologies and electronic devices; hence they are vital for preserving our quality of life. To meet the present and future demand for REEs, it is pressing to integrate REEs into our circular economy. However, REE extraction and separation methods are economically and environmentally expensive and ineffective, thus improving these techniques are critical to meet our REEs needs and create a modern and sustainable future. One of the major obstacles we are currently facing is the lack of information on the biogeochemical behaviour of REEs in the lithosphere, hydrosphere, and biosphere. This knowledge is critical to understand the chemical mechanisms of REEs in separation processes.

This project studies the formation of REE carbonate minerals that are common in carbonatite deposits – which supply over 60% of our REEs need – by mimicking nature through REE-carbonate mineral synthesis. We interacted common carbonates with different REE-rich (La, Ce, Pr, Nd, Dy) aqueous solutions at low hydrothermal conditions (25-220 °C).

The results revealed the individual behaviour of REEs in the presence of carbonates and we presented the precise crystallisation pathway, the kinetics, and mechanisms of the formation of REE carbonate deposits. These findings fill the knowledge gap in understanding of the formation REE-bearing carbonates, especially the mineral bastnasite, which is the main source of REEs for the industry. This knowledge can be used to improve REE separation, exploration, exploitation, and develop new recycling methods. The revealed crystallisation pathway also allows us to produce targeted REE carbonate minerals with tailored structures and chemistries for industrial purposes.

Supply Chain issues in Industry 4.0 and the Circular Economy

Circular Economy - Oral

Mr. Tomas Kenny¹, Dr. Garry Lohan¹, Dr. Leonard Taylor²

1. atu galway, 2. ATU Sligo

While there is potential to utilise Industry 4.0 technologies to achieve CE related targets with a significant research agenda identified, there is limited research on the development of formal decision-making models and tools for integrating innovative digital technologies used in enterprise resource planning. Industry 4.0 technologies such as the Internet of Things (IoT), cyber-physical systems (CPS), additive manufacturing (AM), and blockchains can facilitate Circular Economy (CE) transitioning. However, the correct use and optimisation of these technologies and how organisations accept newer technologies associated with integrated and automated supply chains is not well understood. As past experiences are limited, there are few empirical studies on organizational change relating to CE and I4.0 business strategy. Hence, this research study's purpose is to develop a conceptual framework that connects CE and I4.0 concepts from an strategic transformational change perspective. This research will break down the adoption process and explore the adoption, adaption and utilisation of Decision Support Systems (DSS) while developing support tools that can more effectively link these critical and emergent social, technological, and organizational factors - factors that often require multi-stakeholder, multi-organization, and multi-functional considerations.

The audience for this research study are academia of the field of Operations Management (OM), Supply Chain Management (SCM) and Organizational Change; and industry leaders seeking guidance on transitions towards CE and I4.0. As well as aiding academia through extension of existing theory, the study will aid practitioners within industry who will be able to review the study's findings and contrast the results to systems currently in place inside their organizations with the goal of making strategic change process improvements.

An Engineering Approach to Designing Pilot-Scale Outdoor Duckweed Cultivation Systems

Circular Economy - Oral

Ms. Grace O' Sullivan¹

1. University College Cork

Duckweed (*Lemnaceae*) is a small, aquatic plant that is ubiquitous across Ireland. It is a protein enriched crop with up to 40% dry weight protein which is currently being investigated for use in human nutrition, biofuel production, and as a means of remediation of waste streams. Duckweed growth using agricultural wastewater, where the plant grows by consuming excess wastewater pollutants such as nitrogen and phosphorous, is a perfect example of a circular economy approach to sustainable agriculture.

This work focuses on the design and optimisation of a pilot-scale, outdoor growth system for duckweed production, that is suitable for use on farms. These systems will provide farmers with a plausible solution to the high volumes of nutrient rich waste water produced daily, while also cultivating a high value crop.

There are two main styles of outdoor growth systems that are employed globally; ponds and raceway systems. However, there is currently no evidence on which type of growth system is optimal for duckweed production. A combination of computational fluid dynamics (CFD) and wet lab experiments are used to provide insight into the design of an optimal system for duckweed production. This includes the use of ANSYS Fluent and inert tracer mixing time experiments to inform the design strategy. Later work will focus on the scale-up of the optimal growth system.

This work will inform stakeholders on the most suitable system for duckweed production in a farm setting. In addition to this, it will provide guidance on the style of system that is most suitable for large scale duckweed production sites worldwide.

European Furniture Product Design in the Circular Economy: What are the Circular Design Considerations?

Circular Economy - Oral

Mr. John Hewer¹, Dr. Kate Dunne¹, Mr. Sean Garvey¹

1. Atlantic Technological University Connemara

Product design is seen as one of the most important tools within the European Union's (EU) plans to transition to a circular economy, with a large portion of a product's environmental impact attributed to the design stage. However, the circular design practices of one industry do not necessarily map to others due to the nuances present within different industries and product categories. This research aims to explore the key design considerations when designing for the furniture industry to produce products suitable for the circular economy. Objectives of the research are 1) to review the literature concerning theoretical conceptions of circular design and the circular economy and 2) to gather the experiences of European experts in the application of circular design to furniture products.

Six leading European experts in the field of circular furniture design are interviewed to determine their perspective on how circular design is currently implemented in the industry, and what opportunities and barriers exist. Two of the six are heading up national associations tasked with increasing the adoption of circular practices in the furniture industry. The remaining four are product design practitioners, holding senior roles, and therefore, in a position to influence company-wide circular design policy and procedures.

The research findings highlight that current product design norms practiced within the furniture industry lend themselves to the linear model rather than the circular model. There are, however, isolated examples that demonstrate that circular practices can be viable rather than simply being a theoretical ideal. A set of design considerations emerge from the research. There is a need to create a circular furniture design model that supports the implementation of these circular design considerations in the European furniture industry.

Biomass with Carbon Capture and Storage in Ireland: A techno-economic review

Circular Economy - Oral

***Mr. Daniel Casaban*¹, *Mr. Sean Ritchie*¹, *Dr. Elena Tsalaporta*¹**

1. University College Cork

The European Union has aimed to become the first climate-neutral continent by 2050. Bioenergy with Carbon Capture and Storage (BECCS) together with Direct Air Capture and Storage (DACCS) will play a pivot role in reaching the net zero targets. In Ireland, agriculture and forestry handle almost 40% of greenhouse gases emitted. These sectors are under pressure to reduce their carbon footprint, yet they contribute to the economy and society. International bodies acknowledge biomass as a low carbon renewable energy source: the amount of CO₂ emitted by burning biomass is the same as the amount of carbon collected while growing. CO₂ captured by DAC or BECCS together with hydrogen production via electrolysis of water can be an alternative route for bio-methanol. In order to produce 1 gram of methanol, it is necessary a feedstock of 1.37 grams of CO₂ and 0.18 grams of H₂. The average biomass combustion produces 230 grams of CO₂. If 90% of this CO₂ is re-utilised, it can produce 150 grams of bio-methanol. However, there are still challenges to overcome in order to substitute traditional fuels: the amount of CO₂ capture abated, the origin of the energy, and the conversion rate. In this techno-economical study, we review the production of this alternative compound in the long term for the decarbonisation of certain sectors. Thus, powered by renewable sources, the methanol produced by BECCS and DACCS will help the local agricultural industry to end its dependence on fossil fuels and be on the road to a sustainable future.

Investigating the Environmental Quality of Urban Parks: A case-study of Fitzwilliam Square Park, Dublin, Ireland.

Water Quality & Environmental Monitoring - Oral

***Mr. Kiran Apsunde*¹, *Ms. Mengyi Jin*², *Prof. Brian M. Broderick*¹, *Dr. John Gallagher*¹**

1. Trinity College Dublin, The University of Dublin, 2. Shanghai Jiao Tong University, Shanghai, China.

Urban parks provide a range of benefits to residents, including opportunities for physical activity, social interaction, and improved mental health. The environmental quality (EQ) of these spaces can be affected by local conditions, like urban heat island effects, as well as sources of air and noise pollution. In addition, these green spaces serve as nature-based solutions, mitigating against these EQ parameters. This study applies a mixed methods monitoring approach to investigate the seasonal and spatial variations of EQ, and the influence of the local morphological setting on local EQ, presenting the findings of a case of Fitzwilliam Park, a Georgian park in Dublin, Ireland. A combination of stationary and mobile monitoring equipment was employed to capture EQ data, specifically PM_{2.5}, NO₂ and O₃ for air quality, dB for noise, and temperature. Data were collected at multiple locations within the park, as well as along the park periphery. The spatiotemporal variations were analysed to evaluate the park and its influence on local EQ. Preliminary results indicate that PM_{2.5} levels inside the park were 9% lower, NO₂ levels were 7.5% higher, temperature was 1.2% lower, and noise was 4.75% lower inside the park compared to outside. To further evaluate the impact of seasonal variations on EQ due to changes in the park greenery, satellite images were sourced to derive NDVI values, and LiDAR data (Topographic Openness and Wind Effect) were used to characterise the Urban morphology. Urban morphology and seasonality were found to have influenced the park's performance in altering the local EQ with regards to PM_{2.5} (-6%), NO₂ (-7%), noise (+0.7%), and temperature (-1.6%). The findings of this study can help support more effective monitoring of EQ conditions in urban green spaces, as well as support informed design of urban parks to optimise EQ in the future.

The effects of an offline Runoff Attenuation Feature (RAF) on peak stream flows, water quality and pasture health

Water Quality & Environmental Monitoring - Oral

*Mr. Darragh Murphy*¹, *Dr. Simon Harrison*¹, *Dr. John Weatherill*¹

1. University College Cork

In recent decades, the hydrological regimes of Irish catchments have been altered to promote agricultural land-use intensification. The dominant impact on stream and river hydrology has come from land drainage and stream engineering works, implemented to both speed the flow of water from the land and to reduce local groundwater levels. Whilst these works have enhanced agricultural productivity, they have reduced the ability of natural stream channels and floodplains to attenuate high discharge volumes during storm events, potentially inducing greater flooding downstream. With greater agricultural activity and stocking densities, and increases in the erosive nature of floods, nutrient fluxes through Irish catchments are also increasing, leading to widespread declines in water quality.

Enhancing hydrological and nutrient retention in agricultural landscapes have become key aims of regional and national initiatives to restore water quality to satisfactory status. Nature-based Catchment Management Solutions (NbCMS) are advocated as a means of mitigating the effects of modern agriculture and climate change on rivers. Here, we outline recent research on the role of a Runoff Attenuation Feature (RAF) within a grassland field, adjacent to a headwater stream, in mitigating flood peaks and nutrient flux.

During flood events, the highest portion of the flood peak is directed from the stream channel into the field and temporarily retained there behind a 1m high constructed earthen bund, until the main flood peak has passed. Hydrological and water quality data have been collected and analysed to assess the impact of the RAF on stream hydrology and nutrient status. Additionally, we have collected soil nutrient and grass growth data within the field to assess the impact of the RAF on grass productivity. We discuss the potential for measures such as the RAF to mitigate the pressure on flooding and nutrient fluxes posed by contemporary agricultural practices, without diminishing agricultural pasture productivity.

Occurrence of AMR Enterobacterales in soil and spinach in the presence and absence of zinc amendment

Water Quality & Environmental Monitoring - Oral

***Ms. Elena Anedda*¹, *Mr. Daniel Ekhlās*², *Dr. Elena Alexa*², *Dr. Michael Gaffney*², *Dr. Gillian Madigan*³, *Dr. Catherine Burgess*², *Dr. Dearbhaile Morris*¹**

1. University of Galway, 2. Teagasc Food Research Centre Ashtown, 3. Department of Agriculture, Food and the Marine

Purpose: The objective of this study was to assess the presence of clinically relevant AMR bacteria in spinach and soil, with or without zinc amendment of the soil.

Methods: In total 92 soil samples and 68 spinach samples were collected from two production sites. Enterobacterales were enumerated and the presence of ESBL-producing Enterobacterales (ESBL-PE), carbapenem resistant Enterobacterales (CRE), and ciprofloxacin resistant Enterobacterales (FQR-E) were assessed on selective agars. Suspect colonies were identified by Maldi-TOF. Antimicrobial susceptibility testing (AST) was performed on confirmed Enterobacterales. Characterization of resistance genes was performed through whole genome sequencing and Resfinder, CARD, Plasmidfinder and Megares were the databases used to screen for ARGs, plasmids and the metal resistance genes (MRGs). Soil chemical analysis was also performed.

Results: Overall, 21 confirmed Enterobacterales isolates were obtained from the soil and spinach samples. *Serratia fonticola* was the predominant species detected in both sample types, which were found to be resistant to a range of beta lactam antibiotics, as were the *Citrobacter freundii*, *Enterobacter cloacae*, *Morganella morganii* and *Escherichia coli* isolates. The *E. cloacae* and *M. morganii* isolates were found to be multidrug resistant. No metal resistance genes were identified and there was no significant difference in soil metal concentrations between the two treatments (zinc and control).

Significance: This study demonstrated that fresh produce and its production environment can harbour AMR Enterobacterales.

Estimation of input flow variables to the water quality model of Chlorophyll-a in Claregalway River Catchment

Water Quality & Environmental Monitoring - Oral

***Mr. Moayad M. Dawoud*¹, *Dr. Ahmed Elssidig Nasr*¹, *Dr. Zeinab Bedri*¹**

1. School of Transport & Civil Engineering, Technological University Dublin (TU Dublin)

The presence of toxigenic harmful algal blooms due to eutrophication in freshwater bodies normally causes a major decline in the quality of these water bodies which adversely affects their sustainable uses during the blooming season. Predicting the occurrence and spread of such toxigenic blooms is important to inform any design of mitigation measures taken by decision makers. One of the indicators of the toxigenic algal blooms is the Chlorophyll-a which is normally used to quantify the green biomass in water bodies and hence constitutes a proxy to predict the presence of the toxigenic algal blooms. Modelling the dynamics of Chlorophyll-a concentrations in a water body requires inputs of essential flow variables used in simulating the fate and transport processes of the nutrient loadings of TP and N which cause the eutrophication in the water body.

The current study is aimed at developing a water quality model using the MIKE Software for predicting the spatial and temporal variations of the Chlorophyll-a concentrations in Lough Corrib in Western Ireland. In this paper, the development of the hydrological component of this model will be presented using the application of the model to the Claregalway River Catchment as a case study. The MIKE Hydro Basin modelling package was used to simulate the main hydrological variables of the water balance in the study catchment. Rainfall and evaporation data from weather gauging stations around the catchment were used as inputs to the model while river flows from a gauging station at the outlet of the catchment were used for comparison against the simulated flows by the model. The modelling results have shown perfect matching between the actual and the simulated flow values indicating to a good performance by the model in simulating the required hydrological variables for the Chlorophyll-a water quality model.

Poster with 5 min Presentation

Novel aptasensor for detection of *Cryptosporidium* in water

Sensing Technologies for Climate Change Solutions - Poster with 5 min Presentation

Dr. Seila Couso-Perez ¹, Prof. Tony Byrne ¹, Dr. Pilar Fernandez ¹

1. Ulster University

Cryptosporidium is a protozoan parasite that generally infects the epithelium of the gastrointestinal tract of various vertebrate hosts, including humans, in which cause cryptosporidiosis. It is a waterborne parasite that causes significant economic and human losses annually worldwide and was recognised by the World Health Organization (WHO) as an emerging pathogen. Water contamination with *Cryptosporidium* oocysts (infective form) represents one of the main sources of human infection. This protozoan is one of the most frequently detected infectious agents in waterborne outbreaks of parasitic aetiology reported in developed countries, being involved in 76.5% of the reported outbreaks between 2017-2020.

Taking into account that water is an indispensable resource and is also an essential right for human life, the control or monitoring of the water contamination by *Cryptosporidium* is important in order to prevent waterborne outbreaks. The current protocols approved by various agencies for the detection of *Cryptosporidium* in water are expensive, time-consuming, have limited sensitivity and require laborious sample preparation, specific equipment, and highly specialized personnel. Therefore, there is a strong need to develop a reliable, rapid, and sensitive novel system for real-time detection of *Cryptosporidium* in water, which can resolve the drawbacks that currently approve protocols present.

Here, we present the first results obtained in the development of a biosensor for the detection of *Cryptosporidium* oocysts in water using aptamers as specific oocysts recognition elements immobilised in magnetic beads. The authors wish to acknowledge the Royal Society funding under the international collaboration award reference ICA/R1/201373. SCP fellowship is funded by the Margarita Salas Mobility Fellowship Programme.

The use of low-cost sensors for monitoring and modelling dynamical temporal microplastic pollution in freshwater

Sensing Technologies for Climate Change Solutions - Poster with 5 min Presentation

***Mr. Ismaila Abimbola*¹, *Dr. Marion McAfee*¹, *Dr. Leo Creedon*¹, *Dr. Salem Gharbia*¹**

1. Atlantic Technological University - Sligo

Freshwater pollution is a major global problem. Surface and subsurface water contamination is the leading cause of many diseases, death and human disasters and has adverse effects on the freshwater ecosystem. In the recent decade, there have been growing concerns about microplastic pollution in freshwater and its negative impacts on human health and a sustainable environment. Thus, there is an urgent need for monitoring and mapping microplastic pollution in freshwater to identify the sources. Most surface and groundwater vulnerability models are based on the static conditions of current hydrology and land-use factors. There is a need to consider the dynamic nature of factors that account for freshwater vulnerability to microplastic pollution to maintain and protect freshwater quality for present and future conditions. As such, reliable models and tools that can track and assess freshwater vulnerability to pollution at a fine temporal resolution scale are necessary to effectively aid in controlling microplastic pollution. This research intends to develop an innovative and integrated framework to monitor freshwater vulnerability in real-time by applying integrated machine learning, Geographic Information System (GIS), remote sensing and statistical downscaling methods, and low-cost water quality sensors. The results from this study will aid the government and water managers in land use planning and strategy developments for the maintenance, treatment, and protection of freshwater by selecting, prioritizing, and monitoring current and future sites with high potential risks of freshwater pollution from microplastics.

Development of regional bioeconomy demonstration blueprint with a peatland transitional focus

Flash Presentations - Poster with 5 min Presentation

***Prof. Neil Rowan*¹, *Dr. Emer O'Neill*¹, *Mr. Martin Tighe*², *Prof. Marcel Jansen*³, *Prof. Markus Helfert*⁴, *Dr. Seamus Hoyne*⁵, *Ms. Michelle McKeon Bennett*¹**

1. Technological University of the Shannon - Athlone, 2. UNIVIV, 3. University College Cork, 4. NUI Maynooth, 5. Technological University of the Shannon - Thurles

The first peatlands based freshwater aquaculture recirculation system powered by wind turbines has been established at a 5.2 hectare organic site in the Irish midlands. This unique system uses natural microalgae, bacteria and duckweed to remediate waste and to address water quality without discharge to receiving water. It does not use artificial chemical, antibiotics or pesticides. Publications, in leading journals, have reported that this model food/bioeconomy system can also be used to model the impacts of extreme variance of climate (such as weather events, storms) using a combination of naturally-occurring microalgae, next generation sequencing and bioinformatics as early-warning tools for monitoring process performance.

This constitutes the first study to consider development of such environmental bioeconomy demonstration as a blueprint initiative in order to inform key top down strategic policies using a bottom up user approach. Moreover, there is a strong emphasis on supporting and enabling appropriate real-time decision-making at this interface where innovations can be assessed from discovery to commercial phase (TRLs). This addresses broad stakeholder engagements including public-private-partnerships and exploits the Quintuple Helix framework (academia-industry-government-environment-society) for evaluating, assessing, modeling and informing effectiveness. This initiative also addresses local government and communities to support fair and just transition to low carbon economies along with accelerating green-tech innovation using digital technologies. The outcomes of this novel project will inform pipe-line of next generation of skilled researchers, entrepreneurs and educators. It will also commensurately address risk mitigation and technology disruption using established and emerging sustainable tools. Given its complexity with a solutions-focus, emphasis will be placed on open knowledge exchange for stakeholders so as to educate communities and to accelerate appropriate behavioral change for the betterment of society. This timely research aligns with Midlands Regional Development Plan 2024 and is supported by DAFM.

A pathway towards a net zero smart energy system for Ireland's Border, Midland & West region

Flash Presentations - Poster with 5 min Presentation

Dr. Caitriona Strain¹

1. ERNACT

This study was funded by the Interreg Europe CLEAN project, led by ERNACT, and executed in the Irish Border Midland & West (BMW) region. Motivation was drawn from good practices and discussions with CLEAN project partners throughout Europe, especially through participation by regional stakeholders in staff exchanges, study visits and interregional seminars.

A baseline study was conducted, as part of the process of developing a net zero Action Plan for the North West area of the Irish BMW region. The overall aim was to summate all the significant sources of greenhouse gas emissions arising from the area. The study allowed for:

- Informed annual carbon reduction targets to be set for the north west, which are aligned with the long-term goal to decarbonise and become a “Net Zero” region by 2045.
- Organisations within the region to understand the impact of any local measures taken to reduce carbon emissions and to prioritise those which will have the largest impact at lowest cost.

Conducting the data harvesting phase of the study highlighted a severe lack of accessible open data relating to carbon emissions at both county and regional level. A large proportion of the data required to produce an accurate and reliable study was unavailable or in raw/unusable formats. Investigators faced many challenges gathering this data, often having to revert to basic investigative methods.

The study concluded that if this data was available and easily accessible, it would have a positive impact on carbon emission reduction activities in the region. Energy-usage open data would contribute to the Regional Operational Programme's thematic objective to support a shift towards a low-carbon economy by providing a resource that acts as a foundation from which all actors in the region can pursue effective energy improvement initiatives, intelligent management systems, community engagement and fuel poverty reduction.

Recent Advances in Plasmonic Luminescent Solar Concentrators for Building Integration

Flash Presentations - Poster with 5 min Presentation

Mr. Aaron Glenn¹, Dr. Sarah McCormack¹, Dr. Subhash Chandra¹

1. Trinity College Dublin, The University of Dublin

Approximately 80% of the worlds' energy demands are currently being met via fossil fuel resources of which coal, oil and gas dominate the supply chain. These finite resources, when processed through combustion, produce greenhouse gasses (GHG) like carbon dioxide which are contributing to global warming. The built environment alone accounts for almost 40% of these final energy use and energy process related CO₂ GHG emissions worldwide. The effects of global warming are becoming more and more evident in our day to day lives with flooding, droughts and other extreme weather events occurring more frequently.

This study focuses on a novel type of solar concentrating technology known as a Plasmonic Luminescent Solar Concentrator (PLSC) in an attempt to reduce the reliance on such fossil fuels. The concept is that this technology could replace standard window installations in building design as the functionality of the window remains but with the addition of the ability to produce power. This will be particularly useful in urban environments as space is limited. The advantages to this technology include;

- Good performance in both direct and diffuse environments
- They do not need to track the sun
- Unlimited solar concentration ratio
- Optical characteristics are tuneable to the functionality required.

This project looks at the current state of the art before introducing a novel fabrication methodology as well as preliminary indoor and outdoor performance test results of the large scale PLSC, LSC and reference cell devices' produced in the lab.

Carbon Flux Dynamics Across Three Contrasting Forest Types

Flash Presentations - Poster with 5 min Presentation

Mr. Stephen Byrne¹, Dr. Matt Saunders¹, Dr. Brian Tobin²

1. Trinity College Dublin, The University of Dublin, 2. University College Dublin

Management, climate and forest composition significantly impact the ability of the forest ecosystem to sequester carbon within both plant biomass and the soil. Forest ecosystems are gaining more and more recognition as vital tools for tackling the challenges of climate change. How we manage these ecosystems is vital to enhancing nature-based solutions to climate change. It is also essential to have an in depth understanding of how the climate impacts existing forest ecosystems in order to better predict future response to rapidly changing climate. This research falls under a DAFM funded project called “ADAPTForRes” and aims to gain further understanding of carbon sink strength of Irish forestry using eddy-covariance techniques. Direct ecosystem measurements over 4 years using eddy-covariance will be made to gain further understanding of the carbon balance across three forest sites with unique and varying characteristics like species, soil type and management. The 3 forest sites are located within a 40km radius allowing our research team to investigate the unique response of each forest to climate and management. Climate will be very similar across the 3 sites however three different management approaches are being employed (Clearfell, CCF, Kronoberg) – we intend on mapping the difference in carbon sink strength attributed to management and forest type. The mature conifer is a sitka spruce monoculture on surface water gley soils nearing readiness for clearfell with 4 years of baseline data between 2008-2012. The mature native woodland has trees aged over 100 years on grey brown podzol with a wide a range of broadleaf species while the spruce birch forest is a much younger (~10 years) plantation on peat soils whereby the kronoberg management approach will be employed. We intend on using our data to better inform management practices and policies aimed towards meeting Ireland’s obligations towards becoming carbon neutral.

Evaluation of the performance, profitability and greenhouse gas emissions of dairy-bred AAx steers finished at pasture or indoors: a whole-farm modelling approach

Flash Presentations - Poster with 5 min Presentation

***Mr. Andrew Mc Namee*¹, *Dr. Edward O Riordan*², *Dr. Paul Crosson*², *Dr. Mark Mc Gee*², *Dr. Denis Mc Crudden*¹**

1. Atlantic Technological University - Donegal, 2. Teagasc

The recent increase in the national dairy herd has led to an increase in dairy-origin cattle destined for beef production. This has renewed interest in examining alternative sustainable finishing strategies for dairy cross steers. The objectives of this study will be (i) to quantify the impact of concentrate supplementation on grass intake and subsequent steer performance at pasture in autumn and (ii) to compare steers finished off pasture in autumn or finished indoors at the end of the second winter and (iii) to determine profitability, GHG emissions and net protein efficiency ratios of pasture-based Angus x steers compared to an indoor high-concentrate-based system. In total, 66 Aberdeen Angus x Holstein Friesian steers were blocked on live weight (kg) and assigned to one of three treatments; (i) grazed grass only - (GG0), (ii) grazed grass plus 1.5 kg concentrate (rolled barley) - (GG1.5), and (iii) grazed grass plus 3.0 kg concentrate - (GG3.0). On day 112, half of the animals in each treatment group were slaughtered off pasture (PS). The remainder were housed indoors (slatted floor shed) and underwent an indoor feeding period for an additional 89 days (IS). The animals were individually offered feed through a Calan gate feeding system, which consisted of barley-based concentrates fed ad libitum plus ~1 kg/day silage DM until slaughter.

A whole farm modelling approach will be undertaken, whereby the Grange Dairy Beef System Model (GDBSM) was augmented by incorporating the Beef Greenhouse Gas Emissions Model. The model comprises six sub-models: the farm system, animal nutrition, feed supply, financial, greenhouse gas emissions, and Feed food competition. The study is anticipated to help identify trade-offs concerning the systems' productivity, economics, GHGs, and protein efficiency ratios and, thus, will determine the optimum method of finishing these steers.

Devising a Digital Twinning Framework to Assist the Development of Next Generation Integrated Heat Pump and Heat Recovery Ventilation Technology

Flash Presentations - Poster with 5 min Presentation

***Mr. Ewan Berry*¹, *Dr. Laurentiu Dimache*¹, *Dr. John Lohan*¹, *Mr. David Hunt*¹**

1. Atlantic Technological University - Galway

The *integrated* Sustainable Energy Technologies (iSET) research group based in ATU Galway City was established in 2002. iSET focuses on low carbon heating technologies and their implementation in the context of Ireland's cool maritime climate. The current project is concerned with the development of a multifunctional heat recovery ventilation system which integrates an air source heat pump with a heat recovery ventilation unit that employs a unique reverse flow enthalpy recuperator (RFER). Such technology not only delivers energy efficient residential heating but also a solution to the conflicting requirements of Parts L and F of the building regulations relating to energy efficiency and ventilation, respectively. It delivers efficient year-round thermal comfort and hot water services, and is also timely in a post-COVID world where indoor air quality and ventilation have taken on a new significance.

This research builds on previous work which delivered a state-of-the-art experimental facility (E-THERMAL laboratory) at ATU Galway City. This facility is unique in Ireland and designed to test heat recovery ventilation systems to European standard EN 16573. The current DT-RFER project builds on this experimental foundation by complementing it with computer simulation and data services expertise. This research aims to maximise residential HVAC functionality and performance, specifically low carbon hot-water production and indoor comfort through intelligent airflow management for various climatic conditions, particularly cool marine climates prevalent in Ireland, Britain and Benelux countries. Moreover, the novelty of this research centres on adopting and adapting Industry 4.0's Digital Twinning (DT) model and data driven technology development framework to intelligently design RFER integrated multifunctional heat recovery ventilation technologies that deliver intelligent fluid-flow management by combining the recovery of thermal energy and moisture from exiting stale air and better utilisation of energy contained in fresh external air without using an additional external unit.

Smart Heat in Smart Energy Systems

Flash Presentations - Poster with 5 min Presentation

Mr. Christoph Schellenberg¹, Dr. Laurentiu Dimache¹, Dr. John Lohan¹

1. Atlantic Technological University - Galway

The International Energy Authority (IEA) estimates that heat pumps will supply 50% of global heating demand by 2045 – adding significantly to electricity demand. Today, heat pump controls target thermal comfort without considering the energetic, economic, and environmental performances and their impact on the power grid. Heat pump operation does not prioritise low-cost electricity periods, avoid low-efficiency air temperature conditions, or seek to minimise its impact on the power grid by avoiding peak demand periods. Increasing Ireland's reliance on variable renewable electricity sources, wind and solar PV, increases the need for such flexibility. Indeed, the need for flexibility in global power systems is estimated to more than quadruple by 2050. “Dancing with Renewables” aptly characterises the desired ability of demand-side units to react to the inherent variability and intermittency of renewable electricity sources.

Consequently, this research exploits a digital twin, forecasting and forecasting services, and computational intelligence to optimise the control of heat pumps on the edge of the electricity grid – yielding local and global benefits for both the consumer and energy systems alike. The aim is to develop an operational optimisation framework for enhancing energetic, environmental, and economic performance facilitated by computational intelligence methods, applying Industry 4.0 tools to Smart Heat in Smart Energy Systems.

Preliminary results suggest more than 17% operational cost reductions and the potential to shift up to 100% of critical 5-7pm (peak) loads compared to a load-following reference system. Moreover, a Genetic Algorithm was the most effective and robust global optimisation technique to yield quasi-optimal minima for the non-linear, multi-modal, and discontinuous cost optimisation function

Mobile Plant Electric Track Drives

Flash Presentations - Poster with 5 min Presentation

Mr. Hugh Coyle¹, Dr. Charles Young², Mr. David Gibson³, Dr. Nicola Anderson¹

1. Atlantic Technological University - Donegal, 2. ATU Donegal, 3. Terex Material Processing

The decarbonisation of vehicles is a critical aspect that is being adopted in many industries and sectors in the combat against climate change. The mining and quarrying sectors have a keen interest in this due to the larger scale vehicles in use and the over reliance on hydraulic systems that also use harmful fossil fuels. This is evident by the collaborative aspect of this research as the project is being undertaken in conjunction with Terex, a major manufacturer of large-scale mining and quarrying machinery, and their desire to adopt a decarbonisation strategy for their products. To achieve decarbonisation on these sectors, full electrification of both the vehicle propulsion system and an electrified alternative for the hydraulic system is desired. Propulsion systems for most vehicles consist of typical wheeled systems which can easily make use of the current electric vehicle technology to arrive at suitable solutions. In the context of this project continuous track drive systems are investigated, specifically the feasibility and efficacy of converting the track drives to electric. The complexity of the track drive system arises from the multitude of moving parts present and the complex analysis that is required to check and investigate the power requirements for the mechanism. Duty cycle characteristics of general use cases must therefore be identified for current systems so that the manipulation of these cycles can be applied in an electric system. The determination of these duty cycles is largely dependent on simulation-based work to determine the complex power requirements for the tracks from the hydraulic system which is the focus of this work. The findings of both the research and simulation work can then be used to inform intelligent design decisions to ensure that sufficient and optimal choices are made for any implemented technology and components.

Downscaling ocean models for the Celtic Sea – generating science for stakeholders

Flash Presentations - Poster with 5 min Presentation

***Dr. Rachel Cave*¹, *Dr. Tomasz Dabrowski*², *Dr. Joe McGovern*², *Dr. Janina V. Buescher*¹, *Ms. Aedin McAleer*¹, *Ms. Sheena Fennell*¹**

1. University of Galway, 2. Marine Institute

CE2COAST is one of the next generation ‘Climate Science for Oceans’ JPI Oceans/JPI Climate joint projects. Partners in 8 countries are researching ocean-climate interactions and downscaling global climate earth system models to regional and local ocean models, to better inform climate change adaptation policies and practices in European seas.

In Ireland, a combined physical/biogeochemical model is now being validated for the Celtic Sea area, with daily averages output at 1km scale. The hindcast goes back to 2013, and will eventually go back to 1993. The forecast will initially go to 2030, and eventually to 2050 as more data become available. Hindcasting enables stakeholders to consider past events in their area of interest, and use the model to see what driving forces were present, and when and where they influenced the system. Forecasting enables stakeholders to look forward to see when conditions may arise that could lead to similar events, whether negative or positive, and to prepare management strategies to deal with them.

Stakeholders have been on board since the beginning, highlighting the key services provided by the marine area, their key concerns regarding the future of these services, and the key pressures operating on them. This in turn helps the modellers to optimise the model, to choose the parameters that will generate the most relevant outputs for managers, and to provide the outputs in user-ready and user-friendly formats.

An example use of hindcast and forecast is fish spawning, where a species may use a number of spawning grounds and sub-populations may spawn at different times of year, driven by different environmental factors. Comparing the model hindcast output to known spawning times and locations helps the stakeholder to tease out the key variables relating to past spawning events, and the forecasts can then be used to predict optimum future spawning conditions.

Qualitative decision support tool for evaluating potential microbial hazards for ready-to-eat fresh produce using water re-use systems

Flash Presentations - Poster with 5 min Presentation

Mr. Vaibhav Bhatia¹, Dr. Rajat Nag¹, Dr. Enda Cummins¹

1. University College Dublin

Significantly changing lifestyle and dietary choices have led to consumer demands for quality, nutrition, freshness and convenient on-the-go foods. In recent years, this has accelerated the consumption of ready-to-eat (RTE) horticultural produce, mainly leafy green vegetables and fruits. However, many are minimally processed and consumed raw without additional treatment steps, making them susceptible to foodborne pathogenic contamination and potentially threatening human health, especially when the crops are irrigated using re-use water systems, including treated grey water. The horticultural produce chain is complex, with various production steps that can introduce foodborne pathogens. These may range from the pre-harvest stage, harvesting stage, during post-harvest preparation and handling practices, within storage, distribution and transport chains, and at the retail level or in consumer kitchens. A spreadsheet-based risk assessment tool is presented, which embodies established principles of food safety risk assessment to identify significant risk factors and transmission sources of pathogenic microorganisms for different RTE fresh produce crops in Ireland following re-use water irrigation. The model has two stages of assessment- pre-harvest and post-harvest- based on multiple-choice questions about various routes and mechanisms of produce contamination throughout the farm-to-table continuum that has been widely studied and reviewed in the literature. A scoring system has been framed where a score between 1- 10 is associated with every answer choice for each question. The final risk score for each crop under assessment is calculated by summing the individual scores for each question to generate indices of the final risk category. Based on this research finding, future work may involve developing a web-based risk assessment tool. The model can be adapted to identify key risk factors and transmission sources of foodborne pathogens through horticultural crops flowing water re-use practices and help growers and policymakers ensure food safety.

Development of a feeding assay as a phenotypic measure for ecotoxicology in daphnids

Flash Presentations - Poster with 5 min Presentation

Ms. Maria Giannouli¹, Dr. Konstantinos Panagiotidis¹, Prof. Konstantinos Grintzalis¹

1. Dublin City University

Daphnids are model organisms commonly used to investigate chemical and physical changes to the aquatic environment. Several studies examine how chemicals affect energy endpoints, such as food uptake and ingestion. The commonly used approaches to determine the feeding rate of daphnids are based on algal cell counts and chlorophyll fluorescence. In this study, we developed a feeding assay that resolves around the non-selective filtration for any particle in the culturing media of daphnids using fluorescent microparticles. For the optimization of the feeding assay, daphnids were incubated in OECD media to simulate the absence of food during exposure to chemicals, and the impact of animal number, the concentration of microplastic, and the volume of the media were investigated. The feeding rate of daphnids was measured as the ingestion of the fluorescent microparticles. The optimized protocol was applied to assess the impact on a series of commonly encountered pollutants with a different mode of action. The impact of selected chemicals was determined using non-lethal concentrations. The results indicated that there was a concentration-dependent impact on the feeding rate of daphnids (decreased with the increase of concentration) when animals were exposed to selected chemicals (Zirconium chloride, Zinc sulfate heptahydrate, DL- propranolol hydrochloride, Diltiazem hydrochloride), and concentration-independent impact (Diclofenac sodium, Aluminium sulfate hexadecahydrate).

Investigation of solar irradiance databases for PV system design

Flash Presentations - Poster with 5 min Presentation

Mr. Jamal Alfaraj¹, Dr. Paul Leahy¹, Dr. Emanuel Popovici¹

1. University College Cork

Jamal Alfaraj^{1,2}, Emanuel Popovici³, Paul Leahy²

(1): Electrical and Electronic Engineering, University College Cork, Ireland.

(2): Energy Engineering, School of Engineering & Architecture, University College Cork, Ireland.

(3): Electrical and Electronic Engineering, School of Engineering & Architecture, University College Cork, Ireland.

Abstract:

Designing and correctly sizing PV systems is reliant on solar resource data availability and accuracy. Not only is solar irradiance data important, but other weather parameters also affect PV efficiency such as ambient temperature, wind speed and direction, etc. Recently, satellite-derived databases have become an established data source for sizing solar PV systems. A number of researchers have used satellite-derived databases provided by NASA, Solcast, PVGIS or other providers to conduct their studies as these sources are easy to find and use. This study compares multiple databases with ground-based observations in order to validate the databases' performance.

In order to achieve the research objectives, satellite database and ground (real) measurements for weather data were collected. Dublin, Ireland was used as the location for both techniques. Subsequently, numerical simulation was employed in the data analysis. A comparison method was applied between satellite and ground measurements database using daily, monthly and annual average. A model of PV cell performance was used to find the impact of different data sources on the required PV system size for a specified energy yield.

Daily averages of GHI were compared for ground and satellite. The research results show that ground measurement is more accurate compared to satellite database as they are the actual data measured on solar PV surface. Poorly-sized systems due to errors in the resource quantification have a negative impact: either the required power to the load is not delivered or an unnecessarily large solar system occupies more space and incurs unnecessary expenditure.

Can existing models be combined in new ways to improve our understanding of barrier island and headland-controlled bay evolution?

Flash Presentations - Poster with 5 min Presentation

Ms. Abbie Nugent¹, Prof. Iris Moeller¹

1. Trinity College Dublin, The University of Dublin

Barrier islands are dynamic coastal landforms that are constantly changing due to the interaction of natural processes and anthropogenic activities (Woodroffe, 2002). In headland-controlled bays the evolution of barrier islands is particularly complex as the islands are heavily influenced by the bay geometry, sediment supply and human activities. Barrier-islands within headland controlled bays are not extremely common environments although instances where they form as a result of human intervention (like North Bull Island in Dublin Bay) may become more frequent in the future with increasing anthropogenic activities occurring at the coast. A comprehensive understanding of the evolution of barrier islands in headland bays requires a new model framework that takes into account both the longer scale evolution of the bay area with the more detailed, finer-scale changes on barrier islands themselves. This approach will allow for a better understanding of the past, present and potential future changes of these coastal landforms.

This research aims to create a novel model framework using both numerical and conceptual models for understanding barrier island and headland-controlled bay evolution, specifically focusing on the case study of North Bull Island and Dublin Bay. The goal is to provide a more comprehensive understanding of the processes and interactions that control barrier island and bay evolution, and to improve predictions of future changes in these environments. The project will use planform equilibrium models to understand the balance between sediment supply and transport to understand the longer term (decadal) evolution of Dublin Bay (Moreno et al., 1999; Yasso, 1965). In addition, numerical models like MIKE21 and XBEACH will be used to simulate hydrodynamics and morphodynamics to explore the morphological response of the island to storm events; a key force driving morphological change for barrier islands (Passeri, 2018).

Key words - Barrier islands, model framework, sea level rise, headland bays.

Understanding Carbon Sequestration Potential of Irish Organic and Organo-Mineral Soils Under Grassland Management: A Study of Drainage and Re-wetting Effects.

Flash Presentations - Poster with 5 min Presentation

***Mr. Ian Clancy*¹, *Dr. Matt Saunders*¹, *Prof. Gary Lanigan*²**

1. Trinity College Dublin, The University of Dublin, 2. Teagasc Reseach, Johnstown Castle

Understanding the potential for carbon sequestration in the Irish Agricultural sector is key to Ireland meeting the goals set forth by the Climate Action Bill, as is the need to mitigate current emissions. Irish grasslands are a significant carbon store, with grasslands under mineral and organic soils containing approximately 1.5 billion tonnes of carbon. Histosols, which are large carbon sinks, typically contain between 1000-4000 tC ha⁻¹ with the amount of carbon sequestered governed by hydrological status, vegetation type, and associated management. Currently, over 300,000 ha of these soils are drained for permanent pasture in Ireland and due to the high carbon stocks, they emit large quantities of carbon upon drainage, which is further accelerated by agricultural management resulting in CO₂ emissions of 3.5 million tonnes per annum. The objective of the PhD is to measure field-scale fluxes of CO₂, CH₄ and H₂O and to generate land-use and land management emission factors for grasslands established on shallow and deep-drained nutrient poor and nutrient-rich histosols, and on drained organo-mineral soils, and previously drained systems which have been naturally or actively re-wetted across the full nutrient and drainage gradient. This work will lead to more robust emission factors for key greenhouse gases, will help to understand the drivers of carbon losses, and their relative impacts and will quantify the extent to which re-wetting and changes in water table and management can reduce carbon losses.

Associations between pro-environmental food purchasing behaviour, socio-economic profiles and health characteristics in Ireland

Flash Presentations - Poster with 5 min Presentation

Mr. Daniel Burke¹, Dr. Paul Hynds¹, Dr. Anushree Priyadarshini¹

1. Technological University Dublin (TU Dublin)

Dietary habits contribute to climate change and food security as the type and volume of food consumed have varying levels of environmental impact. Ireland's per capita GHG emissions are the highest in the EU, with 35% emanating from the agri-food sector; changing dietary habits may represent an effective approach to GHG mitigation, however, human behaviour needs to be explored further, and particularly understanding what Irish consumers prioritise when purchasing food. Accordingly, a cross-sectional online questionnaire was developed and conducted across Ireland to collate respondents' top food purchasing priorities, socio-economic profiles, previous and ongoing health status, and diet.

Overall, 968 participants completed the questionnaire; taste was the most frequently selected factor for consumers when purchasing food (n=350, 36.8%), conversely, certification labelling was the least frequently selected (n=19, 2.0%). Significant associations ($p < 0.05$) were identified between respondents' top purchasing priority and socio-economic profiles, health, consumer behaviour, and dietary patterns.

Respondents who selected 'price' as the most important factor when purchasing food were 1.53 times more likely to have attained an education level up to a technical or vocational certificate, 1.48 times more likely to be obese, and 1.41 times more likely to have a 'meat-dominant' diet. Respondents who chose 'taste' were twice as likely to be obese and 1.74 times more likely to have attained an education level up to secondary school, while respondents who chose 'nutrition' were less likely to be attributed to the 'potato-dominant' diet (OR=0.37). Respondents who selected 'where the food was grown' were 5 times more likely to grow their own fruit and vegetables. Respondents who selected 'food seasonality' were approximately 8 times more likely to have purchased food from a farmer's market. By understanding what consumers prioritise when purchasing food and their socio-economic associations, specific groups can be targeted to help motivate environmentally sustainable food purchasing behaviours.

The Association between Disinfectant Use & Antimicrobial Susceptibility of Wild-type Bacterium in Livestock Agriculture: A Laboratory Study

Flash Presentations - Poster with 5 min Presentation

Ms. Meabh Dowler¹, Dr. Paul Hynds¹

1. Technological University of Dublin - City campuses

Antimicrobial resistance (AMR) is recognised as a global public health emergency, with global deaths attributed to AMR infections (~10 million) predicted to surpass cancer by 2050. Biocides are defined as chemical agents containing antimicrobial compounds for preventing/controlling harmful or unwanted organisms, including disinfectants, preservatives, insect repellents, rodenticides, and insecticides. These are frequently used in agriculture and remain relatively unmonitored with little information available regarding the types and quantities used, and how they are applied in the environment. Inappropriate usage including over-use of biocides may potentially lead to the development of resistant bacteria sub-lethal disinfectant concentrations can lead to selection of resistant strains via long-term low-level exposure (i.e., pressure). The current laboratory study sought to investigate the effects of sub-lethal agricultural biocide concentrations and varying exposure times on bacteria, with laboratory parameters based on results from a survey of Irish farmers regarding biocide usage. The experiment comprised a series of three tests; minimum inhibitory concentration (MIC) tests, minimum bactericidal concentration (MBC) tests & clinical (human) and veterinary antibiotic susceptibility testing.

Minimum inhibitory concentration (MIC) is defined as the lowest concentration of an antimicrobial agent (e.g., iodine, surgi-scrub, steri 7, methylated spirits & tri-scrub) that visually inhibits the growth of a microorganism (*E.coli* and *Pseudomonas* spp.) after overnight incubation. Reduction of bacterial cells are measured using broth dilutions (96 well plates) and staining with Alamar blue to identify cell viability. Growth plates were used to determine the MBC, defined as the minimum concentration of an antimicrobial which kills 99.9% of the test microorganisms in the original inoculum. Susceptibility testing will be undertaken subsequent to laboratory MIC and MBC tests on culturable bacterial colonies to assess the impact of biocide concentration on selection for AMR against a suite of commonly prescribed antibiotic compounds.

Doom and Bloom: past, present and future perspectives of Harmful Algal Blooms in Irish waters

Flash Presentations - Poster with 5 min Presentation

***Mrs. Nicolè Caputo*¹, *Mr. Dave Clarke*², *Dr. Fiona Kavanagh*¹, *Dr. Luca Mirimin*¹**

1. Atlantic Technological University - Galway, 2. Marine Institute

Harmful Algal Blooms (HABs) are natural phenomena that cause global ecological, economical and human health issues. A recent systematic review has been carried out to investigate the history of bloom events occurred in Ireland through the last half century. These events have been reported since early 1970's in Irish waters, causing mortalities of littoral and sub-littoral organisms. The national monitoring programme for phytoplankton species identification by microscopy at the Marine Institute laboratories, commenced in the 1980's as the shellfish aquaculture sector expanded throughout the country. From 2007, the phytoplankton laboratory introduced molecular methods for the identification of organisms which are difficult to identify by light microscopy. In the last decade, several methods have been developed for the detection of harmful microalgae and hidden biodiversity, which open the door to many applications in biomonitoring. Molecular techniques are particularly promising when multiple species need to be detected and quantified, even in very low abundances. In particular, HighThroughput Sequencing (HTS), quantitative PCR (qPCR) and digital PCR (dPCR) are extremely sensitive methods that have been applied in recent years to identify and estimate species in natural samples. However, in the current scenario of global climate change, the risk associated with the expansion of emerging toxin-producing species towards higher latitudes need to be assessed, as some of them can be source of novel toxins. Further improvement and development of accurate, cost-effective, efficient and rapid detection technology is fundamental to the early warning system and mitigation strategies for HABs in the future. This research presents a review of the diversity and the occurrence of HABs events in Irish waters, and an overview of a comparative experimental study of some of the most common and reliable methods to investigate the sensitivity and specificity of cross-methodologies for real-time detection of phytoplankton species in the marine environment.

Greenhouse gas emissions from food system activities in Ireland 1990-2018.

Flash Presentations - Poster with 5 min Presentation

Ms. Isobel Stanley¹

1. University College Dublin

‘Food systems’ encompass the interconnected actors and activities involved in bringing food from farm to fork, the disposal of that food, and the broader environments (economic, societal and natural) in which they are embedded. Food systems operate at high cost to planetary health. It is estimated that 20-30% of total human-created GHG emissions globally are attributable to food system activities. The majority of these emissions arise from agriculture and land-use change but post-farm activities also contribute 5-10% of total emissions and are likely to increase in importance in the future.

The agri-food sector plays a vital role in the Irish economy. In 2021 agri-food exports were valued at €18.7 billion while also providing 7.1% of total employment in Ireland. Economic growth in the sector however, has come at the expense of the environment; in 2018 Ireland had the highest GHG emissions from food systems per capita in the EU. Increasing the sustainability of the Irish food system requires an understanding of where and how GHG emissions arise across the whole food system. To date research on Irish food-related emissions has focused on agriculture and land use but there is little published on the contribution of activities later in the system including packaging, processing, retail, transport, consumption and food waste.

This paper presents an overview of GHG emissions from food system activities in Ireland from 1990 to 2018 and maps changes over time to landmark food policy developments. Using data from the EDGAR-FOOD database changes in emissions over time are examined by gas (CO₂, CH₄, N₂O and F gases) and by food system stage (Land use, production, processing, packaging, retail, transport, consumption and food waste). By estimating GHG contribution across the Irish food system this analysis provides important information for targeted policy development for mitigating food system impacts on climate change.

Modification of willow evapotranspiration on-site wastewater treatment system designs following multi-annual monitoring programme of full-scale systems.

Flash Presentations - Poster with 5 min Presentation

Mr. Aaron Coyle¹, Prof. Laurence Gill¹, Dr. Sean Curneen¹

1. Trinity College Dublin, The University of Dublin

The domestic wastewater of approximately one third of the population in Ireland (c. 500,000 dwellings) is treated on-site by domestic wastewater treatment systems (DWWTS), of which more than 87% are septic tanks (CSO, 2016).

Areas with inadequate percolation due to low-permeability subsoils and/or high-water tables present significant challenges in the country whereby ponding and breakout of untreated effluent at the ground surface can occur, with a risk of effluent discharge to nearby surface waters. It is estimated that the overall proportion of the country with inadequate conditions for DWWTS (all year round, or intermittently during wet weather conditions) is 39% (EPA, 2013).

Between 2010 and 2014, fourteen full-scale willow evapotranspiration (ET) systems were constructed and trialed as potential nature-based solutions (NbS) to treat domestic wastewater effluent from single house dwellings at various sites across Ireland. The sites were located in areas with very low permeability (i.e. clayey) subsoils, in which effluent percolation would not be feasible for wastewater effluent. The ET systems were constructed in a sealed basin, made from an impermeable membrane. Effluent flow into the systems, water level, rainfall and potential evapotranspiration were continuously monitored over a ten-year period to determine the water budget and crop coefficients at each site. The primary aim of the ET systems was to achieve zero effluent discharge to the environment. However, no system managed to achieve zero discharge in any year, remaining at maximum levels for much of the winter months, indicating some loss of water by lateral exfiltration at the system surface.

A revised design for new willow ET systems has been formulated based upon a mounded surface profile partially covered in an impermeable membrane to divert approximately 70% of the incident rainfall away from the basins, which, based on predictive modeling, should achieve zero discharge performance throughout the year.

Clothing Circularity, Sufficiency & Sustainable Maximum Use - Everyday Practices For Transformative Sustainability Transitions.

Flash Presentations - Poster with 5 min Presentation

***Ms. Helen Maguire**¹*

1. School of Home Economics, St. Angela's College, Sligo

Recent policy level shifts at EU level aim to accelerate transition from a linear towards a more sustainable, circular economy (EC, 2020; 2019a). As a priority product category, the Commission has presented a new systemic strategy to tackle impacts of fast fashion and to ensure that clothing and textiles are increasingly durable, repairable, reusable, and recyclable (EEA, 2022; EC, 2019b). In the context of transformative sustainability transitions, maximum clothing utilisation must be a key emphasis of any effective closed-loop system, and an enhanced understanding of current everyday clothing use practices can provide valuable signposts for future sustainable policy and practice.

This presentation critically explores the potential for clothing circularity, everyday wardrobe sufficiency practices, and maximum utilisation as vital pieces of the fashion sustainability puzzle, with the potential to support future sustainability transitions. It shares the findings of an interdisciplinary study conducted in the North West of Ireland (in counties Donegal and Sligo) which examined everyday practices in clothing active use from a sustainable consumption perspective. Drawing on current and emerging discourses in clothing geographies and sustainable consumption research, and focusing on circularity, sufficiency, and maximum utilisation of clothing already owned, the key aim of the inquiry was to determine how everyday practices regarding clothing wear, care, and repair are currently constituted in Ireland. Purposive sampling was employed to recruit fifteen participants across three intergenerational life-stage groups: Young Adults (18-24 years); Parents with young children (25-49 years); and older Adults (50 years+). Problem-centered interviews and innovative wardrobe studies were employed to generate a snapshot of lived intergenerational practices.

Research outcomes demonstrated that future scaling of sustainability transitions requires involvement of a broad spectrum of clothing users possessing competent care skills, a keen desire to engage in everyday clothing maintenance, a willingness to accomplish sufficiency practices, and to wear repaired clothing proudly.

Life Cycle Assessment of Dimensional Stone; a Hot-spot Analysis

Flash Presentations - Poster with 5 min Presentation

***Mrs. Christeen Saparamadu*¹, *Prof. Aidan Duffy*¹, *Dr. Aidan Forde*²**

1. Technological University Dublin, 2. Valentia Slate Comapny Ltd.

A major challenge of our time is climate change which poses a severe threat to ecosystems, human health and economy. The use of energy represents by far the largest source of anthropogenic greenhouse gas emissions, two-thirds of which are linked to burning fossil fuels for heating, electricity, transport and industry. The building and construction sector accounts for 39% of global carbon emissions, three-quarters of which are operational, with the remainder being classified as ‘embodied’ carbon from construction, refurbishment and maintenance materials.

Dimensional stone has traditionally been an important component in building cladding, paving and roofing systems. Despite its popularity, there are relatively few studies which focus on the carbon impacts of natural stone. This makes it difficult to target and mitigate emissions in production, transport and maintenance processes. Moreover, the lack of Product Category Rules (PCRs) for dimensional stone means that Environmental Product Declarations (EPDs) are not available, thus hindering the assessment and deployment of stone and related products. Therefore, this paper describes the development of a Life Cycle Assessment methodology for a dimensional stone production system and its application to a slate quarry to identify hot-spots for emissions mitigation.

The methodology involves defining the life cycle of different dimensional stone products at Valentia Slate Quarry in southwest Ireland, establishing a contribution tree for all processes involved and the localization of impact causes. Activity data are collected from site surveys and company accounts, and a tiered hybrid analysis is applied using Ecoinvent and other national inventory data. The system boundary considered for the product is cradle to gate, which excludes the transportation element out of the slate quarry. Impact categories are screened using the IMPACT 2002+ impact assessment method. Findings include the identification of quarrying, dimensioning and finishing processes which contribute most to the carbon emissions.

Are the drivers of discarding of unwanted catch by the demersal bottom trawl fishery in the Celtic Seas ecoregion predominantly regulatory in nature?

Flash Presentations - Poster with 5 min Presentation

***Ms. Maria Browne*¹, *Dr. Deirdre Brophy*¹, *Dr. Julia Calderwood*², *Dr. C il n Minto*¹**

1. Atlantic Technological University - Galway, 2. Marine Institute

The discarding of unwanted catch is an issue of significant complexity across fisheries globally. Discarding in mixed fisheries remains problematic due to unbalanced quota allocations and imperfect selectivity devices. Identification of the predominant drivers behind discarding is critical for the future implementation of effective methods of discard reduction. This study utilized a generalized additive modelling approach to determine influential drivers which impacted the discards per unit effort (DPUE (kg.hr⁻¹)) of cod, whiting, hake and haddock in the Irish demersal trawl fishery in the Celtic Seas ecoregion from 1996-2018. The potential drivers included in the analysis were categorized into operational, biological and regulatory factors. Furthermore, fish above and below the minimum conservation reference size (MCRS) were modelled separately to compare the importance of factors affecting the discarding of these two categories of unwanted catch. Predictions of the DPUE (kg.hr⁻¹) were made across interactions between gears, space, time and available quota (t). Significant model interaction terms showed that the effects of gear type on the DPUE (kg.hr⁻¹) varied spatially. Likewise, the effects of the year of fishing activity on the DPUE (kg.hr⁻¹) showed significant spatial variation. The monthly effect was found to vary significantly between years. These three interaction terms were the only drivers which provided a significant impact on the DPUE (kg.hr⁻¹) for each species for both size classes. A sub-analysis indicated that monthly quota (t) was a significant driver of discarding of > MCRS fish (with the exception of cod). The sub-analysis included abundance indices (kg.km⁻²) for undersized and legally sized components per regulatory area to determine if significant spatio-temporal effects were related to varying year-class strengths. The findings in this study suggest that the principal driving forces behind discarding in this fleet are regulatory with legislation potentially driving discarding more than biological or operational factors.

Microplastics in fresh- and wastewater are potential contributors to antibiotic resistance

Flash Presentations - Poster with 5 min Presentation

***Ms. Shabila Perveen*¹, *Prof. Javier Marugan*², *Dr. Cristina Pablos*², *Dr. Ken Reynolds*³, *Dr. Simon Stanley*³**

1. Universidad Rey Juan Carlos / ProPhotonix Ltd. / ERI University College Cork, 2. Universidad Rey Juan Carlos, 3. ProPhotonix Limited

Increasing antibiotic resistance and microplastic (MP) pollution are among the global environmental challenges of our time. This study reviews relevant studies on MP pollution and the abundance of antibiotic resistant elements in freshwater resources. The objective was to evaluate the potential antibiotic resistance spread via MPs in the freshwater aquatic environment. Studies have indicated that MPs interact with microbial communities differently than natural particles, harboring a unique bacterial community than the surrounding water. The composition of MP biofilm community revealed an abundance of bacterial cells, pathogens, antibiotic resistant genes (ARGs) and mobile genetic elements (MGEs). The closely packed bacterial cells in MP biofilm in a water matrix might offer a favorable environment for horizontal genes transfer (HGT). Furthermore, antibiotics in trace concentrations in freshwater resources could be adsorbed onto MP surfaces and impact the microbial composition by selective enrichment of antibiotic resistant bacteria (ARB). The biofilm matrix provide protection in MP biofilms that could impact the disinfection efficiency of conventional treatment techniques. The impacts of MPs, antibiotic resistant elements and their interaction on human health and aquatic biota remain relatively unknown to date. Future studies on MPs and antibiotic resistant elements need to consider the collective role, challenges, and consequences of the interaction between MPs and antibiotic resistant elements in freshwater ecosystem.

Rights of Nature Perspectives in Ireland

Flash Presentations - Poster with 5 min Presentation

Mr. Julian Suarez¹

1. University College Cork

Between 2021 and 2022 several Council motions in neighbouring counties and districts within the island of Ireland have invited local authorities to embrace rights of nature (RoN) as part of their decision-making processes. At the end of November 2022, the Citizens' Assembly on Biodiversity Loss resulted in a 83% vote recommending a constitutional referendum seeking to protect biodiversity. This proposal includes substantive and procedural environmental rights for both people and for nature as well.

These Council motions, within an ecocentric approach, would currently function as mere legal declarations of political intent regarding the environment. However, local authorities have outlined their potential to become policy goals and values in local planning matters. Furthermore, the recent outcome of the Citizens' Assembly on Biodiversity Loss pinpoints to a possible constitutional enactment of RoN, besides other environmental human rights. What would the consequences of such enshrinement be for Irish law? What have been the experiences of other countries enacting rights of nature within their Constitutions? What practical legal implications can be drawn from such experiences?

To begin the discussion, I would present both Irish initiatives at the stage they are currently in. Next, I would portray the main characteristics of rights of nature initiatives from a selected sample of countries that either have RoN in their Constitutions or have enacted RoN declarations besides having the right to a healthy environment — Colombia, Ecuador, Spain, France. On the third and final part, considering current Irish RoN and the direction they have been given, I would seek to draw parallels with the avenues of possibility within Irish rights of nature and rights of natures initiatives in those other jurisdictions. I hope to convey that integrating RoN into the existing Irish environmental protection framework has the potential to create overlapping, redundant and conflicting environmental regulation.

Evaluating quality and shelf life of silicon enriched fresh produce using novel sustainable packaging solutions

Flash Presentations - Poster with 5 min Presentation

***Ms. Lorraine Foley*¹, *Mr. Francesco Saverio Giordano*¹, *Prof. Jesus Frias*¹, *Dr. Andrew Reynolds*¹, *Dr. Lael Walsh*², *Dr. Shivani Pathania*²**

1. Technological University of Dublin - City campuses, 2. Teagasc Food Research Centre Ashtown

Leaf No Waste are winners of the SFI Future Innovator Prize 2020 Food Challenge. This SFI challenge examines food waste prevention.

The National Food Waste Roadmap is committed to reducing such waste by 50% before 2030. Leaf No Waste is examining food waste prevention throughout the supply lines of perishable leafy vegetables, strawberries and mushrooms. With the support of SFI funding, our research validates sustainable practices in crop production, benchmark effective alternatives to existing plastic solutions and develop Life Cycle Assessments.

Our solutions involved growing crops treated with silicon (Si) enriched biostimulant to test the physiological response, quality and potential of reduced food loss when wrapped in sustainable packaging formats.

Experiments included field trials of spinach and kale grown under randomised block design throughout the Seed Phase 2021.

During 2022, strawberry and mushroom trials were conducted under controlled conditions at Teagasc in Ash-town.

The Life Cycle Assessment examined hotspots in spinach production to determine if environmental impacts can be reduced using silicic acid and reduced packaging intervention.

The agriculture intervention of using silicon demonstrated the ability to help overcome some of the technological limitations of compostable packaging material. Silicon is a potential bridge to help move from plastic as the properties of compostable films for fresh produce continue to improve.

Expansion of team facilitates broader studies on a range of commodities. The data from growing, packaging and post-harvesting analysis was used to develop novel food waste prevention models for spinach and kale. This predictive modelling will be scaled up to include strawberries and mushrooms.

Leaf No Waste will demonstrate the safe use of silicon and test sustainable packaging formats which benefits growers in Ireland. Our goals are to facilitate the just transition towards sustainability along the fresh produce supply lines.

Short-Term Carbon Flux of Cereal Cropland based on Peat Soil

Flash Presentations - Poster with 5 min Presentation

Mr. Richard Slevin¹, Dr. Matt Saunders¹

1. Trinity College Dublin, The University of Dublin

Richard Slevin^{1*} and Matthew Saunders¹

¹Trinity College Dublin, School of Natural Sciences, Botany Discipline

*Corresponding author

Peatlands store significant quantities of atmospheric carbon (C) globally, however these C stores are vulnerable to land use, management practices and climatic variability. In Ireland approximately 35% of the total peatland area has been drained and converted for agricultural use, which has significant implications for biospheric carbon emissions. A greater understanding of their emission profiles is therefore required to inform future sustainable management practices.

In this study the eddy covariance technique was used to assess the conversion of a grass-based peatland system to cereal crop (*Triticum aestivum*) cultivation, and to assess the impacts of this type of land use on the net ecosystem C exchange.

The goals of this work were to:

- Understand the impacts of land use change, cereal cultivation and peat soil dynamics on ecosystem scale C fluxes
- Identify the biological and physical drivers of C flux on this land-use type
- How key drivers might influence future rates of C exchange.

Our preliminary results indicate that the cultivation of cereal crops on peat-based soils can have a significant impact on the annual net ecosystem C exchange, highlighting the need for further research to better understand the implications of peat-based cropland emissions, inform climate action targets, and progress toward more site-specific management practices for greater agricultural sustainability.

Poster

Force Analysis for Conversion of Hydraulic Track Drive Machines to Electrification

POSTERS (only) list - Poster

***Mr. Jamie Farren*¹, *Dr. Charles Young*¹, *Mr. Hugh Coyle*², *Mr. Dean Harron*¹**

1. ATU Donegal, 2. Atlantic Technological University - Donegal

Work pertains to the conversion of Hydraulic track drive machines to Electrification.

Hydraulic systems have several disadvantages in that they require frequent maintenance, are susceptible to leaks, and can be harmful to the environment. In the case of a track driven machine the hydraulic motor is driven by a pump, which in turn is typically driven by a combustion engine such as a diesel engine. Diesel engines produce pollutants such as CO₂, which are harmful to the environment.

The conversion of a diesel-hydraulic tracked vehicle to electric has many benefits and omits many of the negatives mentioned. The machine can then be considered carbon neutral if the energy is provided from a renewable source. Furthermore, electrification represents an improvement of the efficiency of the machine.

This work focuses on establishing the specific power requirements of a track drive machine so that an adequate electrical replacement can be made. This work quantifies the specific forces involved during the manoeuvring (turning) of a track drive vehicle so that the power requirements can be established i.e. the movement of track pads relative to the ground creates shear force exerted on track shoes by terrain in the longitudinal and lateral directions which is a function of the slip and contact force. This is further complicated on account of the position of each portion of the track relative to the centre of rotation.

This work therefore illustrates a mathematically based vector representation of the forces involved in turning a tracked machine by means of summing the forces along each section of the track. Physical experimentation by means of a small RC excavator is then used to validate the projected forces.

Understanding the potential to regulate our biological clock through enhanced daylighting in buildings using luminescent solar concentrators

POSTERS (only) list - Poster

***Mr. Wai Qian Tham*¹, *Mr. Tianren Chen*², *Dr. Subhash Chandra*³, *Dr. Brian Norton*², *Dr. Sarah McCormack*¹**

1. Trinity College Dublin, The University of Dublin, 2. Tyndall National Institute, University College Cork, 3. Department of Civil, Structural and Environmental Engineering, School of Engineering, Trinity College Dublin, The University of Dublin

Our biological clock follows a cycle of day and night, and is regulated through light response. Blue light at the wavelength of approximately 480nm has been shown to be effective at maintaining our biological clock, or circadian rhythm which can be enhanced through increasing daylight in buildings. With the increase in building size, certain areas within buildings have limited to no daylight penetration. Thus, artificial lighting is used to illuminate indoor space to enable people to perform visual tasks effectively. To reduce energy use for nearly-zero energy buildings, often light guides are introduced to channel daylight deep into the room for visual purposes. One such method is by using luminescent solar concentrators (LSCs). Luminescent materials absorb a portion of the solar spectrum, which will then re-emit the light with a shift of wavelength through down-conversion or up-conversion. The light will then be transported through the material through total internal reflection, allowing daylight to be transported through the material which acts as a waveguide. As light guides may not provide sufficient illuminance to maintain a healthy biorhythm, LSCs can shift the wavelengths of daylight to increase the blue intensity of the output spectrum, thus providing sufficient lighting conditions for regulating our biological clock. Daylighting using LSCs could potentially provide a comfortable visual indoor environment, and at the same time enhance the regulation of our biological clock, without the use of artificial lighting, thus reducing energy usage while providing a healthy indoor space.

Lignin Oxidative Depolymerization and Simultaneous Hydrogen Production – Utilization of a Photoelectrochemical Cell (PEC).

POSTERS (only) list - Poster

***Mr. Junhong Liu*¹, *Dr. Kathryn Ralphs*¹, *Dr. Nathan Skillen*¹, *Prof. Peter Robertson*¹**

1. Queens University Belfast

As Net CarbonZero and the development of the circular economy become critical global environmental issues, developing alternative green energy resources for fossil fuels are an area of significant research activity. Bioenergy is potentially one of the most promising green energy resources due to the large annual global output lignocellulosic biomass originated from forestry and agricultural residues. Methods such as fermentation, gasification, catalytic decomposition etc., have been utilized in biorefinery and green hydrogen production applications. One of the main components of lignocellulosic biomass, lignin, however, is the largest naturally renewable source of aromatic compounds. Currently this material is most commonly incinerated as decomposition of this material is challenging due to the cross-linked bonding between cellulosic monomers. This is approach not only has a carbon foot print but also is a loss of a potentially high value raw material. Methods for the highly selective conversion of lignin into aromatic high-value chemicals, consequently needs to be urgently investigated. Consequently, in this research, NiTi-type LDH with synthetic cationic vacancies is used as a photocatalyst for the oxidative depolymerization of lignin in a photoelectrochemical cell as a photoanode, while hydrogen is produced at the photocathode. The device is capable of both lignin valorization and green hydrogen production to provide green energy, solving the problem of high anode overpotential in photoelectrolysis of water.

Catalysts synthesis by mechanochemistry and their applications

POSTERS (only) list - Poster

***Dr. Kathryn Ralphs*¹, *Prof. Stuart James*¹, *Dr. Nathan Skillen*¹, *Prof. Peter Robertson*¹**

1. Queens University Belfast

Catalysts are fundamental to life as we know it. Traditionally catalysis lies at the core of the chemical industry but now extends to every aspect of society, from food, medicine, energy, to pollution control and more recently to develop more sustainable processes and renewable energy systems. Traditional catalysts are often toxic, require high operating temperatures and pressures and require significant quantities of solvents to prepare.

Mechanochemistry is the induction of chemical reactions through the input of mechanical energy. Typically, it is a low energy solvent free method. Mechanochemically prepared catalysts have shown considerable promise over their conventional counterparts. Some examples from our work include;

- Ball milled Ag/Al₂O₃ catalysts for SCR de-NOx [i]^[iii]
- Mechanochemically prepared metalloporphyrins[iii]
- Hydrogenation of fatty acids via mechanochemically prepared Pt-Re/TiO₂ catalysts[iv]

More recent work is focused on the development of materials for deployment within photocatalytic technology, in particular the photo reforming of biomass to H₂ and value-added chemicals. ^{[v],[vi]}

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Carbon stocks, dynamics, and processes in Irish seagrass systems

POSTERS (only) list - Poster

***Ms. L. Saige Alloway*¹, *Dr. Pedro Beca-Carretero*¹, *Dr. Dagmar B. Stengel*¹**

1. Botany and Plant Science, School of Natural Resources, University of Galway, Galway, Ireland

Coastal and marine systems are an active part of the Earth's carbon cycle; as an island country, Ireland's largest long-term carbon sinks are represented by two recognised blue carbon (BC) habitats: saltmarshes and seagrass meadows.

Seagrasses are marine flowering plants (Angiosperms) that exhibit many valuable ecosystem services across intertidal and subtidal habitats. Seagrass systems are globally under threat from climate change, eutrophication and habitat degradation or loss. Irish seagrass communities are characterised by *Zostera marina* and *Z. noltii*, occupying subtidal and intertidal shallow sediments, respectively. They provide habitat, shelter and nursery grounds to many other biota and play a critical role in nutrient cycling and carbon sequestration. However, despite recent interest in seagrass ecology, distribution, and productivity, their extent and associated carbon dynamics are poorly characterised and understood.

As part of the Marine Institute-funded BlueC project, this research aims to increase scientific understanding of carbon dynamics in Irish seagrass systems and the potential for climate mitigation, adaption and ecosystem services. This research will develop baseline data on carbon pools and fluxes in Irish coastal seagrass ecosystems and evaluate seagrass carbon stock in relation to habitat degradation. Specifically, we will investigate (i) the organic carbon content buried in seagrass ecosystems, (ii) carbon sedimentation rates over the last centuries, and (iii) organic carbon fluxes released by photosynthetic plant structures. In combination, these data will be used to parameterise spatial and carbon dynamic models to estimate the capacity of these ecosystems to absorb, accumulate and transform organic carbon over time.

This study will deliver first data on Irish carbon sequestration rates and potential carbon sink systems which will inform management options and create informed policy, thereby assisting Ireland and the EU to meet climate change objectives of the 2030 Climate Target Plan.

Food Waste in Ireland - Assessment, Environmental & Economic Burden, and Mitigation Strategies (FORWARD)

POSTERS (only) list - Poster

***Ms. Talia Moonsamy*¹, *Dr. Gaurav Rajauria*², *Dr. Anushree Priyadarshini*³, *Prof. Marcel Jansen*¹**

1. University College Cork, 2. Munster Technological University - Cork, 3. Technological University Dublin (TU Dublin)

Household food waste is a significant problem in Ireland, with over 200,000 tons being generated per year. Food waste reduction offers multi-faceted benefits for people and our planet. The FORWARD project brings together collaborators with varying expertise, and is aimed at household food waste valorization in the Irish context.

One of the aims of this project is to develop a road map for the conversion of food waste into bio-based products in a cascading approach of a biorefinery. In order to determine bioprocessing strategies and appropriate conversion technologies, it is necessary to quantify the feedstock and profile food waste in terms of its biochemical structure. A rigorous literature study of food waste characteristics will be conducted to determine compositional data such as pH and contents of moisture, ash, carbohydrates, proteins, lipids, and minerals, among others. The content of food waste is variable based on collection sources and geographical location. These variations will be considered in the study using statistical research tools such as a meta-analysis.

Through biochemical profiling, an idea of different processing routes will be established. Examples of bioprocesses to be considered include anaerobic digestion and fermentation to produce biogas and biofuel; humification to produce biofertilizers; fermentation to produce enzymes; and acidogenesis to produce organic acids which may be fermented for the production of bioplastics. Different innovations in bioconversion and challenges in food waste biorefinery implementation will be considered to develop a database of food waste valorization possibilities. Feasibility studies and life cycle assessments will then be conducted to determine the sustainability of various bioprocessing routes.

The FORWARD project will significantly improve our understanding of the volume and origin of food waste generated, and the feasibility of different valorization possibilities. These are critical first steps to supporting effective prevention and reduction strategies in moving towards a zero-waste economy.

Eco-ing the Curriculum: A Pilot Study of one Irish Transition Year Programme Centred on Global Citizenship Education and Sustainability Education

POSTERS (only) list - Poster

Dr. Roisin Nash¹, Mr. Micheal Walsh¹, Mr. Dearcan O'Donnghaile¹, Mr. Michael Faney¹, Dr. Pauline Logue¹

1. ATU Galway City

The concept of the eco-school, promoted globally since the 1990s, is gathering momentum and expanding in its remit as new ecological challenges emerge. In March 2022 a new programme for senior cycle reform was launched by the Irish Department of Education and Skills. Among the agreed reforms was the introduction of a new senior cycle subject, entitled 'Climate Action and Sustainable Development'. In anticipation of such reform, in 2022, a cross-disciplinary STEM Transition Year unit of learning, focusing on global citizenship education, sustainable development education and marine renewable energy education, was developed and piloted in a west of Ireland Irish language medium school (Gaelscoil). The choice to target a Gaelscoil hinged on the recognition of the paucity of Irish language STEM educational resources, not least with respect to global citizenship education and sustainable development education. The development of the Transition Year unit of learning involved collaboration among stakeholders in the fields of marine renewable energy, sustainability, education, and Irish language promotion. This presentation aims to evaluate one aspect of this study, namely, the effectiveness of the piloted Transition Year unit of learning, with respect to enhancing knowledge of global citizenship education and sustainability education among post-primary learners. The methodology employed is a mixed methods case study. Data gathering processes include student questionnaires, stakeholder focus groups, and expert interviews. Regarding findings, increased learning with respect to global citizenship education and sustainability education was confirmed. However, some gaps in knowledge were identified in the specific areas of 1) global citizenship and sustainable development literacy, 2) the capacity to confidently identify and discuss the core components of global citizenship, and 3) specific, detailed knowledge of the sustainable development goals. The study recommends a revision of the unit of learning, to explicitly incorporate teacher instruction and active learning experiences in these gap areas.

An experimental protocol for assessing overland flow producing zones and soil boundaries derived from the Soil Topographic Index

POSTERS (only) list - Poster

Mr. Kevin Atcheson¹, Prof. Phil Jordan¹, Dr. Rachel Cassidy²

1. School of Geography and Environmental Science, Ulster University, 2. Agri-Food and Biosciences Institute

Losses of agriculturally derived pollutants to aquatic receptors are a recognised environmental pressure, contributing to water quality impairment and loss of ecosystem function. It is generally accepted that a large majority of contaminants lost from land to water from diffuse sources occurs over short-duration, rainfall events through specific hydrological pathways. An effective tool in predicting runoff patterns is the Soil Topographic Index (STI) which uses a topographic wetness index derived from LiDAR data with soil hydraulic properties. This model has been previously demonstrated in Irish settings as a method of determining diffuse sources of phosphorus (P) in agricultural landscapes—critical source areas. Runoff risk maps, such as the STI, provide a good indication of where runoff may occur in the environment, but modelled outputs are static in nature. Additionally, and due to seasonal and spatial variability, runoff processes and patterns can be difficult to predict accurately. Therefore, this work proposes an experimental protocol to validate components of the STI used on runoff risk maps. Using high-resolution, wide angled cameras at fixed points, the specific aim of this work is to validate STI modelled overland producing zones, and ambiguities arising from continuous runoff at soil boundaries. The experimental design is presented with some early indications of STI validations.

Agri-environmental scheme and source water quality – are there benefits for water treatment processes?

POSTERS (only) list - Poster

Mr. Kevin Atcheson¹, Prof. Phil Jordan¹, Dr. Rachel Cassidy²

1. School of Geography and Environmental Science, Ulster University, 2. Agri-Food and Biosciences Institute

Changes in source water quality (from diffuse agricultural contamination, for example) places increased burdens on water utility companies to produce water that is suitable for human consumption by meeting legislated standards. Catchment mitigations are proposed as potential solutions. This study evaluated an agri-environmental scheme (AES) as a pre-drinking water treatment step, on source waters in the River Derg, a cross-border, surface water dominated catchment (384km²) supplying approximately 30,000 people. A range of mitigation measures were offered to landowners in the catchment (riparian fencing, alternative livestock drinking points, tree planting) specifically aimed at lowering turbidity and colour burdens in runoff. Incorporating the use of a Before-After-Control-Impact (BACI) design, enhanced resolution discharge, turbidity and colour concentration datasets (1 hour) were compared with similar values collated from neighbouring catchments, which had no mitigation measures installed. Datasets were deconstructed into specific water quality percentiles and assessed using linear and non-linear trend tests during the 18 months prior to, and 18 months after the commencement of the AES. Compared to data from control catchments, there was observed reduction of turbidity during average conditions (50th Percentile, 2.7%) in the River Derg after mitigation measures were implemented, although higher turbidity conditions remained unchanged. Additionally, there were no significant changes observed in colour concentrations across all percentiles. Such investigations are essential to gauge the magnitude of benefits from often costly mitigation measures but are only likely to be fully accounted for by BACI type experimental designs.

Farm Zero C: Quantifying natural capital and ecosystem services of a dairy farm in the west of Ireland

POSTERS (only) list - Poster

***Mr. Fabio Delle Grazie*¹, *Dr. Jane Stout*¹, *Mr. Cian White*¹, *Dr. Lars Hein*²**

1. Trinity College Dublin, The University of Dublin, 2. Wageningen University

Natural Capital Accounts (NCAs) are a tool to track stocks of natural capital and changes in these stocks and flows of ecosystem services. Ecosystem services (ESs) are the outputs of natural systems that contribute to economic activity and can be quantified using different techniques, both in biophysical and monetary terms.

The area studied is Shinagh farm, a demonstration dairy farm in West Cork, set up by a joint programme between Teagasc and Carbery Co-Op, called Farm Zero C, which aims to create the first carbon-neutral farm while at the same time improving biodiversity. A combination of fieldwork and remote sensing has been used to quantify the stocks of natural capital and the flows of some ESs at Shinagh farm.

The Farm Zero C project follows the System of Economic and Environmental Accounting (SEEA) framework, which is the United Nations system of NCA accepted as an international standard. The SEEA comprises two components, the SEEA Central Framework, which can be used to measure non-renewable natural capital as well as environmental expenditure and emissions, and SEEA Ecosystem Accounting (SEEA EA), that is targeted at measuring renewable natural capital and the services it provides. For this project, the SEEA EA is mainly used.

Ecosystem services, including provisioning (biomass), regulating (climate and water), and cultural (aesthetics) services have been quantified. Biomass provision was estimated using grass production and consumption data, carbon storage was estimated using measures of soil and above-ground organic carbon, nitrogen emissions were estimated as run off to water, and aesthetic value was modelled using an existing model.

Overall, the accounts illustrate where changes in management may improve service flow, and contribute to reduced GHG emissions and improved biodiversity. However, modelled data need to be supplemented with measurements on the ground to improve accuracy over time going forward.

Smarter Energy Communities in Northern Periphery and Arctic Regions

POSTERS (only) list - Poster

Dr. Caitriona Strain¹

1. ERNACT

This study was funded by the Interreg Northern Periphery and Arctic (NPA) programme. Eight partners from seven NPA regions, distributed across the 3 NPA zones, including the Faroe Islands and Atlantic Canada, analysed barriers, drivers, good practice examples, business models, and transfer potential, with the ultimate aim to transfer and implement smart energy solutions for housing and public infrastructures in 7 regions.

The common territorial **challenges** tackled were high energy costs and low competition due to peripherality, low population densities, low accessibility and cold climates. The main **objective** was to use transnational cooperation between higher and lower maturity regions to increase the awareness of technologies and solutions for energy efficiency and renewable solutions.

The main **result** was increased energy awareness in the communities and local authorities, evidenced by the following **outputs**: 5 Smarter Energy Communities, 31 energy solutions applied which retrofitted 38 houses to increase their energy consumption classification, alternative energy sources installed in 10 public infrastructures, energy efficiency increased by more than 5% in 22 public buildings. An annual saving of 50GWh and 15,000 tCo2 was achieved. The partnership also estimated that an annual energy saving of €166,124 was realised. The project identified 30 Good Practices and engaged 170,000 citizens to change energy-use behaviours. A survey was conducted across the participating regions to identify energy behaviours. It revealed significant support for insulating homes and energy grants. It discovered that the main motivators for citizen energy initiatives were financial savings, saving natural resources, climate change, and setting a good example.

The **approach** was novel because it packaged solutions from higher energy maturity regions as services for delivery to other parts of the NPA, promoted sustainable resources by increasing local authority capacity, focussed efforts on small rural communities to maximise impact, and brought stakeholders together using a quadruple-helix approach.

In-situ design of molecularly imprinted polymer interfaces for electrochemical sensing of contaminants in water

POSTERS (only) list - Poster

***Ms. Aicha Tasfaout*¹, *Dr. Farah Ibrahim*², *Dr. Aoife Morrin*¹, *Prof. Fiona Regan*¹, *Dr. Catherine Branger*², *Prof. Hugues Brisset*²**

1. Dublin City University, 2. Université de Toulon

Emerging contaminants in water are a topic of growing concern in environmental research, and efforts to improve their detection and extraction from water should be emphasised. Molecularly imprinted polymers (MIPs) have been used in solid phase extraction (SPE) and sample preparation techniques thanks to their high selectivity and the “lock and key” effect occurring during binding with target molecules in their recognition sites. In this work, MIPs were grafted onto gold microelectrodes as part of a sensor as to allow in-situ real-time detection of two persistent contaminants: benzo(a)pyrene (BaP) and 2-ethylhexyl 2-cyano-3,3-diphenylprop-2-enoate (octocrylene). The grafting was possible thanks to the formation of self-assembled monolayers (SAM) of an iniferter on the gold surface, made possible by the gold-sulphur bonds between the surface and thiol groups in the iniferter. The electrochemical probe (ferrocene methacrylate) incorporated in the MIP matrix allows for fast and simple detection of binding events when the target molecules are added into the spiked solution of potassium chloride in water. Cyclic voltammetry (CV) and differential pulse voltammetry are used to quantify the presence of BaP and octocrylene, and to determine a limit of detection (LOD) and limit of quantification (LOQ) for the electrochemical sensor.

Seaweeds of the Waterford Estuary: A DNA-based approach to improve the understanding of heavy metal bioremediation by seaweed.

POSTERS (only) list - Poster

Dr. David O'Neill¹

1. South East Technological University - Waterford

Seaweeds have an excellent ability to trap heavy metals from surrounding water. “Heavy metals” include lead, copper, mercury and chromium, and can come from the burning of fossil fuels, industrial discharge, mining run-off, or natural leaching from rocks. The presence of these metals in the marine environment is highly undesirable because they can be toxic to many organisms, including shellfish and finfish. Heavy metals can bind to proteins, making them dysfunctional. Since many aquatic species are used for human consumption, particularly as a source of protein, the public health significance of toxic substances accumulated in their tissues is of clear concern.

In plants, proteins such as enzymatically-synthesized phytochelatins (PCs) and gene-encoded metallothioneins (MTs) are involved in heavy metal accumulation. However, those of seaweed are not extensively characterized. The research presented here aims to improve our understanding of molecular mechanisms of heavy metal accumulation used by seaweed. Strategies here include (i) a simple screening approach for the identification of novel MTs, (ii) the use of real time PCR to characterize gene expression profiles, and (iii) use of novel recombinant DNA technologies to produce seaweed-derived metal-binding proteins. Future biotechnological approaches to environmental protection and improving water quality are also discussed.

A GEOVISUALISATION OF INFECTION, AGRICULTURAL AND INFRASTRUCTURAL RISK CRITERIA ASSOCIATED WITH PRIMARY VEROTOXIGENIC *E. COLI* (VTEC) INFECTION IN IRELAND

POSTERS (only) list - Poster

***Ms. Florence De Bock*¹, *Dr. Louise O'Connor*¹, *Dr. Zina Alfahl*¹, *Dr. Paul Hynds*², *Dr. Jean O'Dwyer*³,
*Dr. Liam Burke*¹**

1. University of Galway, 2. Technological University Dublin, 3. University College Cork

The Republic of Ireland (RoI) consistently reports the highest infection rate of verotoxin-producing *Escherichia coli* (VTEC) enteritis in the European Union, with a reported crude incidence rate of 17.5 compared to the European average of 2.2 cases per 100 000 population in 2021. VTEC transmission is often zoonotic, occurring via the faecal-oral route, with cattle the most frequently reported animal reservoir. Accordingly, consumption of contaminated water or food represents the primary routes of human exposure. In particular, the consumption of untreated, groundwater-derived drinking water has been identified as a key risk factor for infection in RoI. As such, the aim of the presented research was to map the features of hydrogeological catchments with a high human incidence of VTEC infection for use as a data-driven selection tool for field studies investigating VTEC fate and transport in natural water environments.

A comprehensive dataset containing laboratory-confirmed human VTEC enteritis data and demographic, agricultural and environmental data was collated. Geo-referenced data delineated per electoral divisions (EDs) were selected and ranked by identifying the relevant variables and attributing them numerical rankings. These were multiplied for equal weighing to obtain a final ranking. This was then visualised in ArcMap® 10.8.1 and further overlain with shapefiles of catchments, sub-catchments and water monitoring stations to create a thematic map. During this process, the dataset was edited using ArcToolbox. The spatial data were finally aggregated per catchment to create a final selection in the form of maps and datasets. Findings demonstrate which catchments are at an increased risk of contamination and hence constitute greater VTEC exposure risk for humans. In conclusion, a GIS workflow using geo-referenced data enabled visualisation, mapping and selection of appropriate study catchments. Field studies herein will aid development of tools for the detection, monitoring and risk management of VTEC contamination in groundwater-derived drinking water.

Assessing the spatial variation of carbon storage in managed and unmanaged saltmarshes: An Irish case study

POSTERS (only) list - Poster

***Ms. Juliet Rounce*¹, *Prof. Iris Moeller*¹**

1. Trinity College Dublin, The University of Dublin

Saltmarshes are globally ubiquitous, intertidal wetlands, impacted by complex sedimentary and hydrological processes. Increasingly recognised as important carbon sinks, these ecosystems provide many benefits (ecosystem services), such as flood protection, nutrient exchange and carbon sequestration. The decline of saltmarsh area, due to changing climate conditions and land reclamation, has resulted in the loss of storage capacity for carbon. There is limited understanding of the within-marsh controls on soil organic carbon content (SOC) and the resulting feedbacks (sedimentary, hydrological, geomorphological, ecological), particularly in managed or reclaimed marshes. Quantitative data on such variation in SOC and the processes that facilitate this, remains relatively scarce.

The overall aim of this project is therefore to characterise the spatial variation in SOC across managed and unmanaged saltmarshes and investigate potential explanatory factors. To this end, sediment samples (surface, core) are being collected from managed and unmanaged saltmarsh systems in Turvey Nature Reserve, Ireland. The SOC will be assessed via Loss on Ignition techniques, alongside sedimentary, hydrological and ecological surveys. Secondly, this project aims to quantify the impact of explanatory factors on carbon accumulation, utilising data obtained to update an existing carbon accumulation model. This will be achieved via computation of algorithms between SOC and key controlling factors. The updated model may then inform an investigation of future carbon storage potential under various climate scenarios.

This study presents initial results from an ongoing project to enhance knowledge of the within- and between-marsh variation of SOC in saltmarshes, providing quantitative data via field sampling and laboratory analysis. The outputs help constrain uncertainties around scaled-up carbon accumulation estimates per unit area saltmarsh for regional, national and international inventories. Additionally, comparison between managed and unmanaged saltmarsh systems contributes to the understanding of potential impacts of restoration on carbon accumulation.

Coastal Dune Vulnerability Assessment for Nature-based Solution in Ireland

POSTERS (only) list - Poster

*Ms. Silvia Cascone*¹, *Dr. Kevin Lynch*¹, *Dr. Terry Morley*¹

1. University of Galway

Coastal dunes are dynamic systems that act as a natural buffer against storm surge, waves and erosion. Finding a rapid and repeatable methodology to assess the vulnerability of these ecosystems is now a priority in conservation strategies to support management decisions, maintain coastal dune resilience and preserve the vast biodiversity that they host. The coast of Ireland is highly heterogeneous, it is strongly influenced by physical and biotic factors and simultaneously threatened by human pressure. A better understanding of these complex processes is necessary to evaluate the vulnerability of coastal habitats and to protect the existing dunes and their potential as a Nature-based Solution (NbS). We selected eight sites in the NW of Ireland and used random vegetation plots and ordination analysis to quantify vegetation dynamics, and to identify the main habitats of conservation interest. The Dune Vulnerability Index (DVI) was utilised to determine the level of vulnerability of each site and the strongest drivers involved. We also used the classification obtained to observe additional differences in species and landscape metrics. Three main habitats were recognised: fixed dunes, foredunes and embryo dunes, together with transitional and more disturbed groups. The sites were characterised by different levels of vulnerability, with the geomorphological, vegetation and human indicators being the most relevant drivers. Differences were also found in species and habitat fragmentation between sites. Therefore, to evaluate the vulnerability and the conservation status of coastal dunes, it is important to implement a more flexible methodology able to prioritise the dynamic nature of these ecosystems and the complex network of disturbances. Working with natural processes is crucial to improve conservation actions and to develop Nature-based Solution strategies adapted to Ireland's context.

Mimicking Past Atmospheres to Study the Effect of Plant Evolution on Weathering

POSTERS (only) list - Poster

***Ms. Katie O'Dea*¹, *Dr. Christos Chondrogiannis*¹, *Prof. Jennifer McElwain*¹**

1. Trinity College Dublin, The University of Dublin

TERRAFORM project, an ERC Advanced Grant, aims to unveil and quantify plant effects on Earth system processes such as the carbon, nutrient and hydrological cycles by exploring plant functional trait (PFT) evolution through time. One aspect of the project involves novel paleo-Earth weathering experiments carried out in the joint funded ERC/SFI Variable Atmosphere and Light (VAL) Lab based at Trinity College Dublin. The VAL Lab boasts six state-of-the-art *Conviron Argus* climate control chambers equipped with *Valoya* full solar spectrum LED lights and *Optris* infra-red cameras. Light intensity, light spectra, temperature, humidity and atmospheric composition can all be adjusted to closely mimic field conditions.

During our experiments, the effect of plant evolution on silicate weathering will be tested. Plants will be grown under ambient and elevated CO₂ levels in a soil mix blended with crushed igneous rock, for up to 6 months at a time. Plant responses will be studied by recording a number of physiological and morphological measurements. Cation concentrations in plants and leachate will be measured to quantify weathering rates.

Silicate weathering acts as a carbon sequester. Plant roots accelerate this process by breaking down substrate and increasing surface area for carbon sequestering reactions to take place.

As we face global warming and climatic change, we need emission reduction strategies, as well as negative emission technologies (NET). Enhanced weathering (EW) is becoming a popular avenue of exploration for NET. Our project will shed light on plant contribution to weathering and inform efforts for EW application in the field. In addition, plant nutrient uptake from crushed rocks will be investigated and this could offer an alternative avenue to typical NPK fertilizer application in an agricultural context.

Furthermore, our project will shed light on plant responses under an environment with elevated CO₂, making our predictions for the future more robust.

Nano-Enabled Sensor Development for Arsenic Detection & Determination in Drinking Water

POSTERS (only) list - Poster

***Mr. Abhijnan Bhat*¹, *Dr. Furong Tian*¹, *Dr. Baljit SINGH*¹**

1. Technological University Dublin (TU Dublin)

Global intake of As(III) and As(V) via drinking water and food has dramatically increased in recent years and these species constitutes the highest toxicological risk associated with arsenic in water compared to the organic arsenic species. Inorganic arsenic is a confirmed carcinogen, and the World Health Organization (WHO) has published a guideline value for arsenic in their 'Guidelines for drinking-water quality' and is on the WHO list of 10 chemicals of major public health concern. Presently, approximately, 230 million people worldwide are affected by arsenic toxicity. Chronic arsenic toxicity affects multiple physiological systems and can cause serious health issues (e.g. arsenicosis, cancer etc.) leading to death.

To combat arsenic pollution, the WHO and United States Environmental Protection Agency (US-EPA) have set concentration limits for arsenic in drinking water. The WHO, US-EPA and European Union (EU) have set the maximum limit of arsenic in drinking water at 10 ppb. Therefore, sensitive determination of arsenic with a reliable and cost-effective method is necessary to address the challenges associated with the current methods (ICP-MS, HPLC, AAS): time-consuming, expensive, requires extensive sample preparation/skilled analyst and complex instrumentation, not suitable of on-site or in-field applications.

Therefore, it is essential that rapid, reliable, sensitive and cost-effective detection systems be developed and put into use. We are developing a Nano-enabled sensor for arsenic determination in water. Chromatographic, spectroscopic and electroanalytical techniques are considered for validation and evaluation. Nanoparticles and nanomaterials are considered for response improvement and sensor-fabrication. Surface morphological, compositional/structural characterisation and Arsenic spiked/real sample analysis will be performed. This research will be beneficial and enhance awareness and appreciation of the role of the advanced techniques/sensors in informing and protecting our environment and water resources, globally.

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Updated GHG emissions factors for Irish peatlands: a review

POSTERS (only) list - Poster

***Mrs. Elena Aitova*¹, *Dr. Terry Morley*¹, *Dr. David Wilson*², *Dr. Florence Renou-Wilson*³**

1. University of Galway, 2. Earthy Matters Environmental Consultants, 3. University College Dublin

Healthy, fully functioning peatlands are the most effective natural carbon store. When disturbed, peatlands release greenhouse gases into the atmosphere and lose carbon via surface runoff. Since peatlands cover around 20% of the land area in the Republic of Ireland, their management is of particular significance in reducing national greenhouse gases (GHG) emissions

Ireland is obligated to report anthropogenic emissions from peatlands. Ireland's annual National Inventory Report complies with the methodology described in the Intergovernmental Panel on Climate Change (IPCC) Guidelines and the Wetlands Supplement 2013. They provided globally applicable 'default' emission factors (EFs) for calculating emissions and removals from drained and rewetted peatlands. However, the default EFs were based on field data often collected from geographical areas climatically and ecologically dissimilar to Ireland. Moreover, these EFs were limited by data availability and the level to which they could be disaggregated. In our work, we developed further stratification of peatlands land use categories based on peatlands characteristics and management in Ireland.

We reviewed peatland carbon (C) flux studies within Ireland, extracting data for carbon dioxide, methane, and nitrous oxide fluxes, as well as fluvial losses and here proposed preliminary country-specific EFs for various peatland land uses and management practices Using our derived EFs and latest areal estimates, national emissions from peatlands (excluding horticulture and combustion) amount to 2.3 Mt C y⁻¹ (\pm 0.9–3.7 Mt C y⁻¹), with ½ of all peatland GHG emissions coming from grasslands on organic soils and nearly 1/3 from domestic extraction degraded peatlands. Our analyses suggest that peatland management through rewetting and restoration has the potential to substantially reduce emissions from drained peatlands, and this paper attempts to quantify this reduction. This is critically important given the large areas of degraded peatlands that have been earmarked for rewetting in the next decade.

Soil nematode community response to the field application of recycling derived fertilisers (RDFs) in Irish grassland

POSTERS (only) list - Poster

***Ms. Anna Karpinska*¹, *Mrs. Thomais Kakouli-Duarte*¹**

1. South East Technological University - Carlow

Soil is the main source of nutrients needed for plant growth. The three main such nutrients, phosphorous (P), nitrogen (N) and potassium (K), are routinely applied by farmers via mineral fertilisers. The global demand for recycled phosphorus is increasing due to the growing human population and food consumption. The RDF products have been recovered from phosphate-rich sources as part of the INTERREG_NWE Project called ReNu2Farm (www.nweurope.eu/renu2farm). However, before these RDFs are applied to the soil, it is essential they undergo an ecological risk assessment. Nematodes are the most abundant and widespread soil animals, sensitive to pollutants and environmental disturbance and therefore ideal as biological indicators of environmental change. A three-year field experiment was conducted in Teagasc, Johnstown Castle, Wexford, Ireland. For diversity and community analyses, nematode DNA was extracted from soil samples, the 18S rRNA gene was sequenced and further bioinformatic analysis were employed to reveal any significant differences between the treatments. In 2019, ash derived from sewage sludge showed the lowest number of observed nematode species when compared with those in the unfertilised control. In 2020, the relative abundance of sensitive to environmental disturbance dorylaimids was decreased when compared with that in the unfertilised and mineral control treatment groups. In 2019 and 2020, order Dorylaimida was the dominant taxon across the treatment groups, whereas in 2021, plant parasitic and fungal feeding nematodes belonging to order Tylenchida, dominated across the treatments that received phosphorous in the mineral or recycled form. Neither struvite nor ash derived from poultry litter reduced the number of observed nematode species, thus, maintained soil nematode biodiversity. The sewage sludge ash product requires further investigation before recommending its regular application as fertiliser. Overall, RDFs were identified as a valid source of recycled nutrients and a sustainable alternative to mineral fertilisers.

Rehabilitation progress of two degraded peatland sites in the Republic of Ireland

POSTERS (only) list - Poster

Dr. Magdalena Matysek¹

1. Trinity College Dublin, The University of Dublin

Peatlands are estimated to cover 20.6% of land area in the Republic of Ireland, yet they store 2005–2320 Mt C, which is 53-75% of total SOC stocks in the country. On the isle of Ireland peat has been historically extracted for domestic fuel, electricity generation and horticultural use. In 2021 Bord na Mona, the largest harvester of peat in ROI, announced cessation of all its peat-mining operations and introduced the Peatland Restoration Plan, which aims to rehabilitate its former extraction sites. This study examines the rehabilitation outcomes of two former peat extraction areas in the Republic of Ireland. Cavemount and Ummeras are two Bord na Móna sites located in County Offaly, which came out of production in 2015 and 2019, respectively. They have been rewetted via drain blocking and pond creation, which was followed by spontaneous establishment of vegetation communities typical of fens. The research evaluates the spatial and temporal changes in the carbon cycle (emissions of CO₂ and CH₄ from land and water bodies) at the two sites with the aim of measuring rehabilitation progress.

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