Environ 2025

10-12 March 2025

University College Dublin

One Health for a Sustainable Future

35th Irish Environmental Researchers Colloquium

esai
Environmental Sciences Association of Ireland

UCD DUBLIN

Contents

Welcome to ENVIRON 2025 Delegates

Environmental Sciences Association of Ireland (ESAI)
Welcome to ENVIRON 2025 Delegates

Dear Delegates,

On behalf of the ESAI Council, we wish to extend a warm welcome to all delegates to our 35th Irish Environmental Researchers Colloquium (Environ 2025). This year the ESAI are collaborating with the University College Dublin to host the event. 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 Dublin to focus on the theme of this year's Environ, "One Health for a Sustainable Future". I remember attending Environ while undertaking my PhD studies and have fond memories from that time. The multidisciplinary nature of the conference is one of its main strengths and I hope it will open your world to the vast array of projects currently underway in the environmental sphere across the island of Ireland.

Environ 2025 will commence on Monday 10th March with a choice of a guided tour to UCD Rosemount Environmental Research Station a Workshop on Coastal Resilience through Nature-based Solutions, a Workshop on Sensor and IoT Solutions for Environmental Applications, and a workshop on HOLOSIE to HOLOSEU: A Digital Solution for Sustainable and Low-Carbon Farming. On Monday evening, a reception and public engagement panel discussion will take place "Your Sustainable Shopping list- how can you engage in more environmentally conscious shopping". The evening will commence with a reception at 7pm followed by a panel discussion at 8pm. The panel includes Miriam Keegan - founder Sew Sustainable, Pat Kane - founder and CEO of reuzi.ie, Ciara Coleman - Vision Ireland, Dr Aifric O'Sullivan - Associate Professor, UCD School of Agriculture and Food Science and the evening will be chaired by Dr Tom Curran - Associate Professor and Vice Principal for Internationalisation in UCD College of Engineering & Architecture. The panel will give their tips and reflection on sustainable shopping for fashion, food and household items. All are welcome to engage in 'Your Sustainable Shopping list'.

Environ will formally open on Tuesday 11th March with an opening address by Prof. Paula Bourke, Head of school of Biosystems and Food Engineering UCD, Dr Gerald Barry, Deputy Director of UCD's One Health Centre, Prof Tasman Crowe, Vice-President for Sustainability (UCD). Dr Rajat Nag, Dr Junli Xu, and Fiona Quinn UCD Conference Co-Convenors and ESAI Chairperson, Dr. Niamh Power. The first plenary session of the conference will be delivered by Andy Fanning, Programme Manager, Environment & Health of the EPA, entitled "Key Insights from the State of and Outlook for Ireland's Environment". Following on from that Dr Junli Xu will deliver a second plenary session entitled "Understanding Microplastics: What We Know, What We Don't, and Where Science is Headed". On Wednesday, 12th March we will have our third plenary lecturer by Professor Sukha Ranjan Samadder from the Indian Institute of Technology (Indian School of Mines) on "Energy Recovery Potential and Analysis of Environmental Impacts of Waste to Energy Options: A Case Study of Dhanbad, India".

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 €2,500 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 2025 will culminate on the afternoon of Wednesday 12th March with the prizegiving ceremony.

The ESAI wishes to sincerely thank Environ 2025 conference co-convenors Dr Rajat Nag, Dr Junli Xu and Fiona Quinn and all their team at UCD for hosting Environ and for assembling a very comprehensive programme. We also wish to thank Dr. Sara Meehan for providing excellent administrative support to the event and to take this opportunity to acknowledge her support over the past year. Many thanks Sara.

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.

Dr. Niamh Power, ESAI Chairperson
www.esaiweb.org

Welcome to ENVIRON 2025 Delegates

University College Dublin Organising Committee Welcome to ENVIRON 2025 Delegates

Dear Delegates,

The ENVIRON 2025 Organising Committee offers the warmest welcome for all our delegates to the 35th Irish Environmental Researchers' Colloquium (ENVIRON 2025), co-hosted by cohosted by University College Dublin and the ESAI. The ENVIRON colloquium is the largest gathering of environmental researchers in Ireland, and at this year's event, over 57 posters and 88 oral presentations will be delivered.

The event continues to offer a valuable platform for researchers at different stages of their careers to present their findings to a wide audience drawn from academia, government bodies, industry, and the public. We are delighted to welcome so many delegates to University College Dublin for the occasion.

The theme for the 35th colloquium is "One Health Solution for a Sustainable Future" connects to most of the 17 UN Sustainable Development Goals such as Zero Hunger, Good Health and Well-being, Clean Water and Sanitation, Affordable and Clean Energy, Industry, Innovation, and Infrastructure, Responsible Consumption and Production, Climate Action, Life Below Water, and Life on Land. ENVIRON 2025 aims to reflect how research in different areas could collaborate to create solutions for a healthy and sustainable nature and environment for the well-being of all living organisms in this world.

The conference will be made up of a dynamic mix of workshops, poster presentations, oral presentations and keynote addresses. The conference will commence on Monday, 10th March 2025, with a series of workshops ranging from a guided tour to UCD Rosemount Environmental Research Station, a Workshop on Coastal Resilience through Nature-based Solutions, a Workshop on Sensor and IoT Solutions for Environmental Applications and a workshop on Digital Solutions for Sustainable and Low-Carbon Farming. On Monday evening, a reception and public engagement panel discussion will take place: "Your Sustainable Shopping list- how can you engage in more environmentally conscious shopping".

The second day of the conference, Tuesday, 11th March, will begin with a welcome address and opening speeches from eminent speakers from UCD, Prof Tasman Crowe, UCD Vice-President for Sustainability and Dr Gerald Barry, Deputy Director of UCD's One Health Centre. UCD Conference Convenor Dr Rajat Nag and Dr Junli (Lily) Xu, and ESAI Chairperson Dr Niamh Power, followed by a keynote talk from Mr Andy Fanning, EPA's Programme Manager, Environment & Health and Dr. Junli Xu from University College Dublin. Afterwards, there will be oral parallel sessions throughout the day featuring talks from various keynote chairpersons a dynamic mix of presentations from environmental researchers, including 5-minute short presentations from early-stage researchers. Dedicated networking poster sessions will feature throughout the day. The second day will conclude with the Gala Dinner at the Royal Marine Hotel, situated In Dún Laoghaire, followed by music and dancing.

The last day of the conference, Wednesday, 12th March 2025, will commence with a talk by industry expert S. R. Samadder of the Indian Institute of Technology, where he will explore waste-to-energy solutions for sustainable solid waste management, using LCA to assess viable waste management scenarios. Oral parallel sessions and a dedicated networking poster session will follow this. The conference will conclude with a student award ceremony recognising 'Best In Conference', with over €2500 to be awarded in various categories.

The Organising Committee has enjoyed bringing together this exciting programme and is so looking forward to bringing to life this conference on the UCD Campus after over a decade since ENVIRON was last hosted at UCD. We really hope that all participants will enjoy ENVIRON 2025, which will deliver an exciting programme with fascinating environmental research topics coupled with networking amongst researchers in your subject area and beyond. We hope that you leave with new ideas and connections following the conference. If we can assist in making the conference more enjoyable and impactful for you our organising committee is here to assist.

Dr Rajat Nag

Dr Juni Xu

Fiona Quinn

ENVIRON 2025 Colloquium Co-Convenors,
On behalf of the ENVIRON2025 Organising Committees

Environ 2025 Organising Committee

Co-Chairs	Rajat Nag, Junli Xu & Fiona Quinn University College Dublin	
Organizing Committee (University College Dublin unless otherwise indicated)	Sara Meehan, ESAI	Enda Cummins
	Paula Bourke	Joseph Sweeney
	Camilla Perussello	Kevin McDonnell
	Anna Molter	Liana Ricci
	Barry John McMahon	Md Salauddin
	Caroline Wynne, EPA	Tom Curran
	Tamíris Da Costa	Srikanta Sannigrahi
	Sharon O'Rourke	Ronald Halim
Event Team (University College Dublin)	Junhao Xie	Vaibhav Bhatia
	Emine Merve Canga	Ajay Iyer
	Vasiliki Polychronidou	Shivangi Shekha
	Raphaela Ferreira	Nakisa Soltani
	Fangting Bai	Yiran Li
	Juan Quintero-Marín	Fuxin Yu
	Sara Esteval	Shivangi Shekhar
	Zhongyuan Liu	Soukaina Barroug
	Ashwani Joshi	Svitlana Miros
	Fatima Zahra	Nazan Altun
	Jacob Matovu	Eva Achata

Thanks to the Environ 2025 Conference Sponsors and Exhibitors

Thanks to the ENVIRON 2025

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PRIZE SPONSORS

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The Irish Naturalists' Journal

IEN
Irish Environmental Network

ERINN INNOVATION

CIWM

CIEEM Chartered Institute of Ecology and Environmental Management

Eurachem Ireland

CIWEM Chartered Institution of Water and Environmental Management
Republic of Ireland Branch

Environ 2025

AN APPROVED EVENT FOR CONTINOUS PROFESSIONAL DEVELOPMENT

ENGINEERS IRELAND

CPD APPROVED EVENT 2025

CIWM

Endorsed 2025

Environ 2025

University College Dublin, Belfield, Ireland

10th - 12th March 2025

35th Irish Environmental Researchers Colloquium

"One Health for a Sustainable Future"

INFORMATION FOR DELEGATES

Registration

The Colloquium Registration Desk will be on the ground floor of the East Wing of the O'Brien Centre of Science.

The registration desk will be open at the following times;

Monday 10th March	09:30 – 10:00
Tuesday 11th March	08:30 – 09:15
Wednesday 12th March	09:00 – 09:30

Delegate Badges

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

Locations

All activities start in the O'Brien Centre of Science East, marked on this map as section 67.

Environ Assistants/Event Teams

If you need to contact a member of the Environ team during the conference, for instance if you require directions, please call +353 89 499 9416. This number will only be operational Monday-Wednesday.

Bag Drop

There will be a dedicated bag drop at registration. The bags will be returned to the registration desk near the end of each day. If you require access to your bag during the day please speak to the registration desk colleague.

Emergency Contact Numbers

Medical Emergencies If an emergency arises on UCD Campus please call 01 716 7999 to speak to the Estate Services Team. They will contact the emergency services on your behalf.

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. For O'Brien Centre of Science this is beside the Lake.

It is the policy of University College Dublin that all of its workplaces are smoke- free and that all employees have a right to work in a smoke-free environment. Smoking and vaping/e-smoking in all forms is prohibited. For the avoidance of confusion, vaping/e-smoking relates to the use of any non-tobacco based device from which material is drawn into the body by inhalation, irrespective of whether or not a vapour is released or the product contains nicotine.


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City Centre
Dublin Bus
Aircoach Bus Stop
Merville House Entrance (Pedestrian & Cycle)
Greenfield Entrance (Pedestrian and Cycle)
Belfield Office Park
Rathfarnham Entrance
Clonskeagh Road
Clonskeagh Entrance
Newstead Entrance
Rosemount Entrance
Roebuck Road
Roebuck Castle Gate (Pedestrian and Cycle)
Clonskeagh Park Entrance
Roebuck Avenue

Access to University College Dublin Campus

As we are aiming for a Low Carbon conference, we strongly encourage all participants to come to UCD by public transport, cycling, walking or carpooling. The TFI Plan a Journey feature may be helpful to plan the most suitable journey for you.

When travelling in Dublin by public transport it is highly recommended to have a Leap Card , Student/ Young Adult Leap Card or Visitor Leap Card. This will allow you to change between Bus/ Luas/ Dart/ Commuter Train as many times as required within 90 minutes for €2 (Leap Card) or €1 (Student/ Young Adult Leap Card). A Visitor Leap Card is also available with unlimited travel for set prices over 24 or 72 hour durations. Leap card allows for easy combining of transport options. Bus services take exact fare by coin, no notes will be accepted. Tickets for Luas and Dart can be purchased at the station. If you plan on combining transport methods, a leap card is highly recommended.

By Bike

UCD is located a 19-minute cycle from Dublin City Centre. Bike Parking locations, are spread across campus and can be identified on the Bike Parking Map. Bleeper bike is available for bike rental from the city centre.

By Bus

Dublin Bus provide services to the Belfield campus, including routes- 11, 39A, E1, E2, 47, S4, S6, 142 as well as others. Bus Éireann provides a nationwide bus service, with most major areas having a regular link to Dublin. The majority of Dublin services terminate in Busáras (Central Bus Station, Dublin) from where it is a short walk to connecting buses to UCD.

Several Bus Éireann services from the Greater Dublin area directly serve UCD, Belfield Campus during morning peak. For further information please visit www.buseireann.ie

By Train

Dublin is served by two main intercity railway stations: Connolly Station and Heuston Stations. It is a short walk from Connolly Station to O'Connell Street, where the Dublin Bus can be boarded for UCD. From Heuston Station buses or Red line Luas to the city centre and transfer to a UCD bound route to Belfield. For further information please visit Iarnróad Eireann (Irish Rail). From Connolly Station, bus routes to UCD are available.

By Luas and Dart

The nearest Luas to UCD, is Windy Arbour, on the Green Line. This is about a 40 Minute walk to UCD Campus. Alternativity transferring at the Milltown Station, will allow transfer to the S4 bus, direct.

The closest Dart Stations to UCD are Sydney Parade or Booterstown, about a 30 minute walk from campus.

By Car

Parking is very limited on UCD Campus, public transport is encouraged and recommended.

The conference will take place during the Reading week in UCD, however Permit Parking will still be in action. For this reason, delegates must park in Pay and Display Zones rather than Permit Zones (without an appropriate Permit). A Guide to Parking in UCD is available for reference. Please check out our interactive map for electronic car charging points

Delegates giving oral presentations

After registering for the colloquium, delegates giving oral presentations should upload their presentations via Oxford Abstracts system before 7th March 2025. All presentations for oral sessions should be uploaded well in advance of the session in which the presentation is being given. 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 Zone 2 of the O'Brien Centre for Science. 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 10th March (11:00- 17:00) or on Tuesday morning (08:30-09:15). The first poster session is at 10:50 on Tuesday 11th March. Please do not remove your poster until the end of the poster session at 14:45 on Wednesday 12th March. 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 (It is the same Abstract submission ID on the Oxford Abstract portal). Your poster must be mounted on the poster board assigned to your ID.

Wifi Access

UCD Wireless - Wireless access to the UCD network is available campus-wide in all the main buildings and in the student residences. Please select UCD Wireless when viewing available networks. No login is required.

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.

Social Media

Please use **#Environ2025**, **@UCD School of Biosystems and Food Engineering** (Linkedin), and @ **Environmental Science Association of Ireland ESAI** for your social media posts during and after the event if you post event material.

UCD Facilities

UCD campus is a public space so feel free to explore the campus, in fact we encourage it!
We understand conferences can be busy environments and you may need to step away from the conference for quiet time. UCD campus is home to the wonderful woodland walks, a chance to get out into nature in this urban environment. The trail has many entry and exit points allowing flexible walking times. We will be based in the O'Brien Centre for Science, with plenty of common areas to sit and relax, when a break is required.

A full list of UCD amenities can be found on the UCD Interactive Map including drinking fountains and gender neutral bathrooms.

ATM

The nearest ATM to the conference is located outside the James Joyce Library Building.

Hydration stations

Hydration stations are located outside the main auditorium, **please bring refillable bottle for water**.
Other stations can be found on the interactive map.

Conference Dinner

The conference dinner will be hosted in the Royal Marine Hotel

- **Address**: Royal Marine, Marine Road, Dún Laoghaire, Dublin, A96 K063, Ireland
- **Phone**: +353 (01) 230 0030
- **Location and travel information** can be found on the Royal Marine Website

A bus has been arranged to bring delegates attending the dinner to the conference hotel if required.
There will be two buses running and will be offered on a first come first served basis.
The bus will run from the N2 carpark beside the University Club and will leave at 17.25 (or as soon as full) and around 18.15pm.

Useful Taxi numbers

Bolt, Free Now and Lynk taxi apps are all in operation in Dublin and can be downloaded from your app store.
Ballsbridge Taxi Cab: +353 (01) 2800444

Hydration Stations

Hydration stations are located behind the registration desk, please bring a refillable bottle for water.

Environ 2025

University College Dublin, Belfield, Ireland

11th - 12th March 2025

35th Irish Environmental Researchers Colloquium

"One Health for a Sustainable Future"

ENVIRON 2025 CONFERENCE PROGRAMME OUTLINE

Environ 2025 Programme, Monday 10th March 2025	
9:30 – 10:00	**Registration** Entrance of Moore Auditorium, O'Brien Centre, University College Dublin, Belfield campus
	Workshop 1: Coastal Resilience through Nature-based Solutions Room: G87, Newstead Block B, School of Civil Engineering Meet at Moore Auditorium, O'Brien Centre Demonstrator: Dr Md Salauddin Tour Guide: Xihang Xu (15 min walk from O'Brien Centre)
	Workshop 2: HOLOSIE to HOLOSEU: A Digital Solution for Sustainable and Low-Carbon Farming In the UCD School of Agriculture and Food Science Meet at Moore Auditorium, O'Brien Centre Demonstrator: Dr. Ibrahim Khalil
14:00 – 16:00	**Tour 1: A visit to UCD Rosemount Environmental Research Station** Tour Guide: Fiona Quinn (15 min walk from O'Brien Centre) Meet at Moore Auditorium, O'Brien Centre **Workshop 3: Sensor and IoT Solutions for Environmental Applications** Moore Auditorium, O'Brien Centre of Science Meet at Moore Auditorium, O'Brien Centre In Moore Auditorium and E1.17 SCE Demonstrators: Dr Joseph Sweeney, Dr Anna Molter, Dr Sharon O'Rourke, and Dr Junli Xu
19:00 – 21.00	**Public Engagement Panel Discussion & Q&A session** **"Your Sustainable Shopping list- how can you engage in more environmentally conscious shopping"** Panel Chair: Dr Tom Curran Panel members: Pat Kane, Miriam Keegan, Vision Ireland and Dr Aifric O'Sullivan Moore Auditorium, O'Brien Centre, UCD, Belfield campus

<table>
<tr><th colspan="5">Environ 2025 Programme, Tuesday 11th March 2025</th></tr>
<tr><td>8:30- 9.15</td><td colspan="4">Registration
Entrance of Moore Auditorium, O'Brien Centre,
University College Dublin, Belfield campus</td></tr>
<tr><td rowspan="2">9:15 – 10:00</td><td colspan="4">Opening Session of ENVIRON 2025:
Moore Auditorium, O'Brien Centre, UCD, Belfield campus</td></tr>
<tr><td colspan="4">Speech by:
UCD Vice-President for Sustainability, Prof Tasman Crowe
Deputy Director of UCD's One Health Centre, Dr Gerald Barry
ENVIRON 2025 Conference Convenors: Dr Rajat Nag, Dr Junli Xu, Fiona Quinn, and Prof Paula Bourke
ESAI Chairperson: ESAI Chairperson: Dr Niamh Power</td></tr>
<tr><td rowspan="2">10:00 – 10:50</td><td colspan="4">Keynote Plenary Sessions:
Moore Auditorium, O'Brien Centre, UCD, Belfield campus</td></tr>
<tr><td colspan="4">Plenary Session 1: Andy Fanning
Session title “Key Insights from the State of and Outlook for Ireland's Environment”
Plenary Session 2: Dr Junli Xu
Session title “Understanding Microplastics: What We Know, What We Don’t, and Where Science is Headed”</td></tr>
<tr><td>10:50 – 11:30</td><td colspan="4">Networking, Poster Session,
Refreshments & Meet The Exhibitors
O'Brien Centre Foyer, UCD, Belfield campus</td></tr>
<tr><td>11:30 – 13:00</td><td>Circular Bioeconomy and Waste Management
Moore Auditorium, O'Brien Centre</td><td>Climate Change Mitigation and Adaptation
SCIS 1.67, O'Brien Centre</td><td>Environmental Monitoring and Remediation (including Biobased Approaches)
SCIS 3.56, O'Brien Centre</td><td>One Health and Biodiversity Conservation and Ecosystem Restoration
SCI 2.32, O'Brien Centre</td></tr>
<tr><td>13:00 - 14:00</td><td colspan="4">Lunch
Pi restaurant, O'Brien Centre</td></tr>
</table>

13.15-14.00	**ESAI Early Careers Network (ECN) Meeting** **All Early-Stage Researchers Welcome** Moore Auditorium, O'Brien Centre			
14:00 – 15:35	**Circular Bioeconomy and Waste Management** Moore Auditorium, O'Brien Centre	**Climate Change Mitigation and Adaptation** SCIS 1.67, O'Brien Centre	**Environmental Monitoring and Remediation (including Biobased Approaches)** SCIS 3.56, O'Brien Centre	**One Health and Biodiversity Conservation and Ecosystem Restoration** SCI 2.32, O'Brien Centre
15:35 – 16:15	**Networking, Poster Session,** **Refreshments & Meet The Exhibitors** O'Brien Centre Foyer, UCD, Belfield campus			
16:15 – 17:15	**Circular Bioeconomy and Waste Management and Sustainable Water: Management and Water Conservation** Moore Auditorium, O'Brien Centre	**Climate Change Mitigation and Adaptation** SCIS 1.67, O'Brien Centre	**Sustainable Water: Management and Water Conservation** SCIS 3.56, O'Brien Centre	**Air and Noise Pollution and Emerging Contaminants** SCI 2.32, O'Brien Centre
17.25	**Bus to Royal Marine Hotel for Conference Dinner** Leaving carpark beside University Club			
17:15 – 17.45	**ESAI AGM Featuring presentation from the ESAI Postgraduate Researcher of the Year 2024 Jeovan Araujo** Moore Auditorium, O'Brien Centre			
18.15	**Bus to Royal Marine Hotel for Conference Dinner** Leaving carpark beside University Club			
19:00 – 20:00	**Drinks Reception** The Royal Marine Hotel, Dún Laoghaire, overlooking Dublin Bay, A96 K063			
20:00- Late	**Conference Gala Dinner Followed by Music** The Royal Marine Hotel, Dún Laoghaire, overlooking Dublin Bay, A96 K063			

Environ 2025 Programme, Wednesday 12th March 2025

9:00 – 9.30	**Registration** Entrance of Moore Auditorium, O'Brien Centre, University College Dublin, Belfield campus			
9:30 – 10:00	**Plenary Session 3** **Moore Auditorium, O'Brien Centre, UCD** Professor Sukha Ranjan Samadder from the Indian Institute of Technology (Indian School of Mines), Dhanbad, India. *"Energy Recovery Potential and Analysis of Environmental Impacts of Waste to Energy Options: A Case Study of Dhanbad, India"*			
10:00 – 11:15	**Advancements in Renewable Energy Technologies** Moore Auditorium, O'Brien Centre	**Policy, Governance, and Sustainable Development** SCIS 1.67, O'Brien Centre	**Water and Nature in a Changing Climate** SCIS 3.56, O'Brien Centre	**Marine and Coastal** SCI 2.32, O'Brien Centre
11:15 – 11:50	**Networking, Poster Session,** **Refreshments & Meet The Exhibitors** O'Brien Centre Foyer, UCD, Belfield campus			
11:50 – 13:10	**How Sustainable is my Food?** Moore Auditorium, O'Brien Centre	**Policy, Governance, and Sustainable Development and Sustainable Design Challenge** SCIS 1.67, O'Brien Centre	**Water and Nature in a Changing Climate and Green Chemistry and Sustainable Manufacturing** SCIS 3.56, O'Brien Centre	**Marine and Coastal and Micro and Nano Plastics and Animal/Human Health** SCI 2.32, O'Brien Centre
13:10 – 14:00	**Lunch** Pi restaurant, O'Brien Centre			
14:00 – 14:45	**Student Prize Giving Ceremony "*Best in Conference*"** **Close of Conference** Moore Auditorium, O'Brien Centre, UCD			

Environ 2025

University College Dublin, Belfield, Ireland

11th - 12th March 2025

35th Irish Environmental Researchers Colloquium

"One Health for a Sustainable Future"

BIOGRAPHIES

University College Dublin Co-Convenors

Dr. Rajat Nag

Dr. Rajat Nag is a Lecturer/Assistant Professor in Biological Engineering at UCD School of Biosystems and Food Engineering, University College Dublin, Ireland. He is also a Chartered Engineer (CEng) from Engineers Ireland (Discipline: Civil, Struct, Environmental). With a doctoral degree in Biosystems and Food Engineering, he is an innovative researcher committed to pursuing a career in environmental & human health risk assessment, sustainability & Life Cycle Assessment (LCA), and the health impact of climate change. As an early career researcher, he has enjoyed building strong academic skills, exploring new research topics, and collaborating with other researchers. He is genuinely passionate about participating in multi-disciplinary, problem-solving, collaborative research. Rajat's research interest includes especially, but is not limited to, Quantitative Microbial Risk Assessment (QMRA), looking at hazard pathways such as air, water, and food; chemical risk assessment of micro and nano plastics, engineered nanomaterials and mycotoxins through the food web. He also investigates the benefit-risk assessment of certain chemicals with the novel integration of the Life Cycle Assessment approach, focusing on the Disability-Adjusted Life Years (DALY) under climate change scenarios. Rajat enjoys vlogging, painting, travel photography, and cricket in his spare time.

Dr. Junli (Lily) Xu

Dr. Junli (Lily) Xu is an Associate Professor at the School of Biosystems and Food Engineering, under the UCD Ad Astra Fellowship scheme. Her ongoing research project deals with emerging micro(nano)plastics pollution and improves the understanding of the associated human health and environmental impacts. She has multidisciplinary research interests in the use of spectral imaging combined with advanced data analysis (including machine learning/deep learning) to solve challenging problems in different fields. More information can be found at the UCD Spectral Imagin Research Group (http://www.ucd.ie/sirg).

University College Dublin Co-Convenors

Fiona Quinn

Fiona Quinn is the Programme and Engagement Coordinator in UCD School of Biosystems and Food Engineering. Fiona has an extensive background in supporting University students, particularly students with disabilities and part time learners. She currently supports students engaging in studies related to sustainability, both in-person and remotely. She is passionate about supporting a positive University experience for all students. She has coordinated a wide range of events over the years, including orientations, academic skills workshops, and conferrals. Centred to her work is ensuring an inclusive environment for all attendees.

Workshop at Environ: Coastal Resilience through Nature-based Solutions

Monday 10th March 2025

Speaker

Dr Md Salauddin

Assistant Professor in Civil Engineering, UCD

Dr. Md Salauddin (MS), is an Assistant Professor in the UCD School of Civil Engineering, is a coastal and offshore scientist with over nine years of research experience. His work focuses on both physical and numerical modelling of 'grey' and 'green' marine infrastructures, climate change impacts, scour protections, extreme events, and the safeguarding of critical infrastructures. Currently, he supervises or co-supervises five PhD candidates, four Research Masters, and two Postdoctoral researchers, all of whom are investigating climate resilience in critical coastal and offshore infrastructures. Dr. Salauddin has published more than 60 research papers in prestigious journals and at national and international conferences. He has a proven track record of securing national and international research funding, serving as Principal Investigator for several projects, including the EPA-funded projects 'Extremes', 'RESTORE', and 'RESET'; the GSI-funded project 'CIIMA'; and the MI-funded projects 'AI4Coasts', 'Reefs4Protect', and 'OffshoreAdapt'. The total value of these projects exceeds €3.5 million. Additionally, he is a member of the Working Group for three EU Cost Actions, collaborating with various European partner research institutions to address the water-energy nexus in the context of a changing climate. Dr. Salauddin also serves as the Programme Director for the MEngSc in Water, Waste, and Environmental Engineering within the UCD School of Civil Engineering.

Workshop at Environ: UCD, HOLOSIE to HOLOSEU: A Digital Solution for Sustainable and Low-Carbon Farming

Monday 10th March 2025

Speaker

Dr Ibrahim Khalil

Senior Agri-environmental System Scientist and Modeller, UCD

Dr. Ibrahim Khalil is a Senior Research Fellow at the UCD School of Agriculture and Food Science, University College Dublin, with over three decades of experience in agri-environmental systems research. His work focuses on soil biogeochemistry, greenhouse and trace gas monitoring, climate change mitigation and adaptation, and modelling. Dr. Khalil holds a Double Master's degree and a PhD and has conducted extensive research across Europe and Asia, earning prestigious postdoctoral awards from The Royal Society (UK), the Alexander von Humboldt Foundation (Germany), and Japan Society for the Promotion of Science (Japan). He has led over 30 national and international projects, including the HOLOS-IE project funded by Research Ireland and the development of HOLOSEU, an advanced agricultural systems model for Europe, funded by ICT-AGRI-FOOD/H2020. Dr. Khalil also plays key roles in EU-funded projects such as ReLive and TrueSoil.

A prolific author with 200+ peer-reviewed publications, he has contributed to FAO reports and supervised numerous researchers, students, and interns. Dr. Khalil actively mentors early-career scientists and holds multiple international expert and editorial roles. In 2020, Dr. Khalil founded the International Symposium on Climate Resilient Agri-Environmental Systems (ISCRAES), which he continues to organise biennially, fostering collaboration and knowledge exchange among researchers worldwide.

Workshop at Environ: UCD, Sensor and IoT Solutions for Environmental Applications

Monday 10th March 2025

Facilitator

Dr. Joseph Sweeney

Assistant Professor, UCD

Dr. Joseph Sweeney is an Assistant Professor in the School of Biosystems and Food Engineering, UCD. He possesses a multidisciplinary background consisting of an undergraduate degree in Industrial microbiology, a MSc in Computer science and PhD in Biosystems Engineering. He has been able to merge these contrasting fields to develop novel genetically engineered E. coli - based biosensor platform technologies which he has developed for a number of bioprocesses including Anaerobic Digestion and Green Biorefinery. Dr Sweeney has a particular interest in digital agriculture, agritech, green chemicals and green energy and is the Co-PI of the 1st ever Irish led Climate Action Life programme project - LIFE farm4more, which aims to effect climate change mitigation in agriculture through Green Biorefineries. He is passionate about applied close to market research and won the NovaUCD Invention of the year Award 2023 for his E. coli based biosensor platform technology.

Facilitator

Dr. Anna Mölter

Assistant Professor, UCD

Dr. Anna Mölter is a Lecturer/Assistant Professor in Environmental Modelling with a joint appointment in the School of Architecture, Planning and Environmental Policy and the School of Biosystems and Food Engineering, UCD. Anna has a BSc in Biological Sciences from the University of Essex and an MSc in Pollution and Environmental Control from the University of Manchester. She then worked as a process scientist in Industry, with a focus on the design of wastewater treatment plants and odour modelling, before starting a PhD in Environmental Epidemiology at the University of Manchester. Anna's PhD research was on the effects of air pollution on children's respiratory health. In parallel with this research, Anna also worked as a research assistant on the European Study of Cohorts for Air Pollution Effects (ESCAPE). After her PhD Anna worked at Colorado State University and the University of Manchester as a postdoctoral fellow. Anna joined UCD in 2020.

Workshop at Environ: UCD, Sensor and IoT Solutions for Environmental Applications — Monday 10th March 2025

Facilitator

Dr. Sharon O'Rourke

Assistant Professor, UCD

Dr. Sharon O'Rourke is an Assistant Professor and Ad Astra Fellow in the UCD School of Biosystems & Food Engineering. Her research in the areas of agricultural production systems and environmental protection focuses on sustainable soils for agronomy and climate change mitigation. Working across many soil disciplines including soil chemistry, geochemistry, microbiology, soil imaging and chemometrics she is particularly interested in understanding soil carbon sequestration and stabilisation. Current research projects investigate sustainable soil management practices for soil carbon stock in arable cropping systems across pedo-climatic zones in Europe (ClimateCropping), in-field soil sensors for soil monitoring (PRISM) and CNPS stoichiometry for enhanced soil carbon sequestration (Cfunction).

She has been assistant professor in UCD since 2019, prior to that she held a research position at University of Sydney and a faculty position in the UCD School of Agriculture and Food Science teaching in the area of Air, Soil and Water Resource. Sharon has a degree in Agricultural Science and a PhD in Soil Nutrient Management.

Public Session and Q&A Discussion: Your Sustainable Shopping List- How Can You Engage in More Environmentally Conscious Shopping — Monday 10th March 2025

Chairperson

Dr. Tom curran

Associate Professor, UCD

Dr. Tom Curran is an Associate Professor and Vice Principal for Internationalisation in UCD College of Engineering & Architecture. His research interests include waste management and air quality. He leads the Horizon Europe project, BioBeo, on innovative education for the bioeconomy with 15 partners across 10 European countries. He is a Funded Investigator in BiOrbic Research Ireland Centre for Bioeconomy. He is the Director of the UCD MSc Environmental Technology degree programme. He served as the Chairman of the Environmental Sciences Association of Ireland (ESAI) (2014-16). Tom will also deliver a keynote presentation and chair and give a keynote presentation at one of our "Circular Bioeconomy and Waste Management" session.

Public Session and Q&A Discussion: Your Sustainable Shopping List- How Can You Engage in More Environmentally Conscious Shopping

Monday 10th March 2025

Speaker 1

Miriam Keegan

Founder, Sew Sustainable

Miriam Keegan, from Co. Laois, is an award-winning leading sustainable fashion educator, designer, business strategist, and advocate. In 2022, Miriam received the Gold Gaisce award with her personal goal focusing on sewing. Since the time she began the Gold Gaisce journey, Miriam has dedicated her career to the sustainability of the fashion industry and is now on a mission to teach the people of Ireland how to sew. Miriam is a Fulbright-EPA awardee and completed her Master of Science in Fashion and Apparel Studies with a Graduate Certificate in Social Responsibility and Sustainable Fashion Business at the University of Delaware, USA. Miriam has published research on the production and export strategies of apparel 'Made in Ireland'. In 2023, Miriam was awarded the Mary Immaculate College Alumni of the Year Award for her contributions to sustainability in fashion and education. In the same year, Miriam led the fashion brand Aoife Mc Namara to become the first fashion brand in Ireland to achieve BCorp certification, one of the most rigorous and respected sustainability certifications in the world. Miriam has just concluded her studies at UCD being awarded a Graduate Diploma in Carbon Footprinting and Life Cycle Analysis. Miriam has subsequently conducted if not one of the first ever life cycle assessments on an Irish-made apparel product, calculating the carbon footprint at all stages of its production. Currently working on human rights in the fashion industry with the Fair Labor Association, Miriam works with major fashion brands around the world to improve workers' rights in factories. Miriam's mission is to bring awareness, education and solutions for sustainability in fashion, whether it be for designers, businesses, consumers, or the education system through innovation, transparency and sewing. Miriam has a passion for sewing and has had the opportunity to tailor outfits for celebrities at the Oscars, the Met Gala Ball, and New York Fashion Week, including pieces for Vanessa Hudgens. Having once been a primary teacher, Miriam has also created the first-of-its-kind EPV teacher online summer course on sustainable fashion in the classroom, approved by the Department of Education.

Public Session and Q&A Discussion — Monday 10th March 2025

Speaker 2

Pat Kane

Founder and CEO of reuzi, CSO and partner at Pragmatica

Pat Kane is a sustainability advocate and a strategist. Pat is the founder and CEO of reuzi.ie, Ireland's one-stop shop for sustainably made, low-waste goods and an educational hub on all things sustainable living. Alongside this, she is a Partner and Chief Sustainability Officer of Pragmatica. Together with her team, Pat consults with businesses and organisations from small family businesses to large corporations, on how to up their sustainability credentials

Speaker 3

Dr. Afric O'Sullivan

Associate Professor, UCD

Dr. Aifric O'Sullivan (BSc, MSc, PhD) is an Associate Professor at UCD School of Agriculture and Food Science, Principal Investigator at UCD Institute of Food and Health and Vice Principal (International) at UCD College of Health and Agricultural Sciences. Dr O'Sullivan's research aims to understand interactions between genes, environment, diet and metabolism that define nutrition phenotypes across the lifespan, with a view to informing personalised, sustainable, healthy nutrition strategies. A critical research goal is to foster the transition to sustainable healthy diets (SuHeGuide, MyPlanetDiet and PLAN'EAT). This ongoing research will show the nutrition and health implications of changing dietary patterns to be more sustainable, as well as informing recommendations, tools and interventions that will support dietary behaviour change to sustainable healthy diets in Ireland and Europe.

Public Session and Q&A Discussion — Monday 10th March 2025

Speaker 4

Ciara Coleman

Head of Business Development & Growth, Vision Ireland

Ciara's background is high end luxury retail. She has recently transitioned to the charity retail sector, with a key focus on the development of charity partners that align with our sustainability goals and objectives. Vision Ireland is the national sight loss agency of Ireland, with its retail division operating 134 charity shops as the "green engine of the high street." We drive environmental, social, and economic impact by embedding sustainable practices into every aspect of our operations. We partner with major retailers like Claire's, Mountain Warehouse, New Look, Tesco, and Woodies to repurpose end-of-line stock and visual merchandising equipment. Additionally, we collaborate with sustainable businesses such as An Post, Happy Days Fashion Rental, DNG, Festival Republic, and A Sorted Affair to reduce waste and promote reuse. As a community-focused charity retailer, we provide affordable, high-quality shopping options, support local causes, and create inclusive employment and volunteer opportunities. By leading through example, we demonstrate that progress, purpose, and partnership are the driving forces behind sustainable business.

Opening Event

Tuesday 11th March 2025

Vice-President for Sustainability, UCD

Prof. Tasman Crowe

Professor Tasman Crowe is Vice-President for Sustainability at University College Dublin. Previously, he was director of the UCD Earth Institute and co-founder and co-director of a new interdisciplinary BSc in Sustainability. He is chair of Ireland's National Biodiversity Forum and chaired an advisory group to government on the expansion of Ireland's network of Marine Protected Areas. His research characterises impacts of multiple stressors on marine ecosystems and the services they provide to society, including their cultural value.

Deputy Director One Health Centre, UCD

Dr. Gerald Barry

Dr Gerald Barry is an Assistant Professor of Virology in University College Dublin (UCD). Gerald qualified with a degree in Genetics from Trinity College Dublin before moving to Edinburgh University to complete a masters and PhD in Virology. Gerald worked in The Roslin Institute in Edinburgh after his PhD, before moving to Glasgow to work in the UK's Centre for Virus Research. After a total of 12 years in the UK, Gerald took up his position in UCD where he teaches and manages a research group studying viruses of both humans and animals. In UCD, Gerald is also the deputy director of the newly established UCD One Health Centre.

Opening Event

Tuesday 11th March 2025

Head of School UCD School of Biosystems and Food Engineering

Prof. Paula Bourke

Paula Bourke is a Professor in the UCD School of Biosystems and Food Engineering, a Conway Institute Research Fellow and a member of the UCD Institute of Food and Health. She graduated from the University of limerick in 2001 with a PhD in microbiological safety of novel non thermal processing technologies. During her time as a post-doctoral researcher at University of Limerick and as an Arnold Graves Research Fellow at DIT, she researched both thermal and non-thermal processing and their interactions with food borne pathogens and resistance mechanisms. Her research is primarily in the areas of sustainable processing innovations and novel antimicrobial technologies. She has a strong interest and research cross over to bio-medically relevant issues including infection prevention and control and Biofilms. She collaborates widely and has been successful in gaining funding awards at a national and international level. Her research group works on a range of cold plasma bioscience and sustainable food processing projects. Current research is supported through SFI Investigator, SFI-UKRI/BBSRC and SFI US-Ireland Tripartite awards, Department of Agriculture Food and Marine FIRM, Irish Research Council, the Royal Irish Academy as well as Enterprise Ireland awards. She was designated as a Highly Cited Researcher by Clarivate Web of Science based on her rankings within the top 1% highly cited researchers. She is a member of the recently initiated EU COST network in Plasma Applications for smart and sustainable agriculture, and the COST network in device associated infection iPROMEDAI.

Environmental Sciences Association of Ireland Chairperson

Dr. Niamh Power

Dr. Niamh Power is the current Chairperson of the Environmental Science association of Ireland. She is a Lecturer and Researcher, in Munster Technological University, Ireland. She received an honours degree in Civil & Structural Engineering coming top of her class, before pursuing her PhD in the area of waste management, anaerobic digestion and biogas as a transport fuel. Her interests focus on the area of sustainability with particular expertise in waste management, anaerobic digestion, renewable energy from wastes & crops, nutrient recycling, nutrient recover from wastewater, life cycle analysis and policies & drivers for change and the circular economy. She is involved in a number of large national and EU research projects on the circular economy, solar PV (InVEST) and the sustainable use of nutrients these projects including (ReNu2Cycle, ReNu2Farm and Phos4You,) and future resilience of the farming sector (SIMONE). Dr. Power is also worked on the N-TUTORR project as the sustainability lead for MTU and looked at embedding education for sustainable development with higher education.

Plenary Session

Tuesday 11th March 2025

Keynote Speaker

Mr Andy Fannings

Programme Manager, Environment & Health, The Environmental Protection Agency. ***"Key Insights from the State of and Outlook for Ireland's Environment"***

Mr Andy Fanning has a BSc in Environmental Science and Technology from Sligo RTC, an MSc in Environmental Decision Making from the Open University and an MBA. He worked with Bord na Mona as an environmental scientist and was a part-time lecturer in Sligo RTC before coming to work in the EPA in 1996. During his career in the EPA he has worked as a Licencing and Enforcement inspector and worked for 3 years on National waste reporting and management and on water quality. He subsequently worked in the Office of Licensing Climate and Resource Use dealing with enforcement of producer responsibilities and product compliance. He was the Programme Manager of the Water Management Programme in the Office of Environmental Assessment of the EPA dealing with Water Framework Directive implementation until June 2019. Between 2019 and 2021 he was a Programme Manager in the Office of Environmental Enforcement leading the enforcement on drinking water and waste water and local authority performance assessment. His current role is as Programme Manager in the Office of Environmental Enforcement leading the Environment and Health Programme.

Keynote Speakers

Tuesday 11th March 2025

Climate Change Mitigation and Adaptation

Brian Gilmore

Cement Manufacturers Ireland

Brian Gilmore studied Natural Sciences in Trinity and obtained an MSc in 1990. He has been working in the cement industry for 18 years primarily focused on engaging with local communities, regulators and the media as the industry transitions away from fossil fuel and delivers on its climate action commitments. In addition to making cement, which is essential for our modern way of life, the high temperature manufacturing process offers huge potential to meet societies circular economy and resource recovery challenges. Prior to that he spent 11 years working in the waste industry innovating and problem solving for a diverse range of clients. The goal was always to find value in waste and establish sustainable recovery and recycling options.

Circular Bioeconomy and Waste Management

Dr Amit Jaiswal

Technological University Dublin

Dr. Amit K. Jaiswal is an esteemed academic and researcher, currently a Lecturer at the School of Food Science and Environmental Health, TU Dublin - City Campus, Ireland. He has been recognised among the world's top 1% most cited academics by Clarivate (2023, 2024) and the top 2% of scientists by Stanford University (2021–2024). He also chairs the MSc programme in Sustainable Food Safety Management at TU Dublin–City Campus. Dr. Jaiswal's research focuses on converting lignocellulosic biomass into biofuels, biomaterials, and biochemicals through innovative process development, techno-economic analysis, and life cycle assessment. He has extensive expertise in bio-based materials, such as lignin and microcellulose/nanocellulose, and their applications in sustainable food packaging, water purification, and adhesives. His proficiency in green extraction techniques, including deep eutectic solvents (DES) and ultrasound-assisted processes, enables the valorisation of agri-food biomass into high-value products. With more than 125 peer-reviewed publications, 50 book chapters, and five edited books, Dr. Jaiswal's contributions to scientific literature have significantly impacted food science and biotechnology. His work has received over 10,000 citations, with an h-index exceeding 50. He also serves on the editorial boards of key international journals, including Food Quality and Safety (Oxford University Press) and JSFA Reports (Wiley).

Plenary Session 3 — Wednesday 12th March 2025

Keynote Speaker

Prof. Sukha Ranjan Samadder

Indian Institute of Technology (Indian School of Mines) Dhanbad. ***"Energy recovery potential and analysis of environmental impacts of waste to energy options: a case study of Dhanbad, India"***

Prof. Sukha Ranjan Samadder is a Professor in the Department of Environmental Science & Engineering and Head of the Centre for Water Resource Management at IIT (ISM) Dhanbad. Additionally, he is also the Associate Dean (Research & Development) at IIT (ISM) Dhanbad. With a distinguished academic background, including a PhD in Environmental Engineering from IIT Kharagpur and an MTech from IIT Roorkee, Prof Samadder brings over two decades of expertise in the multi-disciplinary field of Environmental Science and Engineering. Prof Samadder's research focuses on sustainable solutions for environmental challenges, specialising in life cycle assessment (LCA), remote sensing and geographic information systems, solid waste management, water treatment, and impacts of climate change. He has led many national and international projects, developed patents and published articles addressing critical issues like arsenic removal from groundwater, development of bio-coagulant for removal of fine-particulates from coal washery effluents, LCA of solid waste management systems, energy and resource recovery from waste, surface run-off management of iron ore mines, rejuvenation of depleting waterbodies, development of dynamic geospatial framework and ecological vulnerability assessments in coal mining areas. As a top 2% scientist globally (Stanford University rankings), Prof Samadder's work combines cutting-edge research with practical applications.

Keynote Speakers

Wednesday 12th March 2025

Advancements in Renewable Energy Technologies

Francesca Martini

Sustainable Energy Authority of Ireland (SEAI)

Francesca is the Programme Manager for Funded research in the Sustainable Energy Authority of Ireland (SEAI). SEAI is the national funder for energy research in Ireland and Francesca leads the Research, Development and Demonstration (RDD) team. The team manages the SEAI RDD research funding calls for collaborative projects, as well as individual fellowships, and the national calls in some EU and other international programmes such as Clean Energy Transition Partnership and ERA-NET. Prior to her role in SEAI, Francesca worked in academia as a researcher in Ireland, UK Italy and Costa Rica, and in the industry, with R&D and operations roles,always in the field of energy. She holds a PhD in geophysics from UCD

Governance, and Sustainable Development

Aoife Cahill

Green Generation

Green Generation Ltd. is an Irish company operating an anaerobic digestion (AD) plant in Co. Kildare treating food and agricultural waste to produce renewable biogas and digestate, an organic fertiliser. The biogas undergoes an upgrading process which strips the carbon dioxide to produce biomethane for injection into gas distribution networks or direct use as biofuels, with Green Generation operating the first renewable gas grid injection point in Ireland. The company has partnered with UCD's Algae Group to establish the EirAlgae project which aims to explore the connection between AD and microalgae biotechnology by utilising the two main effluent streams of AD, digestate and carbon dioxide, to cultivate microalgae which can be used downstream for animal feed, pharmaceuticals or sustainable fuel production. Aoife Cahill is a PhD Candidate at the School of Biosystems and Food Engineering at UCD working on the EirAlgae project with three years of industry experience at Green Generation. Aoife's research focuses on upstream microalgal biomass production, digestate valorisation and growth strategy optimisation.

Keynote Speakers

Wednesday 12th March 2025

ESAI Postgraduate Researcher of the Year 2024

Jeovan Araujo

Technological University of the Shannon (TUS)

Dr Jeovan Araujo graduated with first-class honours in Chemical Engineering from the Federal University of Maranhão, Brazil. After gaining experience as a production supervisor in the biotechnology industry, he started his PhD funded by the TUS President's Doctoral Scholarship and later by the prestigious EU Horizon 2020 through the BioICEP project. His PhD research, titled "Towards Circularity for Petroleum- and Bio-Based Plastics: Tailoring Properties and End-of-Life Routes," focused on developing high-performance bio-based plastics and advanced recycling and upcycling strategies for single and mixed plastic waste streams. His work addressed critical challenges in plastic circularity, including the enzymatic and microbial degradation of hard-to-recycle, single and mixed petroleum- and bio-based plastic waste streams and the enhancement of bioplastic properties through natural hybrid fillers. He demonstrated novel pathways for upcycling mixed plastic waste into high-value eco-polymers, such as bacterial nanocellulose, and explored green chemical-based approaches to improve bioplastic stability and functionality. Jeovan has disseminated his research widely through peer-reviewed journal publications, national and international conference presentations, and public engagement initiatives. His contributions have been recognized with multiple awards, including best overall research impact at TUS Research Week. Having been awarded his PhD in Polymer Engineering from TUS in 2024, Jeovan continues his commitment to sustainability research in his new role as a Research Support Officer and Assistant Lecturer at TUS, where he focuses on advancing green solutions for pressing environmental issues and fostering new research collaborations dedicated to environmental sustainability.

ESAI Student Competition 2025

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 13:45-14:30 on Wednesday 12th March. 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 Biodiversity Presentation (€250) sponsored by Chartered Institute of Ecology and Environmental Management (CIEEM)
- Best Social Engagement Presentation (€250) in honour of Michael Ewing sponsored by the Irish Environmental Network
- Best Natural History Presentation (€250) sponsored by Irish Naturalists' Journal
- Best Analytical Chemistry Poster (€250) sponsored by Eurachem Ireland
- Richard Fitzgerald Memorial Prize Best Aquatic Environment Poster (€250) sponsored by Eirinn Innovation

Michael Ewing Remembered

Michael was always an environmentalist but he was much more than that. He lived sustainably and organically before it was a movement, and he made friends and built communities wherever he went. In 2008, he was asked by the Irish Environmental Network to help build their network and in 2010 to build the IEN's advocacy arm, the Environmental Pillar, and the fifth national Social Partner.

Michael was also a member of the National Economic and Social Council and served as a member of the National Climate Dialogue Advisory Committee, the National Advisory Group for the Public Participation Networks and chair of the Green Party Policy Council. His passion for peace and nuclear disarmament led him to work with CND Ireland and meet with communities throughout the country to promote its ideals. After he obtained a masters degree in Environmental Science from Sligo ATU in 2003, he worked on a research project on the Aarhus Convention. From this work, allied with his facilitation skills, he became involved in the Irish Environmental Network.

His core skill was as a facilitator with an ability to unite and bring people along. Regularly working 18 hour days, he assisted the members of the IEN and the Pillar to work together and to trust each other so that the environmental movement had a unified voice on environmental matters. This legacy carries on today and the Environmental Pillar regularly meets with ministers and officials and nominates people to various bodies.

It is impossible to sum up how important Michael was to the environmental community in Ireland and to the IEN and Environmental Pillar. Without him IEN would not be where they are today. He will be a huge loss, but his legacy in helping to build a vibrant environmental network and movement and his contribution to sustainable development, social inclusion and local democracy will live on He was and will remain a keystone of the environmental movement in Ireland. Michael is sadly missed.

Environmental Sciences Association of Ireland

ESAI ANNUAL REVIEW 2024

ESAI Chairpersons Address from Dr. Niamh Power

The Environmental Sciences Association of Ireland (ESAI) has been involved in a number of activities throughout 2024. This end of year report summarises some of the key events and activities throughout the year.

The highlight of the year was our Environmental Researchers Colloquium (Environ). The 2024 Environ conference was hosted in collaboration between the ESAI and South East Technological University (SETU) on their Waterford campus. This Environ focused on the theme of "Harvest to Harbour: Research from Soil to Sea". The event took place from the 25th to 27th of March 2024, at its traditional calendar slot of the Easter timeframe. Environ 2024 commenced on the afternoon of Monday 25th of March with an interactive workshop on 'Greener Labs' and two guided field trips to Anne Valley Park, a community-developed amenity and Copper Coast Geopark, a UNESCO Global Geopark. Despite the weather these trips received very positive feedback. Later that evening saw a lively Panel discussion on 'How to Run your Business Sustainably', which was open to the public. Speakers from different fields discussed what their companies are doing sustainably for the environment, with great engagement and interest from the general public. The question-and-answer session which followed gave a wonderful insight into the enthusiasm for this topic. The following two days saw a wide variety of presentations showcasing the best of environmental research on the Island of Ireland. I would like to acknowledge Dr Graece Tan and her team for hosting Environ 2024 at SETU. The colloquium in Waterford was a huge success and extremely well organised.

A meeting of the Early Careers Network took place at Environ2024, which include a short Q&A with a "later stage" researcher followed by short breakout session in small groups. The aim was to highlight the benefit of being within the network, and what members would like to see from it. I hope this network will continue to grow over the next number of years, thanks to the efforts of ESAI council members Nicola Watson and Padraig McDonagh.

Over the summer period we saw the return of the ESAI undergraduate of the year. In 2024 we saw 12 students nominated by 6 universities. These students excelled in environmental engineering at undergraduate level. It is wonderful to see the width and breath of projects undertaken in the environmental field. The future of environmental research looks bright. We would like to extend our special thanks to all the college liaison officers who worked with us and organised the Level 7 and Level 8 nominees for their university.

ESAI Chairpersons Address from Dr. Niamh Power

Thanks to Dr Liam McCarton, Dr John Gallagher and Dr Sara Meehan for co-ordinating the "ESAI Postgraduate Researcher of the Year Award". The applications from postgraduates were evaluated according to the criteria: [1] Scientific excellence and originality; [2] Impact economic/environmental/societal) and; [3] Dissemination (conferences, outreach, media). Congratulations to the winner Jeovan Araujo. Jeovan's project is entitled "Towards Circularity for Petroleum- and Bio-Based Plastics: Tailoring Properties and End-of-Life Routes". Please come along to see Jeovan present his research at the ESAI AGM on Tuesday March 11th at 5.15pm.

A key ESAI meeting was held in November 2024 and again in February 2025 to decide on future strategy. We would like to be the association of choice for environmental researchers on the island of Ireland and to improve the knowledge transfer between the research community and society at large. We also aim to provide the best networking opportunities for environmental science research. From this we hope to reach out to those who work in industry, policy, local government and government agencies to help us to promote the excellent research work that is undertaken on the Island of Ireland.

Dr. Niamh Power, ESAI Chairperson

Annual Review 2024

On behalf of all the team at the ESAI we would like to acknowledge and sincerely thank Environ 2024 conference convenor Dr Graece Tan and all the SETU team on the Waterford campus for hosting Environ and for assembling a very comprehensive programme, which provided an excellent platform for Environmental Researchers to showcase their work. We also wish to thank Dr Sara Meehan for providing excellent administrative support to the event as always.

One of the highlights of the Environ conference is the panel discussion open to the public, where the science community gets to discuss environmental issues pertinent to the region. In 2024, this event was again, well supported by the scientific community and wider public. The Panel discussion was on 'How to Run your Business Sustainably' and the panel consisted of Enda Buckley, Director of Sustainability, Carbery Group; Ben Dallaghan, Project Manager, Bord Iascaigh Mhara; Mark Stafford, Nature & Sustainability Manager, Danone; Kieran Ryan, Energy & Sustainability Lead, MSD Ireland; Malio Power, Managing Director, Monkey Reusable Product Ltd; and chaired by Tess Ames, Ocular Therapeutics Research Group Manager. Speakers from different fields discussed what their companies are doing sustainably for the environment, from renewable energy to material choice, with great engagement and interest from the general public. Presentations from the panel were followed by a lively questions-and-answer session on the current and future actions that companies can take, lessons learned from implementing sustainable practices, to the unexpected benefits in addition to the expected benefits.

Annual Review 2024

ESAI Prizegiving

The quality of research presented at Environ 2024 was exceptional with 95 oral presentations, 56 poster presentations, 151 abstracts and 254 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 ten awards this year. Special mention to Ultan O'Donnell, UCD for winning the ESAI Best Oral Presentation for his work on the 'Impacts of Weather and Human Intervention on Historical Forestry Pest Outbreaks on the Island of Ireland' and to Tapiwa Nyakauru, SETU Waterford for winning the ESAI Best Poster Presentation for his work on 'Expression and functional characterization of recombinant metallothionein proteins of water lettuce (Pistia stratiotes) and water hyacinth (Eichhornia crassipes) in E. coli.)'.

Annual Review 2024

Early Careers Network

In September 2023 the Postgraduate Network changed its name to the Early Careers Network. The Early Careers Network will include researchers and those in industry and the cut-off point is 5 years post PhD and Masters. This change was brought about through the dedication of two of our council members Nicola Watson and Padraig McDonagh. This change is in recognition of the role of post-docs and early career researchers in mentoring and guiding postgraduate students, it also stems from a need to feel part of a research community. Under the ESAI this Early Careers Network will bring together researchers under the umbrella environmental theme. The need of researchers to come together to take part in inter-disciplinary and multi-disciplinary teams is more important now than ever. And this multi-disciplinary aspect is very strong within the ESAI. A meeting of the Early Career Network took place at Environ2024, including a short Q&A with a "later stage" researcher followed by short breakout session in small groups. The aim was to highlight the benefit of being within the network, and what members would like to see from it. In 2025, the EASI along with the Early Career Network expects to publish a newsletter dedicated to highlighting the work of early career researchers.

ESAI HEI Undergraduate of the Year Award 2023/24

Commencing in 2017 and now in its 8th Year, the ESAI Undergraduate of the Year Award continues to be significant on the Island of Ireland. In 2024 we received 12 nominations from 6 universities and 3rd level institutes across the Island. Well done to all the students who received nominations for excelling at environmental research at undergraduate level. The future looks bright. The ESAI would like to thank the college liaisons for their support in running this initiative each year. The following students were awarded ESAI Undergraduate of the Year: Cormac Harte (Level 8, ATU Donegal), Aoife Hillman-Allen (Level 8, ATU Sligo), Samuel O'Donnell (Level 8, ATU Galway), Grainne Mulcahy (Level 8, MTU Cork), Tara Lawton (Level 7, MTU), Aislinn Hare (Level 8, MTU Kerry), Katie Fallon (Level 8, SETU Waterford), Darren Mc Donald (Level 8, SETU Carlow), Caitlin Chapman (Level 7, SETU Carlow), Clara Hurley (Level 8, Trinity College Dublin), Aine Purcell, (Level 8, University College Cork), Olivia Philo (Level 8, University of Galway)

Annual Review 2024

ESAI 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. There will be a rolling call for future grassroots workshops so if you have an idea for a workshop consider applying.

Communications

ESAI members are the core of the organisation, and the communications team is led by Dr. John Gallagher, TCD. We welcome your input and participation through our social media channels whether through our Email, LinkedIn, Facebook, Twitter or by subscribing to our Newsletters. At the end of 2024 the ESAI had 710 members, comprising of 225 full members and 485 student members. Social media reach has increased marginally on social media platforms during 2024 now with >10,300 connections and an increase of 2.9% (+292) LinkedIn connections in 2024, twitter has reduced its following by 2.4% (-84) to ~3,400 followers, and similar numbers of Facebook friends (~2,800) have been maintained. The newsletter readers and e-mailing list have increased by 17% (296+) (1996 subscribers) and 9.6% (150 mailees), recognising growth in these means of communication in 2024.

A review of communications and the ESAI website is continuing, with costs to revamp and streamline systems and processes is proving to be expensive. However, council members review our communication and website requirements on an on-going basis.

ESAI Council Meeting and AGM

The ESAI had a busy year in 2024, with two Council meetings and an AGM. The AGM was convened to coincide with Environ 2024 and therefore held in SETU Waterford Campus. This AGM saw the re-election of a number of council members but also the election of new members. We are delighted to welcome the new ESAI Council members: Dr. Sarah Murnaghan (DKIT), Dr. Junli (Lily) Xu (UCD), and Dr. Rajat Nag (UCD). Additionally, we extend a warm welcome to Dr. Christopher McEleney a past host of ENVIRON2023. A special thank you to Dr. Junli (Lily) Xu and Dr. Rajat Nag for hosting ENVIRON 2025—we greatly appreciate your efforts and dedication. We look forward to working together and value your contributions to the Council

Annual Review 2024

Administration support

As we reflect on 2024, we want to express our sincere gratitude to Sara Meehan for stepping into the role of ESAI Administrator with such dedication and efficiency. Over the past year, Sara has been instrumental in ensuring the smooth running of ESAI, handling queries, coordinating activities, and providing invaluable support to the Council and the wider ESAI community. Her commitment and professionalism have been truly appreciated, and it has been a pleasure working with her. Thank you, Sara, for all your hard work and contributions to ESAI throughout 2024.

On a personal level, I would like to take a moment to sincerely acknowledge the passion, professionalism, and unwavering commitment of the entire ESAI Council. The collective expertise, dedication, and enthusiasm within this group have been truly wonderful. The wealth of knowledge, guidance, and support I have received throughout the year has been invaluable, and I am so grateful for the collaborative spirit and shared vision that drive our work. This is a lovely community to be part of and it has been a privilege to be part of such a committed team. I look forward to continuing our efforts together in the years ahead. Thank you all for your dedication to ESAI and to fostering a stronger environmental community.

Dr. Niamh Power, ESAI Chairperson

Niamh is a Principal Investigator within in Sustainable Infrastructure Research & Innovation Group and an Academic Developer with the N-TUTORR project.

Making the most of your membership

Benefits of Membership

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

- One of the largest environmental research networks on the Island of Ireland.
- 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 up to 300 delegates each year.
- Discounted rates for selected workshops, seminars, further education courses and conferences.
- Access to ESAI listserver
- 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/

2024 Events

Date	Event
January 23rd	**Environ 2024** Registration and Call for abstracts opens
February 29th	**Grassroots** The 2023 recipient of the Grassroots Award, Brakemi Egbedi hosts Blue Economy Workshop
March 1st	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
March 25th - 27th	**Environ 2024 – 34th Annual Irish Environmental Researchers Colloquium** SETU Waterford
March 26th	**ESAI AGM 2024** (Held in conjunction with Environ 2024) All members welcome
April 30th	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
June 3rd	**ESAI Undergraduate of Year Awards 2023/24** Review with HEI's commences
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 17th	**ESAI HEI nominated Undergraduate of Year 2023/24** Announcements and presentation of certificates (by post!)
October 18th	**Undergraduate Membership Offer** Free Membership for all Undergraduate Members Scheme Rolled Out
October 31st	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
October 31st	**ESAI Postgraduate Researcher of Year Award** Closing date for applications
December 31st	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call

ESAI INCOME AND EXPENDITURE ACCOUNT 2024

ESAI Income and Expenditure Account	€	€
For the year ended 31 December 2024		12,754
Opening balance as 01/01/24		
Income	€	€
Membership	1,702	
Environ 2025 – Delegate Fee	4,962	
Environ 2024 – Delegate Fee	30,172	
Environ 2025 - Sponsorship	1,000	
Environ 2024 - Sponsorship	27,456	
Prizes	2,250	
Rebate	-	
Other accrued income	73	
Total Income	**67,616**	
Expenditure	€	€
Environ 2025	4,222	
Environ 2024	26,640	
Environ 2022	4,335	
Prizes	2,750	
Website Maintenance	1,203	
Administration	15,706	
Travel	-	
Accountancy	246	
Bank Charges	1,532	
Merchant Banking	210	
Postage/Stationary	634	
Grassroots	600	
Other	280	
Total Expenditure	**57,383**	

Excess Expenditure over Income	**10,233**
Closing Balance @ 31/12/24	**22,987**

End of Year accounts are overseen and approved by external accountant

ESAI Council Members 2024

Chairperson	Dr Niamh Power	chairperson@esaiweb.org
Honorary Secretary	Dr Philip Shine	secretary@esaiweb.org
Honorary Treasurer	Dr Thomaé Kakouli-Duarte	treasurer@esaiweb.org
Communications Officer	Dr John Gallagher	communications@esaiweb.org
Editor	Ms Caroline Wynne	c.wynne@epa.ie
Conference Coordinator 2025	Dr Rajat Nag and Dr Junli Xu	University College Dublin
Conference Coordinator 2024	Dr Graece Tan	SETU Waterford
Regular Members	Prof Frances Lucy – ATU Dr Tom Curran - UCD Dr Dorothy Stewart - EPA Mr Liam McCarton - TU Dublin Dr Sarah Murnaghan – DKIT Dr Christopher McEleney - ATU Donegal	
Postgraduate Representatives	Nicola Watson - Ulster University Padraig McDonagh - ATU Donegal	earlycareers@esaiweb.org
Membership Officer	c/o Dr Sara Meehan - Administrator	administrator@esaiweb.org

Environ 2025

University College Dublin, Belfield, Ireland

11th - 12th March 2025

35th Irish Environmental Researchers Colloquium

"One Health for a Sustainable Future"

ORAL AND POSTER PRESENTATIONS SCHEDULE

All breakout rooms (4 themes per session) are inside the O'Brien Centre for Science, UCD, Belfield campus, and timings are based on Irish Standard Time (IST).

Sequence – Corresponding author name: Title: Presentation type

11th March: 11:30 – 13:00

	Circular Bioeconomy and Waste Management **Room: Moore Auditorium**	**Climate Change Mitigation and Adaptation** **Room: SCIS 1.67**	**Environmental Monitoring and Remediation (including Biobased Approaches)** **Room: SCIS 3.56**	**One Health and Biodiversity Conservation and Ecosystem Restoration** **Room: SCI 2.32**
11:30	Chair: Paul Hynds (TU Dublin) Keynote: Amit Jaiswal (TU Dublin): Lignocellulosic biomass from agri-food waste for a sustainable circular bioeconomy	Chair and keynote: Brian Gilmore (CMI): Balancing Act: Mitigation and Concrete's Role in Climate Adaptation	Chair: Niamh Power (MTU) Melissa Taylor: A novel application of environmental impact assessments for coastal zone restoration: Oral presentation	Chair: Enda Cummins and Kevin McDonnell (UCD) Yawen Kang: Agricultural Land Optimization for Ecosystem Services and Its Implications for Food Production in Inner Mongolia: Oral presentation
11:45	Neil Rowan: Harnessing a peatlands-based IMTA bioeconomy demonstration facility to help Ireland achieve its substantial United Nation's Sustainable Development Goals (SDGs) – Quo Vadis?: Oral presentation	Samantha Tobias: Between Nature, Culture, and Community: Climate Change Vulnerability of Cultural Landscapes and Intangible Heritage: Oral presentation	Paul Tasker: The adsorptive removal of Pt(IV) ions from simulated wastewater using a novel chitosan-based hydrogel material: Oral presentation	Kelly Macken: How effective is the invasive quagga mussel at colonising the deep lake habitats of Lough Ree, and how do the quagga mussel populations of lake and river habitats compare?: Oral presentation
12:00	Leah Bannon: Microbiological safety evaluation of duckweed cultivated on agricultural wastewaters for sustainable feed production: Oral presentation	Barry OSullivan: Climate Action in Irish Sporting Organisations: Mitigation, Adaptation, or Something Else?: Oral presentation	Robert Hynes: Spatiotemporal dynamics of E. coli in rivers and groundwater wells: comparative insights from two sub-catchments in the midland and western regions of Ireland: Oral presentation	Ultan Ò'Donnell: Firmly Rooted: Using host trees to predict new pest invasions: Oral presentation
12:15	Simon Patterson: The Role of Multi-Actor Interventions in Reducing Food Loss and Waste: A Systematic Literature Review: Oral presentation	Liam mccarton: Could a national rainwater harvesting strategy contribute to climate change mitigation in Ireland: Oral presentation	Salman Khan: Assessing Nitrate Pollution in Surface Waters Through a Random Forest Approach for Irish Catchments: Oral presentation	Aoife crowe: Sampling for "saproxylic" and "other woodland using beetles" in one of Ireland's most important surviving ancient woodlands: Oral presentation
12:30	Krah Courage: Behavioural Drivers of Household Food Waste: A Segmentation Study for Targeted Interventions: Oral presentation	Luke Dowd: The use of mobile LiDAR in the estimation of above-ground biomass stores in commercial forests: Oral presentation	Baile Wu: Continuous Electrochemical Wastewater Treatment and Nutrient Recovery Over 180 Days: Oral presentation	Saurabh Singh, PhD: Enhancing Soil Literacy in Ireland: Insights from the EU funded LOESS Project: Oral presentation
12:45	Jennifer McCarthy: Farm-to-fork quantitative microbial risk assessment (QMRA) of four waste-pathogen combinations from land-spreading in Ireland: Oral presentation			Riona Walsh: Presenting the findings of a One Health PhD research project investigating Lyme borreliosis risk in Ireland: Oral presentation

Lunch break: Pi Restaurant, O'Brien Centre for Science

ESAI Early Careers Network (ECN) Meeting 13.15-14.00 Moore Auditorium, O'Brien Centre

11th March: 14:00 – 15:35

	Circular Bioeconomy and Waste Management	**Climate Change Mitigation and Adaptation**	**Environmental Monitoring and Remediation (including Biobased Approaches)**	**One Health and Biodiversity Conservation and Ecosystem Restoration**
	Room: Moore Auditorium	**Room: SCIS 1.67**	**Room: SCIS 3.56**	**Room: SCI 2.32**
14:00	Chair and keynote: Thomas Curran (UCD): BioBeo bioeconomy education programme: From sustainable systems engineering to saving the curlew from extinction	Chair: Biran Gilmore (CMI) William Horan: Towards Improved Biogenic Carbon and Land Use Accounting for European Wood Products: Oral presentation	Chair: Sarah Murnaghan (DkIT) Nathan Bourke: Utilizing chlorophyll content and photosynthetic efficiency as metrics of macrophyte performance in constructed wetlands treating mine wastewater: Oral presentation	Chair: Enda Cummins (UCD) Geraldine Doolan: Marine restoration and willingness to pay: do the risks matter?: Oral presentation
14:15	Lilian Atira: Ecological impacts of recycled derived fertilisers on soil nematode communities in commercial farms: Oral presentation	Eoin Halpin: Influence of community functional traits on productivity and stability in Irish semi-natural grassland habitat: Oral presentation	Michaela Bartley: Developing novel soil health indicators using lipidomic analyses across key land use types in Ireland: Oral presentation	Grace Nolan: Public perceptions and knowledge of Irish biodiversity – establishing a baseline: Oral presentation
14:30	Sarah Zimmermann: Ireland's Urban Bioeconomy – Opportunities for Climate Action: Oral presentation	Ammara Batool: Exploring Mental Health Vulnerabilities to Extreme Weather Events in Ireland Using the IES-R Scale and Machine Learning: Oral presentation	Hayley Buttimer: Autoclaved-Citrate Extractable protein assay as a method of assessing soil health across soil types in Ireland: Oral presentation	Katie Ward: Ambient ammonia concentrations from cattle (the MACCa model) and their potential risk to Ireland's Natura 2000 Network: Oral presentation
14:45	Robert Ludgate: Developing the Social-Cultural Dimension of Sustainability Assessment for Recycling-Derived Fertilizers in Northwest Europe: Oral presentation	Romane Gurnalec: Breaking tree seedling dormancy: a key test of resilience to climate change: Oral presentation	Izuchukwu Martin Aroh: Variation and factors influencing ammonia concentration levels in finishing pig facilities, Ireland: Oral presentation	David Tosh: Advancing island restoration techniques using technology: a LoRaWAN case study from the LIFE Raft project: Oral presentation
15:00	IVAN PABLO LOAIZA ALAMO: Fog-o-ponics cultivation of aquatic plants? A case study for duckweed: Oral presentation	Ibrahim Khalil: Integrating Agroforestry into HOLOS-IE Software for Enhanced Farm Sustainability: Oral presentation	Elena Anedda: Environmental monitoring for foodborne pathogens in horticultural production settings: Oral presentation	Matheus Fragoso Etges: Forests Beyond Timber: A Tool to Help Balance Nature, Climate, People, and Wood: Oral presentation
15:15	Rasaq Abolore: Sustainable Cellulose Extraction from Distiller's Spent Grains Using Deep Eutectic Solvent: Oral presentation	Antonello Durante: Blue light effects on human health and biodiversity: An assessment of current Irish and European knowledge: Oral presentation	Anna Crowley: Evaluation of a wearable light sensor dataset to identify the effects of blue light on human health and wellbeing: Poster with 5 min oral presentation; (Poster ID: 22)	Freddie Fallon: Soil Compaction and Plant Biodiversity in Green Spaces Along the Urbanisation Gradient: Poster with 5 min oral presentation; (Poster ID: 29)
15:20			Tsitsi Lynn Mupamhadzi: Use of Genomic Tools to Link Soil Biodiversity and Function in different soil and land use contexts for Novel Soil Health Indicators: Poster with 5 min oral presentation; (Poster ID: 70)	Muhammad Inam Bari: Mapping the Drainage Status of Ireland's Peatland through Drones, Vegetation, and Hydrology: Poster with 5 min oral presentation; (Poster ID: 31)
15:25			Gaia Streparola: Assessing the Role of Integrated Constructed Wetlands (ICWs) in Shaping Environmental Antimicrobial Resistance Across Different Sectors: Poster with 5 min oral presentation; (Poster ID: 146)	Olivia Philo: Investigating seagrass restoration potential in Irish restored habitats: Poster with 5 min oral presentation; (Poster ID: 65)
15:30				Nataliia Kosiuk: Composition, Structure, and Dynamics of Ant Communities in Ireland and Ukraine: Poster with 5 min oral presentation; (Poster ID: 83)

Coffee break: Networking, Poster Session & Meet the Exhibitors, Outside Moore Auditorium, O'Brien Centre for Science Foyer

11th March: 16:15 – 17:15

	Circular Bioeconomy and Waste Management and Sustainable Water: Management and Water Conservation **Room: Moore Auditorium**	Climate Change Mitigation and Adaptation **Room: SCIS 1.67**	Sustainable Water: Management and Water Conservation **Room: SCIS 3.56**	Air and Noise Pollution and Emerging Contaminants **Room: SCI 2.32**
16:15	Chair: Eoin O'Neill (UCD) Sakshi Anand: Choco Chase: A Board Game for Bioeconomy Education and Sustainability Awareness: Oral presentation	Chair: Sharon O'Rourke (UCD) YANBIN CHEN: Developing Grassland System Modules for HOLOS-IE Focusing on Carbon Footprint Accounting Driven by Soils, Climate and Management Approaches: Oral presentation	Chair: Padraig McDonagh (ATU) Liam mccarton: Creating a framework for the Circular Economy of Water in Ireland - Reduce / Reuse / Recycle / Recover: Oral presentation	Chair: Anna Molter (UCD) Suresh Pandian Elumalai: A study on the effectiveness of city-level clean air action plan on road air quality: A case study for a coal mine city: Oral presentation
16:30	Mohammadali Babanejadi Sorkhab: Multi-criteria assessment of integrated anaerobic digestion, photosynthetic biogas upgrading, and microalgae biorefinery: Poster with 5 min oral presentation; (Poster ID: 5)	Asfand Bakht Yar: Challenges to Climate Change Education in Universities in Ireland: Oral presentation	Simon Mooney: Identifying perceptual and material barriers to management of domestic wastewater treatment systems: A behavioural survey of Irish households: Oral presentation	Shona O Sullivan: Sources of PM2.5 in the Air of Irish Towns: Poster with 5 min oral presentation; (Poster ID: 106)
16:35	Jingrou Chen: Surface density and plantlet abundance influence yield of floating Azolla filiculoides used to remediate an agri-food wastewater: Poster with 5 min oral presentation; (Poster ID: 89)	16:45 Harrison Odion Ikhumhen: Exploring the Role of ESG Practices in Accelerating Decarbonization in the Construction Industry: Oral presentation	16:45 Sarah Nasr: Predicting River Water Temperature using Machine Learning: Oral presentation	Lord Gyimah: The effects of putting on 25% less nitrogen in grass-based systems and the associated environmental benefits in terms of reduced Green House Gases (GHGs): Poster with 5 min oral presentation; (Poster ID: 113)
16:40	Alexandra Katsara: Duckweed cultivation on fish processing wastewater for biomass production and wastewater remediation: Poster with 5 min oral presentation; (Poster ID: 92)	17:00 Nicholas Ryan: The Assessment of Gypsum Products at Improving Soil Water Infiltration in Grassland in Winter Months: Poster with 5 min oral presentation; (Poster ID: 107)	17:00 Lisa Cronin: An open source workflow for monitoring hydrodynamic events in small rivers using temporary continuous monitoring stations: Oral presentation	16:40 ALOK SINHA: Iron-coated granular activated carbon for enhanced electrochemical oxidation of pharmaceutical compound: Mechanism and degradation pathway: Oral presentation
16:45	IVAN PABLO LOAIZA ALAMO: Shellfish processing wastewater: rich in nutrients but poorly valorised: Poster with 5 min oral presentation; (Poster ID: 108)			16:55 Vicky Polychronidou: Predictive model for kinetic bioaccumulation to predict PFAS levels in aquatic species: Oral presentation
16:50	Vasileios Daimonakos: A Systematic Literature Review of Nitrate Leaching Models Focusing on Cover Crops: Poster with 5 min oral presentation; (Poster ID: 54)			17:00 Egehan Onat Ozfen: Pesticide persistence levels in commercial beeswax across countries: Poster with 5 min oral presentation; (Poster ID: 12)
16:55	Déborah Sousa: Integrated strategies for drinking water quality: bridging source protection and treatment: Poster with 5 min oral presentation; (Poster ID: 105)			

17:15: ESAI AGM Featuring presentation from the ESAI Postgraduate Researcher of the Year 2024; 17:25: Bus (1st) to Royal Marine Hotel for Conference Dinner; 18:15: Bus (2nd) to Royal Marine Hotel for Conference Dinner.

12th March: 10:00 – 11:15

	Advancements in Renewable Energy Technologies		**Policy, Governance, and Sustainable Development**		**Water and Nature in a Changing Climate**		**Marine and Coastal**
	Room: Moore Auditorium		**Room: SCIS 1.67**		**Room: SCIS 3.56**		**Room: SCI 2.32**
10:00	Chair: Louise O'Connor (Sustainable Energy Authority of Ireland (SEAI)) Keynote: Francesca Martini (SEAI): Bridging Research and Impact for Renewable Energy Advancements	10:00	Chair and industry speaker: Aoife Cahill (Green Generation): Anaerobic digestion in Ireland and the potential for microalgae biotechnology integration: realising innovation through academia-industry partnership	10:00	Chair: Yuchen Li and Md Salauddin (UCD) Keynote: Rajat Nag (Engineers Ireland Ag and Food Eng division): Building resilience in water, agriculture, food, and ecosystems amid climate change	10:00	Chair: Brendan McHugh (Marine Institute) Information on "Marine Institute Opportunities for Students": Oral (5 min)
10:15	Naufal Riyandi: Balancing nature restoration and hydropower production: Analysis of a fish-friendly centrifugal screw pump-as-turbine: Oral presentation	10:10	Robert Ludgate: Informing Policy and Empowering Society: Research Impact Driving Transformative Environmental Policies: Oral presentation	10:10	Arghadyuti Banerjee: land use-based regression model to track nitrate concentration in groundwater: a buffer-based approach: Oral presentation	10:05	Emma Verling: The Atlantic-Arctic Agora (A-A Agora) project for Ireland: studying beach and dune morphodynamics and engaging with communities to support sustainable coastal restoration and management in Co. Cork: Oral presentation
10:30	Daniel Dransfield: Analysis of Solar PV Consumption Rates and Subsequent Optimisation for Maximising Self-Consumption for Residential Properties in Ireland: Oral presentation	10:25	Jamie Murray: BioCultúr: Integrating Irish Culture, Heritage, and Language into Bioeconomy Strategies for a Sustainable Future: Oral presentation	10:25	Dieu Anh Dinh: Exploring Historical and Future Changes of Lake Surface Water Temperature in South America: Oral presentation	10:20	Charlene Watters: What lurks in the mud? Using benthic invertebrate communities as a proxy for water quality to elucidate the effects of space and time within two natural harbours: Oral presentation
10:45	Chetanaya Sawhney: Investigating the potential of hybrid renewable energy systems optimisation through a life cycle and circular economy lens: Oral presentation	10:40	Alison Hough: Aarhus Convention Rights and Climate Planning: Enabling democracy in a time of planetary crisis: Oral presentation	10:40	Mohamad Soboh: Combining Machine Learning and Numerical Models for Groundwater Flooding Prediction in Cork City: Oral presentation	10:35	Eliza Fairchild: Exploring Ireland's Blue Carbon Potential: Quantifying Lateral Fluxes of Dissolved Carbon in a Saltmarsh Ecosystem: Oral presentation
11:00	Aiza Ahmad: Unlocking Rooftop Solar Potential: A Study of Factors Affecting PV Potential in Irish Housing: Oral presentation	10:55	Immanuel Darkwa: Communication Breakdown or Disconnect? Investigating the Role of Communication in Addressing Climate Change in Ireland's Agricultural Sector: Oral presentation	10:55	Faisal Mahmood: Advancing Land Cover Classification for Hydrological Modelling and Flood Resilience in Ireland Using Sentinel-2 Imagery: Oral presentation	10:50	Angéline Lefran-Cariou: Coastal phytoplankton in a changing environment: Oral presentation
		11:10	Ewa Dönitz: Agribusiness scenarios 2035 for valorization of biodiversity and ecosystem services in the agri-food value chain: Poster with 5 min oral presentation; (Poster ID: 14)	11:10	Tarig Mohamed: Defining Groundwater Drought in Ireland: A Comparative Study of Threshold Level and Standardized Groundwater Methods: Poster with 5 min oral presentation; (Poster ID: 96)		

Coffee break: Networking, Poster Session & Meet the Exhibitors, Outside Moore Auditorium, O'Brien Centre for Science Foyer

12th March: 11:50 – 13:10

How Sustainable is my Food?	Policy, Governance, and Sustainable Development and Sustainable Design Challenge	Water and Nature in a Changing Climate and Green Chemistry and Sustainable Manufacturing	Marine and Coastal and Micro and Nano Plastics and Animal/Human Health
Room: Moore Auditorium	**Room: SCIS 1.67**	**Room: SCIS 3.56**	**Room: SCI 2.32**
11:50 Chair: Tamíris Da Costa (UCD) Ronald Wankya Kiduma: Using consumer insights to enhance the role of Irish seaweed SMEs in sustainable market innovation and product development: Oral presentation	11:50 Chair: Junli Xu (Lily) (UCD) Ariane Voglhuber-Slavinsky: Building a collaborative future: stakeholder involvement in the HOLOSEU agricultural platform: Poster with 5 min oral presentation; (Poster ID: 21)	11:50 Chair: Caroline Wynne (EPA) Niamh Cahill: The Impact of Temperature Changes on the Survival of Clinically Significant Carbapenemase-Producing E. coli in Coastal Waters: Oral presentation	11:50 Chair: Brendan McHugh (Marine Institute) Manoj Chand: Does the Infaunal Quality Index (IQI) reflect the true ecological status of coastal bays along the Northwestern Coast of Ireland?: Poster with 5 min oral presentation; (Poster ID: 82)
12:05 Tracey O'Connor: Non-husbandry and climate-related food loss and waste in primary production: Identifying sources, estimating quantities, and understanding contributory factors: Oral presentation	11:55 Rabia Asghar: Using agent-based models to simulate environmental behavior and policy intervention scenarios: A case study of private well users in Ireland: Poster with 5 min oral presentation; (Poster ID: 34)	12:05 Tahmida Naher Chowdhury: Predictive analysis of groundwater quality index with advanced machine learning approaches: Oral presentation	11:55 Xihang Xu: Review of Assessment Methods for Seagrass-Induced Wave Attenuation: Oral presentation
12:20 Ismaeel Abdulsalam: Innovative Farming Practices along the Crop Cycle in Northwest Europe: Oral presentation	12:00 Vaishali Thaore: Geographic information systems-based household food waste mapping across Ireland: Poster with 5 min oral presentation; (Poster ID: 120)	12:20 Juan Diego Rodriguez Blanco: Sustainable recovery of rare earths using Ca-Mg-Fe carbonates and eggshell waste: Oral presentation	12:10 Morena Gaudino: The impact of extreme weather events on plastic distribution and abundance in marine ecosystems: Poster with 5 min oral presentation; (Poster ID: 85)
12:35 Islam Darwish: Development and characterisation of co-encapsulated biological control agents, Steinernema feltiae and Pseudomonas ogarae, for enhancing plant health: Oral presentation	12:05 Lorraine Archer: Living Systems Design and Environmental Science: Transforming the Future Through Trans-disciplinary Collaboration: Oral presentation	12:35 Muhammad Aitzaz Akram: Statistical Optimisation of recombinant Amycolatopsis mediterranei cutinase expression for polymer degradation: Oral presentation	12:15 Sara Finnerty: Bioprospecting of bioactive lipids from intertidal microphytobenthic biofilms from the coast of Ireland: Poster with 5 min oral presentation; (Poster ID: 129)
12:50 Fangting Bai: The antioxidant effect of saltwater Nannochloropsis grown on anaerobic digestate water: Oral presentation	12:20 Seyedalireza Mohammadirad: Effects of Curing Regimes on Hardened Properties of Sustainable Concrete Solutions Containing Supplementary Cementitious Materials: Oral presentation	12:50 Aurora Dimache: Advancing Nanofluid-Based Cooling Technologies for Energy-Efficient Data Centres: Oral presentation	12:20 Kristina Petra Zubovic: Crystallisation of CaCO3 polymorphs induced by PET-based microplastic particles: Oral presentation
13:05 Antonio Calvi: Life cycle assessment of an experimental barley cultivation combining reduced amounts of nitrogen fertiliser with different biostimulants: Poster with 5 min oral presentation; (Poster ID: 68)	12:35 Yvonne Cortese: Resealable Reusable Packaging: Bridging Performance and Sustainability for Long Shelf-Life Applications in Reusable Food Packaging: Oral presentation		12:35 Junhao Xie: Spectral Identification of Environmental Microplastics by Open Set Convolutional Neural Networks: Oral presentation
	12:50 Susann Power: Beach Clean 2.0: a transdisciplinary, civic approach to tackling marine plastic pollution in Northern Ireland (NI): Oral presentation		12:50 Emine Merve Canga: Characterisation of polypropylene and nylon microplastics after microwave treatments: Oral presentation

Lunch break: Pi Restaurant, O'Brien Centre for Science

14:00 – 14:45: Student Prize Giving Ceremony "Best in Conference", Close of Conference Moore Auditorium, O'Brien Centre, UCD

Environ 2025

University College Dublin, Belfield, Ireland

11th - 12th March 2025

35th Irish Environmental Researchers Colloquium

"One Health for a Sustainable Future"

ORAL AND POSTER PRESENTATIONS

Table of Contents

Theme: Advancements in Renewable Energy Technologies

Balancing nature restoration and hydropower production: Analysis of a fish-friendly centrifugal screw pump-as-turbine.

Naufal Riyandi ORCID iD[1], John Gallagher ORCID iD[1], Aonghus McNabola ORCID iD[1,2]

[1]Trinity College Dublin, Dublin, Ireland. [2]Royal Melbourne Institute of Technology University, Melbourne, Australia

Abstract

The Nature Restoration Law (NRL), implemented on August 18, 2024, aims to restore aquatic ecosystems, protect biodiversity such as fish species, and enhance waterway connectivity by removing barriers along 25,000 km of rivers by 2030. However, this policy may hinder the development of run-of river micro hydro systems, which rely on barriers, while facing fish-friendliness challenges. An alternative involves modifying barriers using fish-friendly technologies¸ such as a centrifugal screw pump-as-turbine (PAT), which allow fish migration without fully the removing barriers, thereby preserving connectivity in the waterways. Additionally, integrating PAT systems could support the European Union's target of achieving 42.5% renewable energy by 2030. However, the performance of a centrifugal screw PAT remains unknown, as no research has yet been conducted on this topic. This study employs Computational Fluid Dynamics (CFD) to evaluate the performance of a centrifugal screw PAT. The results show that a centrifugal screw pump with an outlet diameter of 7.5 cm, inlet diameter of 15 cm, and length of 15 cm can achieve an optimum power output of 192.68 W with an efficiency of 16% at 500 RPM, a head of 6.2 m, and a flow rate of 20 L/s. At flow rates of 5, 10, 15, and 25 L/s, vortices were observed, with higher intensity compared to 20 L/s. At 30 L/s, water velocity increased but efficiency decreased, indicating that the operating conditions exceeded the optimal design parameters. The suboptimal efficiency and power are attributed to the shrouded impeller design, which affects pressure distribution and impeller dynamics. Further research is needed to evaluate the centrifugal screw PAT performance under varying boundary conditions and optimized geometries, to improve its performance whilst ensuring that the turbine can maintain its fish-friendly requirements

Presentation Types

Oral

Analysis of Solar PV Consumption Rates and Subsequent Optimisation for Maximising Self-Consumption for Residential Properties in Ireland

Daniel Dransfield[1], Evan Finegan[2], Niamh Power ORCID iD[1]

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Abstract

Solar photovoltaic (PV) and in particular residential PV systems are playing a growing role in the move towards a renewable energy future. For this technology deployment to continue to grow at pace in Ireland, as the principal stakeholder, the home occupier must continue to recognise the benefits. To achieve this, the current domestic energy consumption patterns, use of Behind-the-Meter generation, and experiences of domestic users must be understood. However, residential PV systems do not operate in isolation, therefore the evolving energy market and the interests of other stakeholders, including grid operators, utilities, policymakers and other consumers must be considered. There are also a multitude of factors that can impact on the benefit to end-users of residential PV - policies such as subsidies and feed-in-tariffs along with peer effects, electricity consumption patterns, forecasting, technology, rebound effects, data visibility and demand response to name a few. This study aims to understand current real-world experiences of residential PV users in Ireland by using a bottom-up approach to undertake a deep analysis of residential electricity usage and generation data. A model will be developed to enable engagement across the population with the ever evolving energy market scenarios in Ireland. This model is a crucial part of the understanding of the relationships between policy, technology and end consumer behaviour in optimising residential PV, while offering insights into how the different optimisation objectives (such as cost savings, carbon reduction or grid stability) shape optimisation strategies. Data has been processed from over 50 households in Ireland with smart meter data, various PV system sizes, data formats and resolutions. An interesting preliminary finding is that of the households surveyed almost 48% indicated that saving money on energy bills was the top reason for investing the technology, followed closely by carbon footprint at 40%.

Presentation Types

Oral

Investigating the potential of hybrid renewable energy systems optimisation through a life cycle and circular economy lens

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Abstract

Human evolution has been intertwined with environmental destruction. The captivity of negativity of prioritising self-development and progress over nature and climate has disrupted the synergy of sustainability and mutual co-existence. Anthropogenic factors like industrialisation, burning fossil fuels, urbanisation, and deforestation have resulted in rapid climate change. The effects have not only been restricted to the global level but can be commonly observed as variability in local weather phenomena, reduction in surface, and groundwater levels, and shortage of food and energy among many others. The mitigation strategy of increasing the penetration of renewable energy in the total energy mix brings instability to the electric grid because of the variable nature of renewable resources. Hybrid renewable energy systems are perceived to bring a paradigm shift in adopting renewable energy, as they limit the variability factor of renewable energy and increase the generation profile in a particular geographic area. The study emphasises measuring the holistic impact through a Life Cycle Sustainability Assessment, that can balance several sustainability factors – environmental, economic, and social, across the entire value chain of a hybrid renewable energy system. LCSA is defined as the combination of environmental LCA (base LCA), life cycle costing (LCC) and social LCA (S-LCA) and should follow the systematic methodology of LCA [1]. As per, ISO 14040 and ISO 14044 standards LCA is carried out in four phases - Phase 1 - Goal and Scope Definition, Phase 2 - Life Cycle Inventory (LCI) Analysis, Phase 3 - Life Cycle Impact Assessment (LCIA), Phase 4 - Results Interpretation [2, 3]. Integrating the three approaches into a comprehensive LCSA is natural since LCC and S LCA measure the economic and social sustainability dimensions using comparable procedures outlined in ISO 14040 [1]. LCSA could be a decisive framework for much-needed Climate Finance and an effective tool against greenwashing and false solutions.

Presentation Types

Oral

Unlocking Rooftop Solar Potential: A Study of Factors Affecting PV Potential in Irish Housing

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Abstract

In Europe & Ireland, integrating rooftop photovoltaic (PV) panels into residential energy systems has become key focus to achieving net-zero emissions by 2050. PV panels are promising technology for renewable energy generation and climate change mitigation. However, their efficiency and performance depend on various factors including environmental, building and geographical conditions. Solar irradiance is influenced by weather, seasonal changes, geographic location and time of day, all of which plays critical role in determining PV system efficiency. This study explores these factors with respect to Irish residential settings, emphasising the importance of building characteristics such as roof size, PV orientation, tilt angle and roof geometry in optimising rooftop PV energy output. In Ireland, a diverse range of housing typologies like detached, semi-detached, terraced and apartment homes exist, which significantly impact the feasibility of rooftop solar installations. Furthermore, potential of PV system to meet consumers expectation also varies by energy usage patterns, occupant behaviour and self-consumption habits. This research highlights the need to address these interrelated factors to maximise energy generation from solar PV systems. A heatmap has been generated to illustrate the impact of location, orientation and tilt on PV output of the same house. Preliminary results from study, indicate a 60% decrease in PV annual yield from the most optimal location (i.e., 52°N, 8°W) and orientation (south at 30° tilt) to the least optimal configuration (east-west orientation, 45° tilt angle at 54°N, 7°W) for the same house. The results show that PV potential varies based on interrelated factors such as dwelling location, roof specifications, building orientation and tilt. By providing insights into optimal configurations and installation strategies for PV systems, this study aims to optimise PV systems for self-consumption, enabling households to maximise benefits of PV technology and support Ireland and EU in meeting renewable energy targets.

Presentation Types

Oral

Exploring Energy Justice in Ireland: Mapping Inequities in Solar Adoption

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Abstract

Energy justice, energy poverty and the rollout of rooftop solar PV as part of the energy transition are inextricably linked. Adoption of renewable technologies – in particular, solar PV – has the potential to bring about rapid, fundamental transformation in Irish society. It could have a significant impact on reducing emissions and could prove instrumental in helping address energy poverty. While recent years have seen a rapid increase in domestic solar PV installations in Ireland, in part due to the availability of government grants, questions remain around whether justice considerations are being adequately addressed. This research explores energy justice in an Irish context by examining the intersection between socioeconomic factors and the uptake of solar PV across Ireland. Combining data from the Pobal Deprivation Index, CSO Census data and SEAI data on solar installations, this poster presentation illustrates variations in the adoption of solar PV in Ireland across multiple factors including levels of deprivation, housing type and housing tenure.

Presentation Types

Poster

Theme: Air and Noise Pollution

A study on the effectiveness of city-level clean air action plan on road air quality: A case study for a coal mine city

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Abstract

Air pollution has become a significant environmental and public health issue in India, particularly in urban centres. Key contributors to this growing crisis include industrial, vehicular, and dust emissions from coal mining-related activities. Dhanbad city, located in the state of Jharkhand, is known as the coal capital city of India. Due to the availability of coal, the city is surrounded by other dependent industries such as coal washeries, coking of coal, steel production and thermal power plants. The annual average ambient particulate matter (PM) concentration for Dhanbad city exceeded the permissible standards. Therefore, Dhanbad emerged as a non-attainment city under the National Clean Air Program (NCAP) by the Government of India (GOI) and the Ministry of Environment, Forest, and Climate Change (MoEFCC).

The objective is to assess the effectiveness of the Clean Air Action Plan (CAAP) for road dust management. Mixed or heterogeneous traffic is observed on Dhanbad roads. The impact of the mechanical sweeper on-road air quality is studied by measuring the differences in silt loading rate and PM levels using GRIMM Optical Particle Counter 1.108, which allows for real-time aerosol measurement. The use of mechanical sweeping resulted in significant decrease in daily silt loading rate from 71.63 g m^{-2} to 20.44 g m^{-2}. Similarly, its use has marginally improved the measured PM10 from 476 µg m^{-3} to 403 µg m^{-3}. The sweeping operation temporarily increases the levels of particulate matter at most locations, likely due to dust being disturbed during the process. However, after sweeping, PM10 levels generally decrease, suggesting that sweeping helps reduce particulate matter in some areas. The varying effectiveness of sweeping across different locations, could be related to factors such as silt loading rate, vehicular flow rate, the sweeping method, or the characteristics of the surfaces being swept.

Presentation Types

Oral

Air Pollution and Mental Health: Investigating Stress, Anxiety, and Depression in Dublin, Cork, and Limerick.

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Abstract

Air pollution is one of the largest environmental health risks, accounting for about 7 million people annually. It is estimated that nearly 99% of the world's population is breathing polluted air, exceeding WHO guidelines. While air pollution's effects on cardiovascular and respiratory diseases are well-established, its potential impact on mental health, particularly stress, anxiety and depression, remains underexplored in Ireland. This study aims to address this gap by investigating the association between air quality exposure and mental health in three major cities in Ireland: Dublin, Cork and Limerick.

To achieve this, a comprehensive anonymous survey will be conducted, comprising four sections: demographics, general health, mental health, and air quality perceptions. The mental health component utilises validated psychological scales, including PHQ-9 (for depression), GAD-7 (for anxiety), and PSS (for stress). Participants will also provide approximate residential locations, linking their responses with localised air pollution data and meteorological factors.

The survey targets a diverse cohort, including university students in Dublin, Cork, and Limerick and residents near air quality monitoring stations. Survey distribution strategies include brochures, posters, door-to-door distribution, and online platforms, with support from organisations such as Mental Health Ireland and ESAI.

Statistical analyses will employ multiple linear regression to establish baseline relationships between air quality and mental health. Depending on the dataset, advanced techniques such as Random Forest or mixed-effects models will explore complex interactions, ensuring robust and reliable findings.

This is part of an ongoing PhD research that analyses air quality and its effects on mental health, contributing to a holistic understanding of environmental factors influencing psychological disorders. This study's outcomes aim to provide essential insights for policymakers, improve urban planning, enhance awareness, promote mental health and environmental health research, and facilitate targeted interventions to mitigate the mental health impacts of air pollution.

Presentation Types

Poster

Sources of $PM_{2.5}$ in the Air of Irish Towns

Shona O'Sullivan ORCID iD[1], Niall O'Sullivan[1], Vaios Moschos[2], Kirsten Fossum[2], Jurgita Ovadnevaite[2], John Wenger[1], Stig Hellebust[1]

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Abstract

Air pollution is a critical environmental and public health issue, responsible for approximately 1,300 premature deaths annually in Ireland. Following the existing ban on the sale of smoky coal in Dublin, Cork, and larger towns with population over 15,000, the smoky coal ban came into effect across the country in October 2022. The "TownAir" project, a collaboration between UCC and UoG, will address the issue of air quality in regional towns and identify and quantify sources of air pollution

The measurement of air pollutants such as particulate matter ($PM_{2.5}$), sulfur dioxide (SO_2), and black carbon (BC) will be monitored in Enniscorthy, Co. Wexford, and Letterkenny, Co. Donegal during wintertime, when air pollution is at a maximum. Preliminary investigations have demonstrated that pollutant concentrations are influenced by factors such as residential heating, vehicle emissions, and meteorological conditions.

A field measurement campaign in Enniscorthy is currently underway during the winter period of 2024/2025. This campaign employs high-precision instruments such as aethalometers for BC measurement, SO_2 analysers, and High-Volume filter samplers for offline chemical speciation. A network of low-cost sensors is also deployed across the town, capturing spatial variability. The diurnal variations in the concentrations of $PM_{2.5}$, SO_2 and BC, alongside the correlation between pollutants, aids in apportioning the pollutants to different source categories. Parallels between high pollution episodes and extreme weather conditions have also been identified, and multiple peaks in $PM_{2.5}$ of over 80 µg m^{-3} have already been recorded.

Building on previous measurements in Enniscorthy, this campaign evaluates the impact of air quality regulations and changes in domestic burning and traffic patterns. Future comparisons with results from Letterkenny, where a similar campaign will be conducted in Winter 2025/2026, will provide insights into regional differences in air pollution trends and sources.

Presentation Types

Poster with 5 min oral presentation

The effects of putting on 25% less nitrogen in grass-based systems and the associated environmental benefits in terms of reduced Green House Gases (GHGs)

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Abstract

Grass-based systems, such as perennial ryegrass (PRG) and multispecies swards (MSS), are pivotal for sustainable livestock production in Ireland. However, these systems depend heavily on nitrogen (N) fertilizer inputs which contribute significantly to greenhouse gas (GHG) emissions and nitrate leaching. The EU Farm to Fork Strategy and Green Deal aim for a 20% reduction in N fertilizer use by 2030, whereas Ireland's Climate Action Plan targets a 25% reduction**.** This current study focuses on the effects of reducing N fertilizer inputs by 25% in grass-based systems, focusing on environmental benefits like reduced GHG emissions and improved nitrogen use efficiency (NUE). Moreover, MSS comprising grasses, legumes, and forage herbs have shown potential for maintaining productivity under low N fertilizer regimes, although challenges remain in herb species persistence. This study will also investigate whether biostimulants (a seaweed extract) and microbial panels, can enhance forage yield and quality under reduced N conditions while mitigating environmental impacts. Lysimeter trials will assess the impact of biostimulant application on PRG and MSS in terms of yield, NUE, GHG emissions, and nitrate leaching. Preliminary studies to achieve our goal includes set up of analytical tool kits to establish baseline nitrogen content prior to soil treatment and the analysis of GHGs emission.

Additionally, farm-based evaluations in Munster and Leinster will build on lysimeter findings to assess the scalability and practicality of these interventions. Key metrics include dry matter digestibility, crude protein content, GHG emissions, nitrate leachate and species persistence within MSS over multiple growing seasons. This current study will establish the feasibility of achieving a 25% N fertilizer reduction while maintaining productivity and enhancing environmental sustainability in grass-based systems. These outcomes will contribute to achieving the Climate Action Plan goals, providing practical solutions for reducing the environmental footprint of agricultural practices.

Keywords: Biostimulants, Nitrogen reduction, Greenhouse gas emissions

Presentation Types

Poster with 5 min oral presentation

Odour Assessment in Dairy Wastewater Treatment Facilities.

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Abstract

Due to the removal of the milk quota regime in April 2015, the Irish dairy industry has seen continual fluctuations in milk production having increased from 5.7 billion litres in 2014 to 8.4 billion litres in 2023. Dairy processing requires a significant hydraulic demand, with approximately 2.71 m^3 of water required to process 1 m^3 of milk. This results in large volumes of wastewater with the potential to cause water, air and soil pollution.

The dairy processing industry generates 126,718 tonnes/year of dairy processing sludge (DPS), mainly Dissolved Air Flotation (DAF), and brown sludges. Most of the sludge goes to land spreading and a portion goes to anaerobic digestion (AD) without pretreatment.

In collaboration with industry and research partners in the Dairy Processing Technology Centre (DPTC), the overall study is being conducted aimed at the valorisation of dairy processing sludge to recover nutrients, energy, water and odour mitigation. One of the odour aspects covered under this study is baseline odour assessments at industry partners aimed at identifying odour hotspots, determination of odour concentration and air dispersion modelling of odour in the atmosphere to assess odour impact downstream.

Odour samples from identified odour hotspots (balance tanks, sludges, buffer tanks, aeration tanks, and sludge handling enclosures) were sampled using standard sampling procedures and odour concentration (OU_E/m^3) was determined using a T08 olfactometer according to the standard dynamic olfactometry methodology (EN 17325).

Results identified balance tanks as a major source of odour, followed by sludge handling areas and exhaust stacks, respectively. Assessing odour emissions at different hotspots in the dairy wastewater treatment plants will guide compliance with environmental legislation and Best Available Techniques.

Keywords: Odour, Dairy sludge, Dynamic olfactometry

Presentation Types

Poster

Theme: Circular Bioeconomy and Waste Management

Multi-criteria assessment of integrated anaerobic digestion, photosynthetic biogas upgrading, and microalgae biorefinery

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Abstract

SuperPro Designer and Aspen Plus are two common process simulation software, each with differing applications. Aspen Plus is used for chemical processes, has an extensive thermodynamic databank, can handle electrolytes and solids, and includes different reaction mechanisms and reactor types. SuperPro has different built-in models for bioreactors, suitable for modeling bioprocesses. In modeling biorefineries, bioprocesses are used alongside chemical processes. Therefore, it is necessary to integrate Aspen Plus and SuperPro to leverage the benefits and address each one's limitations. Traditionally this integration is done manually which is time-consuming, prone to errors in data exchange between software packages, and makes conducting sensitivity analysis difficult. In this research, Aspen Plus and SuperPro are integrated using MATLAB and Visual Basic for Applications (VBA) as interfaces. This integration allows for the rapid and accurate creation of multiple scenarios which may be compared from a sustainability perspective.

To test the integration, the photosynthetic biogas upgrading process was simulated. In this process, biogas enters a bubble column containing HCO_3^- and CO_3^{2-}. CO_2 reacts with these ions. Upgraded biogas exits the column and liquid exiting the column is used for microalgae production. Microalgae grow and produce OH^- by consuming HCO_3^-. The released OH^- reacts with CO_3^{2-} and produces HCO_3^-. The produced microalgae are separated, and the remaining solution is returned to the column. The biogas and microalgae production process are simulated using SuperPro, and the bubble column is simulated by Aspen Plus. MATLAB and VBA enable an exchange of information between the two simulation software packages. It is possible to produce different products from microalgae, each having different economic, environmental, social, and technical performance. Alteration of process parameters can affect the sustainability of the whole system. Multi-criteria decision-making methods can be used to compare different scenarios, select the most sustainable one, and identify impactful process parameters.

Presentation Types

Poster with 5 min oral presentation

Harnessing a peatlands-based IMTA bioeconomy demonstration facility to help Ireland achieve its substantial United Nation's Sustainable Development Goals (SDGs) – Quo Vadis?

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Abstract

The Social Justice Ireland Report 2024 revealed that Ireland needs to revise strategic policies to make substantial progress on its SDGs by 2030. Integrated bioeconomy demonstration facilities tailored to meet strategic policies can inform appropriate bottom-up green technologies/innovation to help address these SDGs. This describes the role of an integrated multi-trophic aquaculture (IMTA) site that demonstrates bioeconomy activities at scale in the Irish peatlands to address environmental sustainability, economic development and social justice.

This IMTA system comprises 4 pill-ponds for culturing rainbow trout inter-connected with 16 channels across 5.2 hectare of peatland. Fish culture waste rich in nitrogen and phosphate is bioremediated by naturally occurring microalgae and duckweed biomass that return clean water to fish ponds. Duckweed and microalgal biomass can be refined for high-value protein for future fish/animal feed. Energy is supplied by wind turbine where site operates to zero-waste, zero-pollution and climate-action principles. The site received funding from DAFM and EU-JTF to operate as flagship-bioeconomy demonstration to scale wet-technologies and bio-based products that also balance bioecology/biodiversity. The IMTA site operates to Penta-helix-hub for converging multi-actors that includes living lab (including digital twin/extended-reality suite), innovation suite for accelerating businesses training, biorefinery and anaerobic-digester and land-base tanks for culturing freshwater macroalgae from fish waste stream. It will be digitally transformed to enable energy and emissions monitoring for the entire site including nitric oxide.

This IMTA involves cultivating a range of aquatic species from different trophic levels in a synergistic system, thus, enhancing productivity and environmental sustainability. Additionally, IMTA can provide economic benefits by diversifying income sources for local communities transitioning from reliance on fossil fuels and for enhancing food security. The potential for carbon sequestration in peatlands also aligns with climate change mitigation goals. This 'paludiculture' model has potential for replication in other rewetted peatlands globally.

Presentation Types

Oral

Microbiological safety evaluation of duckweed cultivated on agricultural wastewaters for sustainable feed production.

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Abstract

Agricultural sector wastewaters can have a major impact on river, lake and estuarine water quality due to their high organic nutrient loadings and potential presence of pathogenic microorganisms. Novel, sustainable approaches coupling agri-sector wastewater management with resource recovery are currently being explored, such as the DUCKFEED project focused on wastewater use as a feedstock to produce human and animal food and feed. Duckweeds (Lemnaceae) are free floating aquatic plants characterised by a rapid growth rate and high protein (up to 40%) content. These plants are known to grow on a range of wastewaters, and efficiently remove nitrogen, phosphorus and other contaminants. Duckweed has been used as both an animal and human food source for many years in Asia and has the potential to displace Irish reliance on imported soy protein use in winter animal feed. However, as wastewaters generated from the agro-industrial sector could harbour pathogenic bacteria, there is a need for evaluation of the microbiological safety of Duckweed cultivated on wastewaters.

Here we report the microbiological profiling of duckweed cultivated on farmyard wastewater (dairy milking parlour and yard waste) over a 28-day period, comparing wastewater and frond-associated bacteria. Our study suggests a temporal shift from enteric to environmental bacterial associations with fronds, and a particular dominance of plant growth promoting bacteria including *Pseudomonas, Comamonas* and, *Herbaspirillum.* Food safety concerns and impacts of duckfeed processing are also discussed.

Presentation Types

Oral

GABFI: Generation and Analysis of Bioplastics from and for the Farming Industry

Stephen Foster

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Abstract

Pot ale, a liquid by-product of whiskey distillation, varies significantly in its composition depending on raw materials, fermentation conditions, and distillery-specific processing methods. Its natural variability presents both challenges and opportunities for its valorisation, particularly in bioplastic production. Understanding these differences is crucial for it's optimisation as a feedstock for sustainable material applications. This study characterises pot ale samples from multiple Irish distilleries, focusing on key chemical and physical properties, including protein and nitrogen content, pH, moisture, ash composition, and structural properties. Analytical techniques such as LECO protein analysis, FTIR spectroscopy, Shore A hardness testing, and solubility studies were employed to assess how distillery practices influence pot ale composition. The results reveal substantial variability, with protein content ranging from 0.7% to 4.84%, nitrogen levels between 0.112% and 0.774%, and pH values spanning 3.49 to 4.44. Differences in ash content and structural integrity further highlight how raw material selection and distillation techniques shape pot ale characteristics. This compositional diversity has direct implications for bioplastic formulation, affecting polymerisation potential, mechanical strength, and biodegradability. By mapping the range of pot ale properties, this study provides essential data for optimising biopolymer synthesis and tailoring formulations to specific applications. Future research will focus on refining processing techniques to enhance material consistency while leveraging pot ale's natural variability to develop customisable, biodegradable plastics suited for different industries. The work underscores the importance of understanding by-product variability in sustainable material development, advancing the potential of pot ale as a high-value feedstock in the circular economy.

Presentation Types

Poster

The Role of Multi-Actor Interventions in Reducing Food Loss and Waste: A Systematic Literature Review

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Abstract

Food loss and waste (FLW) is a pressing global issue with profound environmental, economic, and social consequences, accounting for one third of food produced annually and 8-10% of global greenhouse gas emissions. This study systematically reviewed FLW reduction interventions, filling a critical gap in the literature by emphasising the role of multi-actor systems in shaping FLW reduction decision-making and enhancing outcomes. It explores the interactions among diverse food system actors across supply chain stages, assessing their influence on the success of FLW reduction interventions.

Using bibliometric literature review techniques, the study analysed 6,848 documents from Scopus related to FLW interventions. Citation mapping was used to identify papers related to FLW prevention interventions specifically, resulting in identification of 49 papers that were analysed through systematic literature review. Science mapping revealed thematic clusters, emerging trends, and research gaps, categorising interventions by supply chain stage and type, including technological, behavioural, and policy-related measures. Technological innovations, such as crop monitoring systems, cold chains, and active packaging, improve efficiency and reduce FLW, while behavioural and policy interventions, including educational campaigns and economic incentives, address systemic inefficiencies.

The findings underscore the importance of cross-sector collaboration and accessible technologies in FLW reduction. Technological innovations, such as crop monitoring systems, cold chains, and active packaging, improve efficiency and reduce FLW, while behavioural and policy interventions, including educational campaigns and economic incentives, address systemic inefficiencies. This review advances the literature on FLW and food systems governance, offering actionable insights for stakeholders and aligning with the UN Sustainable Development Goals and climate action targets.

Presentation Types

Oral

Behavioural Drivers of Household Food Waste: A Segmentation Study for Targeted Interventions

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Abstract

Private households are responsible for approximately 30% of consumer food waste in developed countries. Generation of household food waste is driven by several complex behaviours related to various food acquisition and management activities, including planning, shopping, storing, preparing, and disposing of food. Addressing the issue of consumer food waste therefor requires identification of specific consumer sub-populations and a thorough understanding of their behaviours to design effective interventions aimed at reducing household food waste. To this end, our study focused on identifying and quantifying the key food waste-related behaviours, as well as drivers such as the motivation to avoid waste.

A cross-sectional survey was developed, tested and circulated online over the course of one year (2023-2024) across all counties of the Republic of Ireland and was completed by 994 Irish households, representing 3,163 individuals. Preliminary statistical analysis categorized the volumes of household consumer-generated waste into three levels: low, medium, and high waste generators. Low-waste generators produced 158.19 g/capita/week (SD=78.66), with fruits and vegetables accounting for the highest volume of wasted food items. Medium-waste generators produced approximately 459.48 g/capita/week (SD= 107.28), with fruits and vegetables dominating the waste stream. High-waste generators produced about 1,284.1 g/capita/week (SD= 787.61), with bread and milk emerging as the most wasted food items.

Moving forward, the study will employ hierarchical clustering to generate consumer clusters based on food handling behaviours and the levels (volumes) of waste generated. The primary outcome is to identify distinct groups of households that share similar patterns of food waste generation and behaviours. By integrating behavioural and demographic insights with advanced clustering techniques, this research enhances the understanding of household food waste and provides actionable recommendations for designing targeted and effective interventions to reduce waste.

Presentation Types

Oral

The Circular Bioeconomy: Identifying Key Regional Resources and Needs Across Europe

Thomas McCarthy ORCID iD[1], Patrick Forrestal[1], Carmen Dominguez[2]

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Abstract

The effective use of biomass is projected to play a key role in meeting climate targets globally. European (EU) member states increasingly consider resource-efficient biomass use in achieving these targets. The circular bio-economy aims to maximise biomass utilisation in agricultural, forestry and food production, being intrinsic to closing nutrient loops, reducing reliance on synthetic fertilisers in agriculture, and thereby lowering the carbon footprint and water quality degradation implications associated to agricultural production. The upcycling, valorisation and processing of biomass waste streams requires a detailed synopsis of the resources available in a region, along with the processing needs of industry stakeholders in order to effectively transition towards more circular processes. The aim of this project was to identify the key biomass resources available in 6 EU member states and their current uses, as well as to identify and prioritise the key processing needs required in each region for a socio-ecological transition to the circular economy. BBioNets is a European project with six established regional Forest and Agriculture Networks (FANs) in EU member states (Ireland, Spain, Greece, Italy, Poland, Czech Republic), which promotes and advances management and processing of agricultural and forest biomass with Bio-Based Technologies (BBTs). Workshops were held in each FAN to identify the regional resources and needs. The predominant regional resources available were reflective of the dominant primary industries in that region. Key needs identified included a lack of appropriate processing technologies, such as incinerators for producing biomass ash, mulchers for processing forestry debris, and anaerobic digesters. Governmental support in appropriate funding and access to technology and infrastructure enabling BBT processing is also identified in a number of regions.

Presentation Types

Poster

Production of biochar from wastes in Ireland and their bioremediation potential

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Abstract

Biowaste including solid waste, animal waste, sewage sludge, industrial sludge, and forest waste can be used to produce biochar through pyrolyzing the biomass in the absence or under limited supply of oxygen at a temperature ranging from 300 to 700°C and obtaining a carbon-rich structure that can be used in many industries. The conversion of biomass into biochar is a rapidly growing field in the waste management area as it offers sustainable solutions for waste disposal, laying the foundation to treat waste as a valuable resource rather than an undesirable by-product.

Biochar can be used in soil and water remediation, enhancing soil fertility, increasing water retention capacity and organic content in soil, while also absorbing organic and inorganic pollutants from water and soil. The bioremediation capacity of biochar is conferred by the chemistry, pore structure and specific surface area of biochar, and these characteristics are determined mainly by the feedstock and pyrolysis conditions (temperature and residence time) used to produce the biochar.

The aim of this project is to produce and characterize biochar´s produced from biowastes and to evaluate the effect of the biochar materials produced on soil microbiome dynamics, plant growth, in addition to the effect of biochar on microplastic and heavy metal accumulation and removal in wastewater. The study also seeks to promote waste management and biomass valorization, with a sustainable technique that aligns with the SDGs on circular and eco-friendly economy.

Keywords: Biochar, waste, bioremediation, wastewater

Presentation Types

Poster

Farm-to-fork quantitative microbial risk assessment (QMRA) of four waste-pathogen combinations from land-spreading in Ireland

Jennifer McCarthy[1,2], Paul Hynds[2], Declan Bolton[3], Jesús Frías Celayeta[2]

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Abstract

Land-spread biowastes may pose food- and waterborne public health risks, particularly via consumption of horticultural produce and groundwater supplies in Ireland. These biowastes provide a valuable approach for sustainable waste management in the circular bioeconomy, with Ireland generating ≈85 million and ≈60,000 tonnes/annum of animal manures and biosolids, respectively. These risks can be estimated via quantitative microbial risk assessment (QMRA), which is a mathematical modelling tool to measure the probability of human infection due to pathogenic exposure from environmental sources. Distributed concentrations for four waste-pathogen combinations (W-PCs) (i.e., bovine slurry-STEC O157/O26, bovine slurry-*C. parvum*, broiler litter-*C. jejuni*, and biosolids-norovirus GI/GII) from land-spreading were derived from 19 farm-level datasets via a scoping review and meta-analyses and fitted with generalised additive models. Parameters for initial $\log_{10}$ concentrations in exposure assessment of QMRA included STEC O157/O26 (Weibull distribution; μ=1.62, p=2.16×10^{-7}; σ=1.77, p=0.001; n=8), *C. parvum* (Weibull; μ=1.71, p=0.0002; σ=1.2, p=0.04; n=6), *C. jejuni* (Weibull; μ=1.73, p=0.001; σ=1.24, p=0.05; n=5), and norovirus GI/GII (normal; μ=1.33, p=0.02; σ=0.68, p=0.002; n=15). Additional model parameters for farm-to-fork QMRA were extracted from the literature. A QMRA modular framework was developed via directed graphical model chains and systems dynamic modelling to represent the complexity of the farm-to-fork system. Several mathematical and computational models were integrated into the QMRA architecture (i.e., compartmental and agent-based models; Markov chain Monte Carlo methods) to characterise uncertainty and variability associated with model parameters for increasingly accurate risk estimates. Preliminary food- and waterborne risk estimates will be determined via iterative simulations. Subsequently, the W-PCs will be ranked via disability-adjusted life years (DALYs). This research will inform risk management and communication regarding the microbiological safety of land-spread biowastes from farm-to-fork to safeguard horticultural production and groundwater supplies in Ireland in addition to ensuring improved scenario-based waste management practices in the circular bioeconomy.

Acknowledgement: Department of Agriculture, Food, and the Marine (DAFM) grant number: R2021453

Presentation Types

Oral

Efficient nitrogen recovery from livestock manure using membrane contactor

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UCD School of Chemical and Bioprocess Engineering, University College Dublin, Dublin, Ireland

Abstract

The rapid growth of livestock production has led to the generation of large volumes of animal manure, which is rich in nutrients and organic matter. However, manure management poses significant environmental challenges, including greenhouse gas emissions from ammonia (NH_3) release and nutrient leaching that degrades water quality. Addressing these issues requires effective treatment strategies to recover nutrients which are essential for reducing environmental pollution and supporting sustainable farming practices. In the present study, we explored the application of a membrane contactor to recover ammoniacal nitrogen (ammonia nitrogen, NH_3-N and ammonium nitrogen, NH_4^+-N) from animal manure. The membrane contactor system used in this research utilizes hydrophobic dense hollow fiber membranes, enabling the selective transfer of NH_3 gas from liquid manure into an acidic stripping solution, where it is converted into a stable ammonium salt. Key operating parameters affecting mass transfer rate, including pH, flow rate, and concentration of the feed solution were optimized to enhance nitrogen recovery efficiency. According to preliminary results, membrane contactor achieved an overall mass transfer coefficient of 2.08×10^{-6} m/s and a recovery efficiency of up to 94% for ammonium present in the liquid fraction of cattle manure sample after solid separation. The membrane contactor system offers a compact, efficient, and scalable solution for nutrient recovery, reducing ammonia emissions and mitigating the environmental impact of livestock farming.

Keywords: ammoniacal nitrogen, animal manure, membrane contactor, nutrient recovery

Presentation Types

Poster

Ecological impacts of recycled derived fertilisers on soil nematode communities in commercial farms

Lilian Atira, Thomais Kakouli-Duarte

South East Technological University, Carlow, Ireland

Abstract

This study investigates the ecological impacts of recycling-derived fertiliser (RDF) blends on soil health using nematodes as bioindicators. Two trials were conducted on commercial farms in the Northwest Europe region: one in Flanders, Belgium (F1) and the other in Carlow, Ireland (F2). The research is part of the ReNu2Cycle project which aims to reduce the region's reliance on fossil-based fertiliser imports by promoting nutrient recycling from organic waste. The F1 trial tested the following RDF blends: pig urine + mineral concentrate (PM), ammonium sulphate + mineral concentrate (AM), and light fraction from pig manure + mineral concentrate (LM). Conventional synthetic fertiliser (S) and the farmer's practice (FP) (a blend of synthetic fertilisers the farmer had been using), served as references, while the unfertilised (untreated) (U) group was the negative control.

The F2 trial investigated the following RDF blends: digestate + mineral (DM), digestate + struvite + mineral (DSM), and struvite+ mineral (SM). A blend of mineral fertilisers only (MO) was used as the positive control while another with no phosphorus + mineral (NP) as negative control. The impacts on soil nematode abundance, diversity, and food web complexity were analysed using morphological and molecular techniques for nematode identification. We hypothesised that RDF application would affect these factors, influencing soil health compared to untreated controls and synthetic fertilisers.

Preliminary results showed that RDF fertilisation increases nematode abundance in both trials. All treatments in trial F1 significantly differed from the unfertilised control. LM differed from FP, PM, and S, but not AM. In trial F2, blends SM, DM, and DSM had similar impact on nematode abundance as conventional MO. The similarity in impact of the RDF blends to synthetic fertilisers suggests that they could be sustainable alternatives to conventional fertilisers for agricultural production.

Keywords: RDF, nematode abundance, nematode diversity, food security, UN-SDG

The research is supported by Interreg-NWE.

Presentation Types

Oral

Ireland's Urban Bioeconomy – Opportunities for Climate Action

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Abstract

Resource efficiency, characterised by the minimisation of consumption and waste, has significant potential to mitigate climate change. In this regard, the urban circular bioeconomy concept is gaining international and national traction among policy makers, legislators, businesses and consumers as a means to improve resource efficiency and reduce greenhouse gas emissions. This fast-track-to-policy EPA-funded desk study identifies climate action opportunities presented by urban bioeconomy development within the context of meeting Ireland's climate mitigation targets. The research findings will inform policy updates due in 2025 for the national Bioeconomy Action Plan and Climate Action Plan, and Irish and EU Bioeconomy Strategies. The 2024 Circularity Gap Report Ireland, commissioned by the Department of the Environment, Climate and Communications, assessed Ireland's circularity baseline and carbon profile. A circular built environment and a circular food system are two of five target circular economy areas that have the potential to significantly reduce Ireland's greenhouse gas emissions. While building sector operational emissions have fallen, a greater focus is needed on reducing the consumption of high-impact construction materials such as concrete to reduce embodied emissions. We consider how slowing, closing and narrowing resource loops and greater use of bio-based materials in the construction sector can contribute to climate mitigation. In addition, we explore the potential for urban food waste reduction, capture and valorisation to reduce greenhouse gas emissions.

Presentation Types

Oral

Material Flow Analysis of Recycling-Derived Fertilizers: Advancing Circularity in Nutrient Management

Milka Susan Kollannur Biju ORCID iD[1,2], S M Ashekuzzaman[1], Ciaran O'Donnell[3], Erik Meers[2], Niamh Power[1]

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Abstract

Sustainable nutrient management has become a critical concern as population and consumption continue to increase, necessitating an urgent need to enhance crop productivity by reducing emissions and decreasing dependence on mineral fertilizers, many of which are derived from finite resources. Climate change and nutrient pollution, along with the overuse of chemical fertilizers, have detrimental effects on soil health and fertility. The EU has recommended a circular economy that aims to close the synthetic fertilizer production loop and to prevent excess nutrients being dispersed into the environment. Therefore, the concept of recycling-derived fertilizers (RDFs) has emerged, which are fertilizers produced from animal manure, agri-food industry byproducts, urban green waste, and food waste from catering establishments and households. The utilization of RDFs in agriculture contributes to increased nutrient recycling rates and reduced reliance on synthetic fertilizers. Material Flow Analysis (MFA) examines material and substance flow from a systemic perspective, thereby yielding efficient results. Material flow analysis can be employed to monitor the movement of nutrients through ecosystems to assess the environmental impacts of RDFs. Through the evaluation of MFA, one can comprehend resource utilization as well as waste generation. Employing Life Cycle Assessment (LCA) in conjunction with MFA provides valuable insights into the sustainability of Recycling derived Fertilisers. The integration of these analytical methods promotes a circular economy, consequently reducing the utilization of non-renewable resources and mitigating environmental pollution and degradation.

Presentation Types

Poster

Surface density and plantlet abundance influence yield of floating Azolla filiculoides used to remediate an agri-food wastewater.

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Abstract

The agri-food sectors consume substantial quantities of treated freshwater annually, making the optimization of water reuse essential. Biological treatments can enhance remediation of agri-food wastewaters in an eco-friendly manner. The water fern, *Azolla filiculoides* (Azolla), is a floating aquatic plant capable of rapid growth, particularly in nutrient-rich wastewater environments. Moreover, Azolla is increasingly utilized as an alternative protein source for livestock due to its high crude-protein content (25-30%). The integration of Azolla into a wastewater management system can support the valorisation of agri-food wastewaters, promoting a closed-loop nutrient cycle where nitrogen and phosphorus are recovered by Azolla and retained within the agri-food chain through incorporation of Azolla biomass into livestock diets. Preliminary investigations indicate Azolla can be cultivated using effluent from a large industrial meat processor, that had undergone primary treatment. The effects of plant density (10, 20, 40, and 60% of surface cover) and plantlet abundance (1, 2, 3, and 6 of fragments) on growth were assessed over seven days under controlled laboratory conditions. The relative growth rate and chlorophyll fluorescence measurements were used to examine the influence and relevance of plant growth, as well as the impact of the plant physical parameters. Findings will underpin the development of Azolla-based phytoremediation and high-protein biomass production as part of agri-food wastewater management.

Presentation Types

Poster with 5 min oral presentation

Developing the Social-Cultural Dimension of Sustainability Assessment for Recycling-Derived Fertilizers in Northwest Europe.

Robert Ludgate ORCID iD[1,2], Milka Susan Kollannur Biju ORCID iD[1,3], Niamh Power ORCID iD[1], Maximilian Zoll[4], Katharina Gapp-Schmeling[4], Katja Weiler[4]

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Abstract

Recycling derived fertilisers (RDFs) offer a sustainable substitute to conventional mineral fertilisers, contributing to sustainable agricultural practices. To be sustainable you need to ensure that the three pillars of sustainability are met, namely environmental, economic and social. However, a comprehensive sustainability assessment addressing these dimensions, with a focus on social-cultural dimensions is lacking across current literature. Our research focuses on the methodological development of RDF assessment across these pillars within a multi-criteria framework to develop a market for RDFs across North West Europe. This study will adapt an existing sustainability assessment framework, developed within the context of RDFs.

Underpinning this methodology is a co-creation approach rooted within a Living Lab ethos involving our internal research team, but also across our network, designed to deliver joint value to all involved stakeholders. This participatory process ensures that the framework will reflect the diverse stakeholder perspectives whilst maintaining scientific rigor. The social-cultural dimension will emphasise stakeholder awareness, equity, collaboration amongst other elements as critical factors for advancing market development and transformation.

This work will describe the methodology development through our co-creation ethos used for criteria development and will explain how the indicators within the social-cultural dimension have been defined and will be put into practice. This methodology lays the groundwork for future research RDF market development and their potential for broader application in advancing socio-ecological transformation.

Presentation Types

Oral

Duckweed cultivation on fish processing wastewater for biomass production and wastewater remediation

Alexandra Katsara ORCID iD, Marcel Jansen

University College Cork, Cork, Ireland

Abstract

Seafood processing industries generate significant volumes of highly polluted wastewater posing serious environmental challenges. To avoid negative impacts on the environment, expensive wastewater treatment is required. As part of the EU funded IMPRESS project, the characteristics of seafood processing wastewaters were identified, focussing on the different processing stages. Furthermore, the potential cultivation of duckweed species on fish processing wastewaters was assessed. The focus was on biomass production and remediation. Duckweed (*Lemna minor*) cultivation on some, but not all, fish processing wastewaters resulted in good growth measured as a relative growth rate (RGR). Different dilutions (25%, 50% and 100%) of wastewater from the fish filleting stage gave great growth of *L. minor*, and plant health was good as ascertained using chlorophyll fluorometry. Different adjustments were applied to the wastewater to optimize *L. minor* biomass growth, including pH adjustment, addition of micro-nutrients and of calcium and magnesium. Dilutions of 25% and 50% of the "raw" fish wastewater were found to be optimal for duckweed cultivation. Additionally, duckweed cultivation trials on pre-treated fish processing (filtered) waters were performed during this period. Fish processing wastewater from which only protein had been valorized, using alkali extraction, presented good duckweed growth and excellent photosynthetic activity. Thus, the data show that a cascading approach of protein harvesting followed by duckweed valorization is a realistic route for further exploration. This research is a part of the EU funded IMPRESS Project, which explores the characteristics of the wastewaters at the different processing stages of seafood, and assesses the potential of duckweed species to grow and produce valuable biomass for various applications, while simultaneously remediating the wastewater.

Presentation Types

Poster with 5 min oral presentation

Navigating the regulatory framework for the advancement of agrifood innovation in bioeconomy development.

Theresa Rubhara ORCID iD[1], Hannah Gould ORCID iD[2], Robert Ludgate ORCID iD[3], Luke Kelleher ORCID iD[2], Eoin O'Neill ORCID iD[2], Helena McMahon ORCID iD[1]

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Abstract

The bioeconomy policy development is complex in that the bioeconomy broadly focuses on the use of renewable biological resources which spans from different sectors including agriculture, food, marine, forestry and energy. Most of these key subsectors are already heavily regulated from their own sectoral policies which sometimes act as a barrier for bioeconomy development. As part of the Enable Bio project whose aim is to develop a roadmap towards an enabling regulatory environment in bio-based sectors, this research provides a snapshot of the current regulatory framework impacting agri-food waste streams and the circular bioeconomy in Ireland.

A desktop study was carried out to create a database of the regulations impacting agrifood waste management and their relationship to the circular bioeconomy**.** Common waste streams included dairy waste, inedible animal body parts, manure, seafood waste and wastewater from agrifood processing. These waste streams can be used in innovations such as biorefineries to develop different bio-based products such as pharmaceuticals, food additives and bioenergy. Key policy documents and legislation were identified at EU and national level, and it was noted that most Irish statutory instruments are transpositions of EU directives, ensuring coherence between national and EU regulations. The regulations address waste management, environmental protection, climate action, agriculture, and circular economy. Regulations such as The Circular Economy Act can be key enablers promoting waste reduction and valorisation thereby supporting innovation in the circular bioeconomy. On the other hand, licencing costs and complexities in attaining the licences can hinder bioeconomy development. This research supports action points 1.5.1 in the Ireland Bioeconomy Action Plan of understanding the current regulatory framework by providing a summary of key policies and legislation affecting the bioeconomy.

Presentation Types

Poster

Shellfish processing wastewater: rich in nutrients but poorly valorised

Iván Loaiza ORCID iD, Neil Coughlan, Gavin Burnell, Marcel Jansen

University College Cork (UCC), Cork, Ireland

Abstract

The seafood processing industry generates large volumes of wastewaters that are released to the environment following variable treatment processes. The composition of shellfish (e.g., mussel, crab) processing wastewater is dependent on the processing technology used, shellfish species and quantities processed, as well as the final product, among other factors. Mussel processing wastewater, for example, can contain up to 860 mg L^{-1} biochemical oxygen demand (BOD_5), 250 mg L^{-1} ammonia (NH_3-N) and ammonium (NH_4-N), 2000 mg L^{-1} total nitrogen (TN), 2400 mg L^{-1} sulphates (SO_4^{2-}) and 20 g L^{-1} chloride (Cl^-). There are marked differences in concentrations of BOD_5, chemical oxygen demand (COD), total suspended solids (TSS), NH_3-N, and fats, oils and grease (FOG) in the processing wastewaters from different shellfish group of species. Ranked from high to low concentration are wastewaters from: mussel> crab> fish> scallop> shrimp> clam> sea snail > oyster> lobster≥ squid. In most cases, concentrations exceed the international standards and limits for effluent discharges. Yet, processing wastewater is a rich source of nutrients and minerals that can be utilised. It is estimated that valorisation of fats (e.g., eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) from mussel processing wastewater may generate a monetary value of up to 65 000 USD per tonne of shellfish processed. Another innovative approach is to cultivate complementary species, e.g. plants or algae, on wastewater resulting in remediation and valorisation. These approaches are aligned with circular economy principles and can contribute towards the goal of a zero-waste industry.

Presentation Types

Poster with 5 min oral presentation

Fog-o-ponics cultivation of aquatic plants? A case study for duckweed

Iván Loaiza ORCID iD, Marcel Jansen

University College Cork (UCC), Cork, Ireland

Abstract

Aero or fog-ponics is a method of growing plants without soil or a substrate. It is a well-established horticultural practice, mostly for terrestrial plants where the roots are suspended in the air and irrigated with a nutrient-dense mist or fog. Duckweed *Lemna minor* is a small, free-floating and unrooted aquatic plant. In this research study, we assess the growth of the duckweed species *L. minor* suspended on a fabric textile (UNMF) under a nutrient-rich medium (half-strength Hutner's solution) provided as a fog. Experiments using this fog-o-ponics system were conducted with *L. minor* under different (e.g., light, fog-duration times,..) conditions. The best growth of *L. minor* was a relative growth rate (RGR) of 0.24 d^{-1} under 50 µmol m^{-2} s^{-1} of light intensity. For fog-duration times, a constant fog provided the best condition for *L. minor* culture (e.g., RGR of 0.22 d^{-1}, significantly higher than the 0.14 and 0.19 d^{-1} found for the 15 | 45 min and 30 | 30 min fog on-off conditions, respectively). The Chl *a* parameters Fv/Fm and Y(II) also exhibited the highest values for the *L. minor* cultured in the constant fog treatment, about 0.7 and 0.5 for Fv/Fm and Y(II), respectively, which means they were in a good health condition. These results reveal that the duckweed *L. minor* can efficiently grow in this fog-o-ponic system, therefore an innovative upscaling system of UNMF multi-layers is considered for further experiments. The removal of the water column on which duckweed is grown, the use of the UNMF and the nutrient-rich fog can achieve a considerable space saving and minimize the weight required per culture layer for this plant.

Presentation Types

Oral

BioBeo bioeconomy education programme: From sustainable systems engineering to saving the curlew from extinction

Thomas P. Curran ORCID iD[1,2], Máire Nic an Bhaird ORCID iD[3,2], Laoise Ní Chléirigh ORCID iD[3,2], Clare Patten[4]

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Abstract

BioBeo is a Horizon Europe project which is developing a bioeconomy education programme from preschool to university level. The consortium covers 10 European countries with 15 partners including UCD (coordinator), Maynooth University (education lead) and An Taisce Green Schools (newsletter). The bioeconomy means using renewable biological resources from land and sea, like crops, forests, fish, animals and micro-organisms to produce food, materials and energy. Learning materials have been created across five themes: food loop, forestry, life below water, outdoor learning and interconnectedness. Lesson plans have been designed to facilitate implementation by educators within appropriate time slots across target age groups and according to relevant Sustainable Development Goals. The consortium is engaging with the European Commission in updating the EU Bioeconomy Strategy. The project outputs including a song, comics, animated videos, newsletter, board games, and Bioeconomy Matters podcast, can be downloaded from the website www.biobeo.eu. The free BioBeo Buzz monthly newsletter is available for email subscription through the HEA list server and is an effective tool to highlight bioeconomy information in an accessible way for all ages using short articles, puzzles, and jokes; it is intended to continue the newsletter after the end of the project. The BioBeo resources range from quite high-tech sustainable systems engineering issues explained in animated videos to using a comic for highlighting the urgency of saving the breeding curlew from extinction in Ireland. There is a continuous thread of outlining the importance of nature being a prerequisite for a thriving bioeconomy to address the biodiversity and climate crises. The curlew comic shows how education and public engagement is critical in ensuring a healthy ecosystem can co-exist with the BioBeo themes of food loop, forestry, life below water, outdoor learning and interconnectedness.

Keywords: bioeconomy, education, biodiversity, interconnectedness

Presentation Types

Oral

Antimicrobial and Antioxidant Activities of Filamentous Fungi Mycelium Cultivated on Dairy Whey Permeate

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Abstract

Dairy whey permeate (DWP), a by-product of cheese production, is rich in lactose and essential nutrients. While its high nutrient content poses challenges for waste management, it also offers significant potential as a substrate for fungal biomass production. This study evaluates the antimicrobial and antioxidant properties of the mycelium of four filamentous fungi species — *Ganoderma lucidum*, *Pleurotus ostreatus*, *Laetiporus sulphureus*, and *Fomitopsis betulina* — from the phylum Basidiomycota. The fungi were cultivated for 14 days on non-autoclaved DWP. A 5% (w/v) whey solution was prepared, centrifuged at 10,000 rpm for 15 minutes, and the supernatant was used as the growth medium. The antioxidant activity of the freeze-dried fungal biomass was assessed using the DPPH radical scavenging assay and expressed in Trolox equivalents per 100 g (TE/100 g). Antimicrobial activity was evaluated against bacterial strains isolated from DWP to determine the fungi's ability to thrive under non-sterile conditions — a key factor for large-scale applications. Bacterial identification was conducted using a metabolic approach with the Biolog system. Initial microbiological analysis revealed high bacterial contamination of DWP (~10^4 CFU/mL), including *Bacillus hwajinpoensis*, *Brevundimonas vesicularis*, *Stenotrophomonas maltophilia*, and *Microbacterium maritypicum*. After 14 days of fungal cultivation, distinct differences were observed in the bacterial communities of the cultures. In *P. ostreatus* and *F. betulina* cultures, only *B. hwajinpoensis* persisted, whereas *G. lucidum* cultures retained *B. hwajinpoensis* and *M. maritypicum*. In *L. sulphureus* cultures, only *M. maritypicum* was detected. Antioxidant activity, as determined by DPPH assay, ranked the fungi as follows: *L. sulphureus* (3.92 µM TE/g), *P. ostreatus* (0.91 µM TE/g), *F. betulina* (0.18 µM TE/g), and *G. lucidum* (0.03 µM TE/g). These findings demonstrate the dual functionality of fungal mycelium as both antimicrobial and antioxidant agents, presenting a sustainable approach for the valorization of dairy waste permeate.

Presentation Types

Poster

Ammonia recovery from agricultural manure by Hollow Fibre Membrane Contactors: Process simulation

Niloufar Azizi[1], Dominika Krol[2], Shaun Connolly[2], Eoin Syron[1]

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Abstract

The emissions of ammoniacal nitrogen (NH_3 and NH_4^+) from agricultural manure have increased, and their presence in the environment can cause global warming and toxicity problems. Ammonia emissions from manure occur naturally, being accelerated by pumping and land application of slurries and agricultural manure is the main source of nitrogen emissions in Ireland. However, ammonia is also an important component of fertilizer. Membrane technology is one of the potential technologies for ammonia recovery with the potential for deployment at a smaller Irish Farm scale. This study explores the operation of the Hollow Fibre Membrane Contactor (HFMC) as a suitable method for recovering ammonia from agricultural manure. Using the Aspen Plus V11 Simulation software, an HFMC was simulated, and operational factors were investigated to determine suitable operating conditions to recover ammonium sulphate from agricultural manure. Results show that increasing the pH value of the manure up to 10 promotes overall mass transfer while a further increase to 11 resulted in only a slight improvement. The manure velocity through the membrane and pH were shown to be crucial factors in determining efficient HFMC operation.

Presentation Types

Poster

Sustainable Cellulose Extraction from Distiller's Spent Grains Using Deep Eutectic Solvent

Abolore Rasaq ORCID iD, Amit Jaiswal, Swarna Jaiswal

Technological University Dublin, Dublin, Ireland

Abstract

Cellulose fibre has gained great interest in various industrial applications due to its excellent properties, such as biodegradability, biocompatibility, and renewability. Lignocellulosic food industry wastes, such as Distiller's Spent Grains (DSG), which is a by-product of whiskey production, present significant environmental burdens worldwide. This current study investigates the application of deep eutectic solvent for the selective dissolution of DSG for cellulose recovery using a biorefinery approach. Milled DSG was treated with a DES composed of choline chloride formic acid in a specific molar ratio. The DSG and DES mixture was subjected to heat treatment using an autoclave at different temperatures and time to determine the optimum condition for the pre-treatment of DSG giving the desired cellulose yield and purity. The cellulose-rich residue was further bleached with peracetic acid to obtain a white purified cellulose fibre. Advanced analytical techniques such as X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) were used to evaluate the impact of processing conditions on the final quality of the extracted cellulose. Under optimal conditions, DES solubilises lignin and hemicellulose and significantly improve cellulose content of the residual crude cellulose fibre. After purification, coloured residual lignin were further remove and cellulose purity increased. DES showed promising potential as an efficient, green, and environmentally friendly cellulose extraction method. Further, the utilisation of DSG as a low-cost feedstock for cellulose fibre production will support the quest for alternative lignocellulosic feedstock for cellulose production, reduce waste, promote circular bioeconomy and enhance the sustainability of the Irish distilleries.

Presentation Types

Oral

Choco Chase: A Board Game for Bioeconomy Education and Sustainability Awareness

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Abstract

As part of the BioBeo Horizon Europe project, Choco Chase is an educational board game designed to teach secondary-level students the principles of the circular bioeconomy and its role in achieving sustainability. The game integrates the themes of food production, circular economy, and interconnectedness with nature. Players navigate challenges in sustainable chocolate production, from sourcing raw materials to reducing carbon footprints while learning how their choices impact biodiversity, climate, and local communities. The educational aim of Choco Chase is to simplify complex bioeconomy concepts using tools such as Life Cycle Analysis (LCA) and resource efficiency in an interactive and engaging format. The game also incorporates lessons on unsustainable practices' environmental and social consequences, reinforcing the importance of achieving Net Zero emissions. This aligns with the broader BioBeo themes, which aim to promote circular bioeconomy education across all age groups. Field testing with educators and students has shown that the game is an effective tool for fostering an understanding of circular bioeconomy concepts. It encourages critical thinking, collaboration, and decision-making, making it an innovative addition to circular bioeconomy education materials. The game complements the BioBeo programme's broader outputs, such as comics, podcasts, and videos, by offering an interactive learning experience emphasising the interconnectedness of biodiversity and the bioeconomy.

Keywords: bioeconomy, education, sustainability, Life Cycle Analysis (LCA), circular economy.

Presentation Types

Oral

Theme: Climate Change Mitigation and Adaptation

Between Nature, Culture, and Community: Climate Change Vulnerability of Cultural Landscapes and Intangible Heritage

Samantha Tobiáš ORCID iD

UCD, Dublin, Ireland

Abstract

Climate Vulnerability Assessments (CVAs) are commonly used to quantify the degree to which a system is susceptible to adverse climate change effects. An innovative CVA framework with the aim to integrate community voices and landscape-level perspectives was designed, researching the impacts and challenges climate change poses to intangible heritage practices contributing to landscape management of living cultural landscapes. Based on a post-human research paradigm and state-of-the-art climate vulnerability research, this CVA framework utilises documentary climate science research, global examples of long-term adaptation strategies, and quantitative and qualitative primary research documenting the experiences of a vulnerable community.

The pilot case study in Connemara, Ireland, is located in a rural, marginalised area with traditional, biocultural heritage threatened by and exposed to rapid climate change. This includes traditional landscape management practices, cultural heritage sites of national importance, and internationally significant ecological sites. Through community interviews and observational landscape-level research, key landscape features of particular value to the local community are emphasised. To enable landscape quantification, landscape types are defined. While this research illustrates some preliminary results from this pilot study application, it also discusses the challenges faced en route to an iterative, community-integrated assessment framework of climate vulnerability and how the framework may contribute to climate adaptation on landscape-level.

Ultimately, the production of a spatial GIS representation of climate vulnerability overlaid with the cultural geographies of intangible heritage and the landscape is the aim of this research project to contribute to a holistic interpretation of the sites' abilities to adjust to climate change.

Presentation Types

Oral

Climate Action in Irish Sporting Organisations: Mitigation, Adaptation, or Something Else?

Barry OSullivan

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Abstract

The ever-intensifying immediacy of climate change and environmental degradation has heightened the significance of climate action and environmental sustainability initiatives for all organisations. Sporting organisations are no different, and like other elements of society face pressures to become more sustainable and reduce their environmental impact. However, the types of climate action undertaken by sporting organisations vary greatly, and literature notes a need for a more comprehensive understanding of these activities in terms of their scope and structure. Utilising theoretical influences from sport ecology and the green waves of environmentalism in sport, this research uses content analysis to examine the online communications of League of Ireland football clubs over a five-year period. Analysis indicates that while clubs are engaged in a range of mitigation efforts, there is no evidence of involvement in adaptive measures. Notably, data supports the emergence of various other types of climate related actions. These will be examined and discussed during the presentation, with appropriate examples provided. This study advances knowledge of climate action in Irish sporting organisations and highlights the important role that clubs play in environmental sustainability involvement.

Keywords: sport ecology, sport and the environment, environmental sustainability, football and climate change.

Presentation Types

Oral

Could a national rainwater harvesting strategy contribute to climate change mitigation in Ireland.

liam mccarton ORCID iD

TU Dublin, Dublin, Ireland

Abstract

The primary aim of this research study was to evaluate the impact of rainwater harvesting (rwh) as a climate change mitigation tool in Ireland.

A new integrated water resource management tool (ReWateR) was developed and validated using daily water use data from rwh systems in Ireland. The rwh performance efficiencies were optimised by varying the usable storage volume within the system in response to extreme weather patterns (droughts or storms). Several new dimensionless coefficients were developed and these have been subsequently integrated into Irish and European codes of practice.

This study also investigated the impact of the spatial variability of rainfall on the performance of rwh systems within a catchment. To evaluate the range of possible rwh performance within the living lab catchments under different rainfall extremes, the ReWateR model used the same water demand data but varied the rainfall inputs. The 10th, 50th and 90th percentiles, derived from the thirty-year daily rainfall dataset were used as representative of wet, average and dry years for the catchment. The outputs from this analysis produced a set of reliability charts which describe the tank supply efficiency, mains water supply, reliability and roof run-off reduction. To generalise the reliability charts, a total of twenty-six spatially distributed rainfall catchments to represent the national variation in rainfall were selected from the Met Eireann daily rainfall dataset. Using these datasets, ReWateR was used to develop a set of design charts to optimise rwh system performance. Moreover, a new set of design equations was derived from the ReWateR modelling results using historical Irish rainfall. These design equations can be used to optimise tank supply and corresponding stormwater attenuation efficiency based on the Yield/Demand ratio.

The impact of this research is that this methodology can be applied to any catchment within any region in Ireland (or elsewhere).

Presentation Types

Oral

The use of mobile LiDAR in the estimation of above-ground biomass stores in commercial forests

Luke Dowd ORCID iD, Brian Tobin ORCID iD

University College Dublin, Dublin, Ireland

Abstract

Above-ground biomass (AGB) is a key metric for assessing forest productivity and carbon storage, both of which are essential components of effective forest management and climate change mitigation strategies. Traditional methods for quantifying AGB rely on allometric equations derived from destructive sampling. However, this approach is labour-intensive, time-consuming and exhibits biases, particularly underestimating AGB in larger trees due to a sampling preference for smaller trees. Recent advancements in LiDAR, specifically handheld mobile laser scanning (MLS), present an innovative and non-destructive alternative for AGB estimation.

In this study, MLS was used to capture high-density point cloud data (~300,000 points per second) from standing sample trees prior to destructive sampling, enabling direct comparisons between destructive measurements and scanned data. The weights of stem, branch and foliar biomass were measured in the field. The MLS data were used to estimate multiple stem diameters and volume up to the height of the last reliable diameter measurement (9-11 meters into the stem). While the upper end of the stem was estimated using a species-specific stem-taper equation. Total stem volume was converted to biomass for direct comparison with the measured values. The stem represents the most substantial potential for long-term climate mitigation as its carbon can be sustainably locked into harvested wood products. Thus improvements in its assessment are important for accurate carbon accounting.

This approach demonstrates the potential of MLS technology to deliver accurate and efficient biomass quantification, with potential implications for emerging carbon markets. It has the capacity to greatly enhance the accuracy and efficiency of forest inventories. Additionally, integrating MLS-derived data into forest growth models presents exciting opportunities for developing precise growth projections, particularly for uneven-aged stands.

Presentation Types

Oral

Towards Improved Biogenic Carbon and Land Use Accounting for European Wood Products

William Horan[1], Michael Quilligan[1], George Bishop[2], David Styles[2]

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Abstract

A critical review of sawlog and sawn wood Life Cycle Inventory (LCI) processes from commercial Life Cycle Assessment (LCA) databases identified a need for more disaggregated datasets for forest products to ensure consistent accounting for land requirements and biogenic carbon flows through wood (by)products. Critical factors include national and regional basic wood density by tree species, forest productivity by ecological domain, wood product market breakouts, and sawn wood production system efficiency. This study provides preliminary European Union (EU) country-specific biogenic carbon LCI data for coniferous sawn wood by tree species, linking (1) merchantable wood productivity for even aged conifer plantations from the EU Carbon Budget Model, and (2) sawn wood production outputs based on national product breakouts and sawmill product efficiency factors. Biogenic carbon storage potential of sawn wood products is found to range from 0.703 - 1.15 tCO_2/m^3 for disparate species throughout Europe at 10% moisture content. This study provides the first robust EU-wide land occupation comparison of dried sawn wood by species, which is found to range from 976 to 26,184 m^2.yr per m^3. Incorporating these factors into LCA of construction and wood value chains, based on wood source country, could enhance accuracy of climate mitigation attribution and enable integration of wood use in construction with land use models.

Presentation Types

Oral

Blue light effects on human health and biodiversity: An assessment of current Irish and European knowledge

Antonello Durante ORCID iD[1], George Amarandei ORCID iD[2,3], Anna Crowley[2,3], Siofra Harrington ORCID iD[2,3], Grainne Scanlon ORCID iD[2,3], Paul Hynds ORCID iD[1]

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Abstract

Plants and animals operate on a 24-hour cycle governed by the sun, with humans relying on environmental signals (e.g., diurnal cycles) to regulate their internal biological clocks and key physiological processes, including sleep, blood pressure, heart rate, and hormone secretion. The relationship between humans and lighting has changed dramatically over recent decades. Modern lifestyles have increasingly drawn people away from outdoor activities, resulting in an ongoing reliance on self-illuminated devices and environments (i.e., computers, tablets, TVs and smartphones for work and leisure). In concurrence, light-emitting diodes (LEDs) have gradually replaced traditional light sources due to higher energy efficiency.

LED illumination, along with computers and smartphones, emit significantly more (high energy) blue light than traditional incandescent bulbs. Depending on their correlated colour temperature and brightness, blue light content can range from 15% to 47%, compared to just 9% in incandescent bulbs. This marked excess can have harmful effects on human health and the environment. Short-wavelength electromagnetic radiation, including blue light, can be toxic to the retina and disrupt circadian rhythms, leading to myopia, sleep disorders, hormonal imbalances, increased stress, and an increased incidence of conditions including diabetes, breast and prostate cancers. It may also impact the environment by affecting biodiversity and altering patterns of predation and migration.

Accordingly, the European Environment Agency has recently recommended the introduction of new thresholds, guidelines, and policies to minimise the effects of blue light exposure. However, to date, EU member states including Ireland lack specific regulations, with only non-binding guidelines in place to address the health risks associated with blue light exposure and light pollution. Findings of our analysis of current knowledge across Europe indicate that no academic research on this topic has been conducted in Ireland. The EPA-funded Blu-RAY project aims to address this gap.

Keywords: blue light, health effects, LED technology

Presentation Types

Oral

Influence of community functional traits on productivity and stability in Irish semi-natural grassland habitat.

Eoin Halpin[1], Oliver Lynch Milner[2], Astrid Wingler[1], Fiona Cawkwell[1], Samuel Hayes[1], Karen L. Bacon[2]

[1]University College Cork, Cork, Ireland. [2]University of Galway, Galway, Ireland

Abstract

The aim of this research project is to investigate the diversity of functional traits and strategies in Irish semi-natural grassland communities and how these strategies influence wider ecosystem services such as productivity, yield stability and carbon sequestration. Grasslands are highly dynamic ecosystems, and their ecosystem services are greatly influenced by environmental perturbations and climatic changes. Plant functional traits indicate optimal survival strategies in response to the external environment. Community level functional traits can also influence ecosystem level functions. Plant traits (leaf area, specific leaf area, leaf dry matter content and root length density) were determined in Irish semi-natural grassland habitats. The diversity of plant traits and strategies was analyzed using both emergent and well-established functional diversity metrics, such as community weighted mean values, functional evenness and Rao's functional divergence. These were then compared against soil measurements that are established proxies for both environmental conditions and ecosystem processes. The results thus far suggest positive relationships between some functional diversity metrics and carbon content in the soil. Significant differences were found between grassland habitat types in relation to soil parameters and functional composition of vegetation.

Presentation Types

Oral

Investigating the effect of warming temperatures on carbon sequestration in salt marsh habitats

Ragna Hoogenboom, Grace Cott

University College Dublin, Dublin, Ireland

Abstract

Coastal ecosystems categorised as blue carbon habitats provide a globally significant ecosystem service by sequestering and storing carbon, but due to environmental change, the carbon capture mechanism may be affected. The carbon balance is determined by the uptake of carbon into the soil and the release of carbon through soil decomposition. As temperatures increase, both primary production rates of vegetation and soil decomposition rates are predicted to increase in temperate regions. In an effort to better understand future carbon sequestration rates of macro-tidal East Atlantic salt marsh ecosystems under global warming scenarios, a long-term in situ passive warming experiment is set up. Using custom-designed open-top chambers (OTC) at Derrymore Island, Co. Kerry high marsh and mid-marsh communities are exposed to increased temperatures. Using methods for determining carbon uptake (i.e. shoot biomass, root biomass, soil carbon through LOI and Li-Cor gas exchange) and carbon release (i.e. greenhouse gas measurements, decomposition) an estimation of the carbon balance can be made. This knowledge will contribute to management practices of salt marshes, aiding climate mitigation.

Presentation Types

Poster

Exploring Mental Health Vulnerabilities to Extreme Weather Events in Ireland Using the IES-R Scale and Machine Learning

Ammara Batool ORCID iD[1], Daniel Burke[1], Carlos Chique[2], Jean Dwyer[2], Kahleem Fiona Fong[3], Anushree Priyadarshini[4], Paul Hynds[1]

[1]Technological University Dublin, Dublin, Ireland. [2]University College Cork, Cork, Ireland. [3]Chestnut Hill College, Philadelphia, USA. [4]Maynooth University, Kildare, Ireland

Abstract

Extreme weather events (EWEs) have caused widespread devastation globally, resulting in millions of deaths, countless injuries, substantial economic losses, and significant impacts on both physical and mental health. The connection between EWEs and mental health is poorly understood in Ireland; therefore, examining the relationships between EWEs and mental health in an Irish context can enhance strategies for managing psychological well-being.

A cross-sectional survey was conducted across Ireland, with a sample size of 456 adults. Subsequently, two-step cluster analysis, generalised linear modelling, and decision trees were employed.

Based on respondents' verified mental health and well-being measures, four psychological stress clusters were identified ('high-', 'moderate-', 'mild-', and 'low-') and statistically profiled. The largest cluster, 'high-psychological stress' (33.8%), had the highest mean IES-R score (59/88), followed by the 'moderate-' (21.2%) and 'mild-psychological stress' (18.9%) clusters with mean scores of 43/88 and 26/88, respectively, while the 'low-psychological stress' cluster (26.3%) had the lowest mean score (4/88). 'High psychological stress' members were significantly less likely to reside in suburban areas (OR=0.31), have graduate (OR=0.32) or postgraduate (OR=0.37) educational attainment, and more likely to have poorer post-EWE health (OR=1.91) and a worsened financial situation (OR=1.95). Conversely, 'low psychological stress' members were less likely to have experienced personal injuries (OR=0.29) or a worsened financial situation (OR=0.28), were more likely to be >65 years of age (OR=5.42), retired (OR=6.21), have a post-graduate qualification (OR=4.19), or reside in a suburban area (OR=3.75). Machine learning models demonstrated an increasingly accurate fit for predicting 'low psychological stress' membership (AUC=0.74), with EWE-related injuries, age, EWE type/recency, and occupation found to be primary predictors for cluster membership.

This study enhances current understanding of the mental health effects of EWEs in Ireland and can guide targeted interventions to improve mental health outcomes for vulnerable populations in Ireland and similar regions.

Presentation Types

Oral

Breaking tree seedling dormancy: a key test of resilience to climate change

Romane Guernalec[1,2], Brian Tobin[2], Conor O'Reilly[2], Niall Farrelly[3]

[1]Teagasc, Ashtown, Dublin, Ireland. [2]University College Dublin, School of Agriculture and Food Science, Dublin, Ireland. [3]Teagasc, Mellows centre, Athenry, Ireland

Abstract

Irish forestry relies heavily on Sitka spruce. Although non-native, originating from North America, Sitka spruce grows exceptionally well in Ireland due to the similarity in the oceanic climatic conditions. However, climate change may affect Sitka spruce's performance in Ireland rapidly. There is a need to assess the extent to which Sitka spruce can adapt or acclimate to a changing climate. In addition, as this species follows a clinal range in its native distribution, there might be an opportunity to select different provenances to better match the likely future climate of Ireland.

Bud flushing is a strong adaptive trait in temperate tree species, as they need a minimum accumulation of cold temperature (chilling) to be able to break their dormancy and resume growth in the spring. If future climate brings milder winters this would affect how these trees exploit the growing season, potentially affecting tree growth.

The phenological responses of three Sitka spruce provenances to varying chilling durations (none to three weeks) were studied, followed by growth chamber tests to assess the level of dormancy. Measurements included seedling height, needle chlorophyll content, growth cessation, and bud formation (leaf primordia count). After the chilling was applied, the time taken to flush was the main response variable. Once the trees flushed, they were destroyed to determine effects on biomass allocations.

Trees given the longest chilling flushed earlier, regardless of provenance. The effects of treatments were stronger than the provenances differences and only the no-chilling treatment showed two strong provenance differences: northern seedlings had higher flushing rates than the southern ones. However, provenances exhibited large differences in their morphology and dormancy timing.

Keywords: Tree adaptation, chilling, bud flushing, Sitka spruce provenances.

Presentation Types

Oral

Integrating Agroforestry into HOLOS-IE Software for Enhanced Farm Sustainability

Mahjabin Siddique ORCID iD[1], Rem Collier[1], Badhan Sen[1], Sarah Pogue[2], Aaron McPherson[2], Roland Kröbel[2], Adnan Shafi[3], Bruce Osborne[1], Phillip O'Brien[4], Mohammad I. Khalil[1]

[1]University College Dublin, Dublin, Ireland. [2]Agriculture and Agri-Food Canada,, Lethbridge, Canada. [3]Prudence College Dublin, Dublin, Ireland. [4]Climate Change Advisory Council, Dublin, Ireland

Abstract

The agricultural sector is a cornerstone of Ireland's economy and a significant contributor to greenhouse gas (GHG) emissions. Agroforestry is a promising solution to address this dual challenge of economic sustainability and environmental impact. Agroforestry integrates trees, crops, grasses, and livestock into a harmonious system that supports farm sustainability while significantly mitigating and offsetting GHG emissions.

This research focuses on quantifying the impact of agroforestry on GHG emissions by comparing scenarios with and without agroforestry practices. An agroforestry module has been developed within the HOLOS-IE software to estimate key variables such as tree biomass, soil organic carbon (SOC), soil health indices, and Nitrous Oxide (N2O) emissions. For biomass calculations, parameters such as tree diameter, age, height, growth rate, aboveground and belowground biomass ratios, number of trees, plantation area, tree pruning, and litterfall were considered. SOC density was estimated using SOC content and the bulk density values derived from HOLOS-IE map data. N_2O emissions were calculated based on fertiliser input provided by the user.

Considering the dairy farm alone, the total carbon emissions for 30 hectares of grassland and livestock amounted to 5985.8 tCO_2ha^{-1}. After allocating 5% of the land to an agroforestry system, the emissions decreased by 23.8%. This significant reduction demonstrates the effectiveness of the agroforestry module in lowering overall carbon emissions.

This module is being developed after extensive stakeholder engagement, including interviews with agricultural professionals, workshops, and online feedback sessions. It is currently in the calibration and refinement phases, and future enhancements will incorporate additional driving variables to improve its accuracy.

This project is funded by the Science Foundation Ireland (Research Ireland) through the Gov.ie and the ECRRF (Grant No. 22/NCF/FD/10947) in collaboration with ReLive funded by ERA-NET through the Department of Agriculture, Food and the Marine, Ireland.

Presentation Types

Oral

Developing Grassland System Modules for HOLOS-IE Focusing on Carbon Footprint Accounting Driven by Soils, Climate and Management Approaches

Yanbin Chen[1,2], Magdalena Necpalova[1], Denpan Bu[2], Mohammad Ibrahim Khalil[1]

[1]School of Agriculture and Food Science, University College Dublin, Dublin, Ireland. [2]Institute of Animal Husbandry and Veterinary Medicine, Chinese Academy of Agricultural Sciences, Beijing, Beijing, China

Abstract

Grassland systems, including livestock, are key contributors to agricultural greenhouse gas (GHG) emissions. These emissions primarily stem from methane (CH_4) produced through enteric fermentation and manure storage, as well as nitrous oxide (N_2O) emissions from soils as influenced by management practices. However, grassland systems also hold significant potential for carbon sequestration when managed optimally. Traditional grassland models such as DynaGraM, ModVege, and MoSt-GG have limitations in dynamically predicting the complex interactions required for comprehensive grassland carbon footprint assessments and mitigation planning. This research aims to address these gaps by developing novel modules that integrate grassland and livestock growth and productivity with tailored carbon footprint reduction strategies. These modules are specifically designed for Irish agricultural conditions and will be integrated into the HOLOS-IE model to develop a robust digital platform for assessing, sectoral GHG emissions, soil organic carbon (SOC) sequestration. Our approach includes collection and compilation of evidence-based databases for the development of algorithms and response functions for interactive grassland and livestock modules and refine the existing components built mainly of IPCC default EFs and algorithms. We are also enhancing these modules to explore alternative land use and management options aimed at achieving climate-resilient agriculture. This study could improve the predictive accuracy of grassland-livestock interaction modeling under Irish conditions and provides practical strategies for reducing farm carbon footprints. Future work will involve validation across diverse agricultural systems and calibration to ensure scalability and precision, paving the way for sustainable and carbon-neutral farming practices in Ireland.

Keywords: HOLOS-IE, Greenhouse gas emission, Carbon footprint assessment, Irish agriculture, Grassland-livestock interactions, Digital platform

Acknowledgement: This PhD research is supported by IAS-CAAS (China)(CSC) and University College Dublin, the HOLOS-IE project, funded by Science Foundation Ireland (Research Ireland) through the Government of Ireland and the European Council's Resilience and Recovery Facilities, (Grant No. 22/NCF/FD/10947).

Presentation Types

Oral

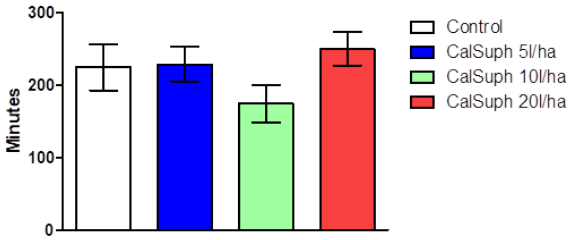
The Assessment of Gypsum Products at Improving Soil Water Infiltration in Grassland in Winter Months

Nicholas Ryan ORCID iD

Golden Vale Research, Clonmel, Ireland. South East Technological University, Wexford, Ireland

Abstract

Ireland's temperate maritime climate creates unique soil infiltration challenges. The decade from 2006-2015 was the wettest in the period 1711-2016 (Met Éireann, 2022), with increasing winter rainfall levels driving this (EPA, 2023). This presents livestock farmers with difficulties in preparing pasture for grazing after winter months. Saturated soils in early spring can delay grazing commencing and may prolong silage consumption, depleting reserves. Therefore, soil applications to improve soil water drainage are needed. Gypsum has been noted for its ability to improve soil structure in tillage crops (Bello et al., 2021). However, its use as an effective aid to soil water drainage in grassland is unclear. The objective of this study is to assess several rates of gypsum-based liquid applications to improve soil water drainage in grassland during autumn/winter months. The research trial was carried out on free-draining grassland. Thirty plots (5m x 2m) were created for four treatments with five replicates each in RCBD; Control, CalSulph at 5l/hectacre (ha), 10/ha and 20l/ha. Treatments were applied on 3rd October 2024. Grass was trimmed, drainpipes were driven 10cm into ground and 400ml of water poured into each pipe. Soil water drainage was timed until all water all water had fully drained away. The drainage cut-off time was 6 hours. This was carried out once a week for six weeks. Statistical analysis was carried out using SAS 9.4. Results showed negligible differences in soil water drainage between groups (P>0.05). The CalSulph 10/ha treatment drained soil water the fastest of all groups (173.8 ±26.4 minutes) but it was similar to the control (225.5 ±27.8 minutes; P=0.1). These findings indicate that the CalSulph application showed little improvement in soil water infiltration over winter months. Future research will evaluate the optimum rate of gypsum for soil water infiltration in grassland.



Presentation Types

Poster with 5 min oral presentation

Challenges to Climate Change Education in Universities in Ireland

Asfand Bakht Yar ORCID iD, Ken Boyle

TU Dublin, Dublin, Ireland

Abstract

The challenge posed by Climate Change to our society is immense. Addressing climate change requires an environmentally conscious global population. IPCC Sixth Assessment Report suggests that enhancing climate change literacy is necessary to ensure the implementation of adaptation protocols by state and non-state actors. Climate change (CC) will continue to alter habitats, environments, economies, and the ability of people to live healthy and safe lives for many years into the future. Hence, developing literacy on the issue is critical to providing future generations with the skills to live in this transforming world. Fundamentally, Climate Change Education (CCE) pertains to acquiring knowledge on danger, uncertainty, and rapid change. It is widely acknowledged that universities can play a key role in helping to meet the various challenges posed by climate change especially the need to create awareness. However, the means to do so are not always widely known.

The Open Letter to COP21 Ministers and Governments stresses how the complexity of CC requires “more support for transdisciplinary learning, teaching and research approaches. Ireland's higher education system is transforming, with the establishment of Technological Universities through the consolidation of existing Institutes of Technology. This change may lead to new research cultures (based on principles of interdisciplinarity) in HEIs in Ireland.

This research evaluates the perception and views of the faculty members of 8 universities in Ireland regarding the challenges of Climate Change Education in Universities. The institutional resistance is considered to be one of the biggest challenges in efficiently addressing climate change in Universities in Ireland. Moreover, Faculty workloads and administrative barriers limit the scope of what we can achieve in climate education in Ireland.

Presentation Types

Oral

Exploring the Role of ESG Practices in Accelerating Decarbonization in the Construction Industry

Harrison Odion Ikhumhen[1,2,3], Mihail Istratii[3], Magdalena Hajdukiewicz[1,2]

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Abstract

The construction industry is crucial to global sustainability, contributing around one-third of carbon emissions, resource utilisation, and 40% of global energy consumption. Hence, this study assesses the progress of the Irish construction companies towards adopting Environmental, Social, and Governance (ESG) practices, in alignment with EU Corporate Sustainability Reporting Directives, ISO IWA 48 ESG targets, Paris Agreement, EU Green Deal, UN Sustainable Development Goals (SDGs), and Ireland's 2050 carbon-neutrality goals. The research focuses on selected 50 Irish construction companies, categorised under micro, small and medium (SMEs), and large enterprises. The results highlight strengths in environmental practices, with 90% of companies adopting circular economy models, significant progress in biodiversity conservation (68%) and energy efficiency (68%). However, advanced measures such as material substitution and R&D investments remain underdeveloped, with 18% and 20% of companies adopting those respectively. Governance practices, including stakeholder engagement and regulatory compliance, are strong (96% and 100% adoption respectively), but gaps exist in sustainability monitoring (34% adoption) and internal control systems (28% adoption). On the social front, companies show strong commitments to workplace health, safety and employee engagement (96% and 88% adoption respectively). However, the attention to human rights across the value chain is limited (24%). Large enterprises lead in comprehensive ESG integration, leveraging more resources, while SMEs excel in pollution control and biodiversity conservation. Micro enterprises show basic ESG efforts but face resource limitations. The research findings underscore the need for targeted policy interventions, financial support and capacity-building initiatives, particularly for SMEs and micro enterprises. Strengthening governance, improving sustainability tracking, and fostering industry collaboration are key to achieving Ireland's decarbonisation objectives and supporting the EU Green Deal. This study highlights the construction sector's potential to drive transformative change towards a sustainable future.

Keywords: ESG Practices, Decarbonisation, Construction Industry, Sustainability Monitoring, Carbon-Neutrality Goals.

Presentation Types

Oral

Theme: Emerging Contaminants

Pesticide persistence levels in commercial beeswax across countries

Egehan Onat Özfen, Marcela A. Díaz ORCID iD, Darren P. O'Connell ORCID iD, Julia C. Jones ORCID iD

University College Dublin (UCD), Dublin, Ireland

Abstract

Beeswax is the most contaminated hive material due to its lipophilic nature, which allows pesticides to persist for over 30 years. These residues can migrate to honey and pollen, posing risks to both bee and human health. A recent study in Ireland detected twelve pesticides in honey and pollen samples. Notably, propargite was the most frequently detected pesticide in beekeeping products, despite having been banned since 2014. Additionally, tau-fluvalinate and coumaphos were detected, although they have also been banned. It is hypothesized that these residues could have migrated from contaminated beeswax. This contamination may persist because beeswax trade is not regulated globally, and most of the beeswax in the market is imported from non-European countries where banned pesticides are approved for use. To address this issue, beeswax samples were collected from ten countries to compare pesticide persistence levels. Samples will be analysed by ultra-high-performance liquid chromatography-mass spectrometry (UHPLC-MS) and gas chromatography-tandem mass spectrometry (GC-MS/MS) to screen for over 300 pesticides, including propargite, tau-fluvalinate, and coumaphos. This research aims to enhance honey bee health and ensure the safety of beekeeping products.

Presentation Types

Poster with 5 min oral presentation

Using Sedimentary Records to Track AMR in Lake Systems Through Time

Julie O Donovan[1,2], Jean O 'Dwyer[3,2], Michelle McKeown[3], Aaron Potito[1,2]

[1]University of Galway, Galway, Ireland. [2]iCRAG, Dublin, Ireland. [3]University College Cork, Cork, Ireland

Abstract

One of the biggest global threats to human health is Antimicrobial resistance. The TARE project assesses

1. The impact of the shift in Irish agriculture - from a traditional crop/pasture rotational system to modern and intensive pastures and
2. The impact of human sewage discharge on both faecal pollution (via E. coli) and the antimicrobial susceptibly profiles of faecal bacteria in the aquatic environment.

This will be investigated by obtaining representative core samples spanning the last ~ 80 years from Lough Muckno Co. Monaghan, a lake influenced by significant urban and agricultural environmental pressures. E. coli will be cultured at depth intervals in each core and antimicrobial susceptibility analyses on the cultured E. coli isolates will be performed, producing a high-resolution and chronologically constrained record of antimicrobial resistance (AMR). Climate data and population statistics will be analysed alongside these results to see if correlations can be found. TARE aims to increase our scientific understanding of the historical and current levels of faecal pollution, and concurrently AMR in an anthropogenically impacted surface waterbody and identify the trends, drivers and mediating factors which lead to AMR development. Results will provide a critical evidence base for informing current and future policy relating to environmental pollution and human health. TARE is the first study to assess the evolution of antibiotic resistance from a spatiotemporal perspective in an environment impacted by both human and agricultural waste.

Presentation Types

Poster

Assessing environmental risks of urease and nitrification inhibitors in soil and water

Xin Wang[1], Patrick Forrestal[2], Karl Richards[2], Dumsane Matse[2], Enda Cummins[1]

[1]University College Dublin, Dublin, Ireland. [2]Teagasc, Dublin, Ireland

Abstract

The use of urease and nitrification inhibitors with nitrogen fertilisers is a potential strategy for farmers to enhance nitrogen use efficiency and reduce emissions of ammonia and nitrous oxide. However, the increasing usage of inhibitors raises questions about their subsequent release into unintended environments after application and if this could lead to the potential occurrence in the food chain. This study evaluated the fate and distribution of inhibitors in soil and water by developing a framework for an environmental risk assessment model, considering potential risk factors. For the urease inhibitor N-(n-butyl) thiophosphoric triamide (NBPT), a short half-life of up to five days has been observed with limited mobility in soil; therefore, the environmental risk is presumed low. On the other hand, nitrification inhibitors including dicyandiamide (DCD), nitrapyrin, and 1,2,4-triazole exhibit varying half-lives, ranging from days to months, affected by multiple factors such as soil temperature, soil type, and application rate. For DCD, recovery in leachate samples has been reported along with detection in surface water. This indicates a potential risk of leaching and runoff from agricultural fields, and it is likely to be related to the use case. Overall, it is important for the agricultural sector to benefit from the use of urease and nitrification inhibitors while minimizing their environmental footprint. Conducting a comprehensive risk assessment is recommended for nitrification inhibitors, particularly DCD.

Presentation Types

Poster

Iron-coated granular activated carbon for enhanced electrochemical oxidation of pharmaceutical compound: Mechanism and degradation pathway

Charulata Sivodia, Alok Sinha

IIT (ISM) Dhanbad, Dhanbad, India

Abstract

Electrochemical oxidation processes have caused increasing interest of the researchers on account of its simple configuration, smooth operation, and environmental compatibility. In this study we used iron-coated granular activated carbon (Fe-GAC) as a 3D particle electrode to augment the electrochemical treatment of an anticancer drug (ACD) in aqueous solution. The performance of Fe-GAC was evaluated at varying current density, pH and particle dose. The 3D process removed 99% of the targeted ACD within 45 min of reaction time. The addition of Fe-GAC particles increased the surface-to-volume ratio and provided shorter migration distance to the reactant which surged the removal efficiency. Later the efficiency of Fe-GAC assisted electrochemical treatment was compared with 2D system to comprehend the performance of the both the processes.

Presentation Types

Oral

Predictive model for kinetic bioaccumulation to predict PFAS levels in aquatic species

Vasiliki Polychronidou, Rajat Nag

University College Dublin, Dublin, Ireland

Abstract

Per- and polyfluoroalkyl substances (PFAS) are synthetic compounds of global concern due to their persistence, bioaccumulation potential, and adverse health effects. PFAS contamination of aquatic ecosystems arises from industrial discharge, wastewater effluents, and atmospheric deposition, leading to accumulation in aquatic species and subsequent biomagnification through the food chain. This study presents a probabilistic kinetic bioaccumulation model to predict PFAS concentrations in fish tissue, considering growth, dilution, uptake, and elimination processes. The model integrates differential equations with parameters derived from literature, simulating PFAS kinetics under diverse environmental scenarios. Monte Carlo simulation was performed (100,000 iterations) to capture the uncertainty and variability of the model parameters. Furthermore, a sensitivity analysis was conducted to identify critical factors influencing bioaccumulation, such as uptake and elimination rate constants. Results demonstrated that long-chain PFAS compounds, including perfluorooctane sulfonic acid (PFOS), exhibit higher bioaccumulation potential due to their strong protein-binding affinity and hydrophobicity. Validation of the model against empirical data from reported field studies in the literature confirmed its accuracy in forecasting PFAS tissue concentrations across different fish species and exposure levels. The model facilitates a wider human health risk assessment framework by comparing predicted PFAS concentrations to health-based reference values, such as tolerable daily intake levels. This approach highlighted potential risks to human health associated with the consumption of PFAS-contaminated fish, particularly in regions with high environmental PFAS levels. Additionally, the model underscores the importance of precise parameterisation to improve predictive reliability and guide mitigation strategies. This research advances understanding of PFAS bioaccumulation mechanisms, providing valuable tools for regulatory agencies and policymakers to assess ecological and health risks. By informing the development of strategies to reduce PFAS emissions and manage contaminated ecosystems, this study contributes to safeguarding environmental and public health.

Keywords: aquatic ecosystems, food safety, One Health, per- and polyfluoroalkyl substances, risk assessment

Presentation Types

Oral

Exposure to bioplastic leachates impacts growth of freshwater green algae.

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Abstract

As bioplastics gain popularity for being eco-friendly alternatives to conventional plastics, understanding their environmental impact, particularly their potential to release harmful substances, is crucial. This research investigates how bioplastic leachates affect aquatic organisms, focusing on mechanisms of growth inhibition and toxicity. A controlled experimental setup has been developed, including an irradiance chamber simulating two months of environmental sun exposure in one week by subjecting polylactic acid (PLA) and conventional polypropylene (PP) to UVA/B light at 40°C. Preliminary findings from short-term migration studies indicate that leachate from PLA promote algal growth at higher concentrations and PP negatively affects algal growth. Future work will expand to include long-term migration studies on PLA, starch-based bioplastics, and PP, along with additional bioplastics such as polyhydroxyalkanoates (PHA). Organisms tested will include freshwater algae, daphnia, and hermit crabs to evaluate effects on growth, reproduction, and behaviour. Two methods will be used to create leachate: water migration and ultrasonic extraction. Chemical characterization of bioplastics and their leachates will employ Fourier Transform Infrared (FTIR) spectroscopy and High-Performance Liquid Chromatography (HPLC) to analyse structural changes and chemical composition. This study addresses the knowledge gap concerning the chemicals released by bioplastics and their potential risks to aquatic ecosystems. Results will contribute to regulatory efforts and inform future EU policies on bioplastic use and environmental safety. The long-term study is expected to conclude by early 2025, offering critical insights into the environmental implications of these materials.

Keywords: bioplastics, leachate, ecotoxicity, growth inhibition, weathering

Presentation Types

Poster

Theme: Environmental Monitoring and Remediation (including Biobased Approaches)

A novel application of environmental impact assessments for coastal zone restoration

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Abstract

Environmental impact assessments (EIA) in the USA are used to assess and record significant impacts that may arise from engineered projects. As coastal restoration projects are exempted from EIAs and associated policies, disconnects may occur when water quality, biodiversity, and landscapes are not considered. In the Hawai'ian Island of O'ahu, invasive mangroves are eradicated without scoping and baselines demonstrating stringent approaches are needed to determine potential impacts. Three sites were selected: Kahana Beach (mangroves present), He'eia Beach (partial eradication), and Kahalu'u Beach (control site, no mangroves). Water quality tests included dissolved oxygen (DO), biochemical oxygen demand (BOD), nitrate, pH, phosphate, salinity, turbidity, and coliform. Testing was performed annually over three years and available historical data compiled over a longer timeframe. Water quality results and historical data indicated DO, nitrate, phosphate, and salinity were statistically significant showing variability, particularly between 2021–2023, due to further eradication at He'eia Beach. Eradication continued, but slowed, during 2020–2022 COVID restrictions. As eradication areas were smaller and removal less frequent, water quality improved over a shorter timeframe. However, 2023 eradication over larger areas showed 67% DO decrease, 81% nitrate increase, 69% phosphate increase, and a 64% salinity decrease, whereas Kahana Beach and control site parameter levels remained fairly static. Predictive modelling of water quality for the four statistically significant parameters, erosion, sea-level rise, storm surge, and land runoff demonstrated that while Kahana Beach mangroves had a positive mitigation effect, the control site and partially eradicated He'eia Beach provided better native biodiversity habitats. These results suggest water quality analysis and environmental modelling could provide critical information for documenting potential Kahana Beach eradication impacts in the EIA. Further research needs to be conducted to determine a timeline of expected eradicated site recovery and if the novel EIA approach could assess gains/losses of potential restoration sites.

Presentation Types

Oral

Evaluation of a wearable light sensor dataset to identify the effects of blue light on human health and wellbeing

Anna Crowley[1,2], Grainne Scanlon[1], George Amarandei[1], Antonello Durante[1], Siofra Harrington[1], Paul Hynds[1]

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Abstract

Light exposure has non-visual effects on human physiology which can lead to changes in sleep, mood and alertness. These non-visual effects are primarily mediated by the intrinsically photosensitive ganglion cells (ipRCGs), which have a peak sensitivity to short wavelength light. Accurate monitoring of daily (blue) light exposure is crucial. While recent studies have sought to address this via wearable light loggers, work on their use in real world light exposure studies is still in infancy, with protocols and methodologies needing standardisation. Accordingly, a preliminary short-term study was conducted to test a wearable light sensor to capture spectral power density data and evaluate participant's exposure in the 380-780nm range, with Melanopic Equivalent-Daylight-Illuminance (mEDI) used to quantify the effectiveness of light in simulating these ipRCGs. Fourteen participants wore the devices and fitness watches for 7 days, permitting comparison between measured light exposure and sleep quality/duration as an effect of light exposure. The study aimed to identify the methodological limitations of these devices and refining the experimental protocol(s) to optimise data reliability and validity. Results of this study showed an increase in morning illuminance (rho=0.552, p=0.041) and morning mEDI(rho=0.556, p=0.039) was positively correlated with an increase in deep sleep. Conversely, a negative correlation was found between REM sleep and both overnight illuminance (rho=-0.623, p=0.017) and overnight mEDI (rho=-0.573, p=0.032). Showing that even preliminary studies of a limited Irish cohort reveal significant links between light exposure and health. The most significant limitation seems to be the unexpectedly wide range of measured light exposure, making comparison and analyses difficult. This issue is currently being addressed by utilising a transdisciplinary "flow duration exceedance curve" approach from surface hydrology, which permits improved data normalisation and interpretability. This would be the first time such traditionally "hydrological" approaches have been used in a light exposure study.

Presentation Types

Poster with 5 min oral presentation

The adsorptive removal of Pt(IV) ions from simulated wastewater using a novel chitosan-based hydrogel material

Paul Tasker ORCID iD, Teresa Curtin ORCID iD

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Abstract

Water contamination has been identified as a significant threat to human and environmental health, varying in risk and intensity based on many factors, such as local industries, environmental regulations and enforcement, etc. While the removal of water contaminants is essential to lowering these risks, the associated economic impact cannot be overlooked. For example, efficient recovery of Platinum Group Metals (PGMs) may prove economically favourable due to their high values. PGMs, particularly Pt, see widespread modern-day employment due to their high chemical and thermal stability, and excellent catalytic behaviour. Typically originating within road dusts from the degradation of automobile catalytic converters, aqueous Pt contamination may then occur from the dissolution of water soluble fractions during natural rainfall patterns. Thus, the recovery of noble metals accomplishes the two-fold task of minimising negative environmental harm while also serving as a viable recycling stream for PGMs. To this end, a chitosan-based hydrogel modified with L-cysteine and glutaraldehyde (CS-g-CY) in a concerted reaction scheme was prepared and tested for its adsorptive capability towards the Pt(IV) ion. After modification, the material pH stability was greatly enhanced, facilitating the well-modelled adsorption of Pt(IV) according to Pseudo-Second Order (PSO) kinetics and the Langmuir adsorption isotherm model. While the synthesised material possesses excellent capacities toward platinate, with a predicted Langmuir ($R^2 > 0.97$) monolayer capacity of 25.45 mg/g in its hydrated state, which increases to a theoretical 199.53 mg/g monolayer capacity if used as an anhydrous aerogel, an overwhelming presence of electrolyte had a dramatic reductive impact on adsorption capacity. Thus, while the material's ability to adsorb Pt(IV) is clearly demonstrated, improvements to capacity in the presence of co-existing ions, and validation of material application in an anhydrous state remain a crucial future endeavours.

Keywords: adsorption, platinum group metals, chitosan

Presentation Types

Oral

Spatiotemporal dynamics of *E. coli* in rivers and groundwater wells: comparative insights from two sub-catchments in the midland and western regions of Ireland.

Mr. Robert J. Hynes[1,2], Dr. Zina Alfahl[1,2], Ms. Leah Doherty[1,2], Dr. Louise O'Connor[1,2,3], Dr. Jean O'Dwyer[4,5], Dr. Paul D. Hynds[5,6], Dr. Liam P. Burke[1,2]

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Abstract

Private groundwater wells are a critical source of drinking water in Ireland; however, they contribute significantly to the spread of waterborne pathogens. Protecting these sources requires a detailed understanding of contamination patterns at the sub-catchment scale. This study investigated temporal variations in *E. coli* concentrations in rivers and groundwater wells within the Little Brosna sub-catchment over a seven-month period (June – December 2024).

Colilert-18® method was used to detect the presence of total coliforms and *E. coli*. These data were combined with publicly available datasets, including groundwater vulnerability maps (GSI), rainfall records (Met Éireann), and continuous river level and discharge measurements (OPW). Fortnightly sampling was conducted at 14 sites, including rivers (n = 2) and private groundwater wells (n = 12), yielding 204 samples (31 river and 173 groundwater). *E. coli* was detected in 45 samples (22%), comprising all 31 river samples (100%) with a median of 866.4 most probable number (MPN)/100mL and 14 groundwater samples (8%) with a median of 3.1 MPN/100mL. Peaks in *E. coli* concentrations occurred in rivers during June, September, and December (≥2419.6 MPN/100 mL), while groundwater wells showed a single peak in June (18.3 MPN/100 mL). Spearman's rank correlation revealed no significant relationships between *E. coli* concentrations and environmental variables such as rainfall, air temperature, water temperature, water level, or river discharge ($p > 0.05$). A chi-squared test revealed a significant association between source type and E. coli presence ($\chi^2 = 123.87$, $p < 0.001$), with rivers more contaminated than groundwater.

The findings from this period of the study describe *E. coli* dynamics in rivers and groundwaters in the Little Brosna sub-catchment and will be statistically and hydrologically compared with results from a previous study in the Black River sub-catchment. Study insights will inform strategies for protecting groundwater sources and managing risks to drinking water supplies.

Presentation Types

Oral

Assessing Nitrate Pollution in Surface Waters Through a Random Forest Approach for Irish Catchments

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[1]Dooge Centre for Water Resources Research, University College Dublin, Dublin, Ireland. [2]Catchment Science & Management Unit, Environmental Protection Agency, Dublin, Ireland

Abstract

Nitrate leaching from agriculture and other anthropogenic activities is a leading source of pollution, contributing to eutrophication in water bodies. To identify the sources of nutrient loading and implement mitigation measures, accurate modelling of nutrient loading is essential. Here, we develop a data-driven approach to simulate total oxidised nitrogen (TON-$NO3^-$) across more than a thousand waterbodies in the Republic of Ireland using several variables, derived from the catchment's climate, land use, soil properties, and topography, as predictors. The study highlights the major contributors to nitrate loading in each watershed, which are further used to project future loadings under different climate and land-use scenarios. The most significant factor responsible for nitrate emissions was related to agricultural sources of nutrients, while climatic variables such as daily maximum temperature and mean annual precipitation were also identified as significant predictors. Catchments with drier and warmer climates exhibited higher nitrate concentrations in downstream surface water. This highlights the need for optimal strategies to minimise nutrient loading under future climate change scenarios. The accuracy of the simulation results was assessed using the coefficient of determination (R^2) and root mean square error (RMSE), achieving an R^2 value of 0.57 and an RMSE of 1.07 mg/L on the validation dataset. These findings demonstrate the efficacy of the random forest model in identifying key contributors to nitrate concentrations and accurately simulating nitrate levels in surface water across Irish catchments.

Presentation Types

Oral

Continuous Electrochemical Wastewater Treatment and Nutrient Recovery Over 180 Days

Baile Wu ORCID iD

University College Cork, Cork, Ireland

Abstract

Electrochemical technology presents a promising solution for decentralized wastewater treatment and nutrient recovery, addressing critical needs in global sanitation and sustainable agriculture. However, its widespread adoption has been hindered by limited knowledge of its long-term performance. Here, we report a continuous, flow-through electrochemical system utilizing carbonate minerals (i.e., dolomite) to treat wastewater and recover nutrients effectively. Over 180 days, the system achieved high removal efficiencies – 87.7% for organic carbon, 93.1% for ammonia, and 83.7% for total phosphorus - under optimized hydraulic retention time and applied voltage. The removed phosphorus was transformed into phosphorus-calcium-magnesium-containing solids, with mineral phases and elemental compositions adjustable by operational parameters and reactor sampling locations, enabling customizable solid fertilizer production. Application of the recovered mineral-based fertilizers significantly improved the yields of lettuce and shallots by enhancing soil phosphorus availability, microbial diversity, and populations of phosphorus-, carbon-, and nitrogen-associated microorganisms. This decentralized electrochemical system demonstrates substantial potential for scalable wastewater treatment and nutrient recovery, aligning with global sustainable development goals.

Presentation Types

Oral

Nematode abundance and diversity as indicators of soil health at Mount Congreve Gardens

Alejandra Vieyra-Ramírez[1], Lisa Moran[2], Cara Daly[3], Zeta Dooly[3], Thomais Kakouli-Duarte[1]

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Abstract

Soil health is defined as the ability of the soil to sustain its productivity, diversity, and environmental services in terrestrial ecosystems. Biodiversity is therefore a fundamental part of soil health assessments. A healthy soil ecosystem has a food web that enables energy flow. In this regard, soil health can be studied and understood using nematodes as bioindicators, as they provide valuable information about the soil food web structure. However, soil health is a term that also encompasses social systems. Transdisciplinary approaches, that involve actors from different communities in the knowledge production process, can be used to study and create solutions for complex socio-scientific challenges, like soil health.

The BIOSOC project aims to use a transdisciplinary approach to explore soil health in Mount Congreve Gardens, using nematode and plant diversity as soil health indicators, whilst simultaneously mapping the various knowledge cultures of horticulturists and gardeners working at the site. The project will also develop a digital platform for soil health education and knowledge exchange. Through the dialogue with gardeners at Mount Congreve, seven sites were selected and soil sampled in October 2024 based on different plant species distribution. Nematode abundance estimation and taxonomic identification reveal differences between the sampling sites, indicating variability in biodiversity and soil health status inside the Gardens.

Keywords: Soil health, transdiscipline, nematode diversity, Mount Congreve Gardens, UN-SDG

Presentation Types

Poster

Use of Genomic Tools to Link Soil Biodiversity and Function in different soil and land use contexts for Novel Soil Health Indicators

Tsitsi L Mupamhadzi[1], Aisling Moffat[2], Michaela Bartley[1], Hayley Buttimer[1], Sean F Jordan[3], Brian Kelleher[3], Olaf Schmidt[2], Tancredi Caruso[2], Shane S O'Reilly[1]

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Abstract

Traditional methods for assessing soil health focus mainly on measuring soil physical and chemical properties, such as soil structure and nutrient content. While physical and chemical indicators provide useful information, they do not reflect the current biological state of the soil. Furthermore, physical properties, such as aggregation often change slowly, while chemical properties can be easily influenced by external inputs, making them less reliable for real-time soil health assessments. On the other hand, biological properties such as microbial diversity respond rapidly to changes in soil management and environmental conditions and are also very sensitive to agricultural practices such as crop rotation, organic amendments or tillage and can show improvements or deterioration of soil health quickly. Despite the importance of soil biology as soil health indicators, there is a lack of information linking soil biology to soil function and overall health. This study seeks to address this gap by identifying novel biological indicators of soil health through the genomic characterization of microbial communities. A total of 219 soil samples were collected across Ireland, representing a range of soil types and land uses. Genomic DNA was extracted, followed by amplification of the 16S rRNA gene for bacterial communities and the ITS2 region for fungal communities. Amplicons will go through next-generation sequencing on the Illumina MiSeq platform. Subsequent bioinformatics analyses will reveal microbial taxonomic diversity and possible associations with soil functionality, which will assist with the identification of potentially novel biological soil indicators. This research will provide valuable insights into soil microbial communities and their roles in ecosystem functions, advancing the development of biological indicators for soil health supporting sustainable soil management practices.

Keywords: Soil health indicators, microbial diversity, genomic characterization, soil function, ne xt-generation sequencing

Presentation Types

Poster with 5 min oral presentation

Utilizing chlorophyll content and photosynthetic efficiency as metrics of macrophyte performance in constructed wetlands treating mine wastewater

Nathan Bourke ORCID iD[1,2], Audrey O'Grady ORCID iD[1], Ronan Courtney ORCID iD[1,2]

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Abstract

Continued mining and refining of critical elements are essential for the clean energy transition, but associated wastewater can cause environmental risk. Current treatment methods are intensive in terms of finance, labour, energy and reagent inputs and passive treatment such as constructed wetlands (CW) are proposed as an effective alternative. Mine wastewaters can display high metal content and/or extreme pH and may impede macrophyte growth and function in CW. Portable tools measuring chlorophyll content and photosynthetic efficiency offer quick and non-destructive assessment of macrophyte health and can inform management of CW. A series of hydroponic trials exposed *Typha latifolia* and *Phragmites australis* to varying levels of Zn content or alkalinity. The trials ran for 6-7 weeks, where prior to termination, all macrophytes were measured for chlorophyll content, effective (Y(II)) and maximum (F_v/F_m) quantum efficiency of photosystem II, element analysis and growth parameters (shoot length, root length, biomass, leaf number). A trend of reduced growth, chlorophyll content and photosynthetic efficiency was observed when Zn concentration increased above 7mg/L for *P. australis*. The growth and maximum photosynthetic efficiency (F_v/F_m) for *T latifolia* displayed reductions only above 14mg/L Zn however chlorophyll content and effective photosynthetic efficiency (Y(II)) was reduced at 7mg/L. For alkalinity, no stress was observed for *T. latifolia* growth until pH 12. This result was reflected by the Y(II) and the F_v/F_m readings. The chlorophyll content for both trials, exhibited earlier signs of stress than other parameters. F_v/F_m was found to be a more accurate indicator of macrophyte health than Y(II). The results indicate that extreme levels of zinc and pH in wastewater may impact macrophyte establishment, growth and function in CW. These tools could benefit regular CW monitoring through rapid and in-situ informing on macrophyte toxicity limits and timelines for maintenance.

Presentation Types

Oral

Developing novel soil health indicators using lipidomic analyses across key land use types in Ireland

Michaela Bartley ORCID iD[1], Hayley Buttimer[1], Tsitsi Lynn Mupamhadzi[1], Seán F. Jordan[2], Brian Kelleher[2], Aisling Moffat[3], Olaf Schmidt[3], Shane O'Reilly[1]

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Abstract

Healthy soils are essential in achieving climate neutrality, reversing biodiversity loss, providing nutritious food, and safeguarding human health. Despite decades of soil research, soil remains a highly threatened non-renewable resource, with an estimated 62% of EU soils already degraded. This is attributed to the complexity of soil as a material and ecosystem, the diversity of soil types and land uses and to a large extent, the global focus on soil as an agricultural resource rather than as an essential part of environmental protection. The EPA funded project Microbial and Metabolite-based indicators for Soil Health (MMeSH) aims to address the need for biological soil health indicators and environmental protection of soils by using a combined lipidomics, metabolomics, and genomics approach. Advanced mass spectrometry and nuclear magnetic resonance-based techniques will be used to profile the soil lipidomes from soil organisms. Soils (n=219) were sampled between Sep 2023 to April 2024 from existing Tellus sites. Sample sites represented key land uses and soil types in Ireland: 51% corresponded to pastures, 13% to agricultural with natural vegetation, and 12% to peat bogs (based on Corine land use categories). Peat soils (21%) were the major soil type, followed by luvisols (18%), brown Earths (17%) and surface-water gleys (12%) (based on the Irish Soil Information System database). Lipid extraction and analysis by both gas and liquid chromatography mass spectrometry is ongoing. Phospholipid fatty acids as well as intact polar lipids will be used to identify taxonomic and phenotype changes within the soil microbiome. This coupled with untargeted metabolomics and the identification of other secondary metabolites will aid in the understanding and the development of novel soil health indicators for each unique soil system.

Presentation Types

Oral

Autoclaved-Citrate Extractable protein assay as a method of assessing soil health across soil types in Ireland

Hayley Buttimer ORCID iD[1], Michaela Bartley[1], Tsitsi Lynn Mupamhadzi[1], Brian Kelleher[2], Seán F. Jordan[2], Shane S. O' Reilly[1]

[1]Technological University Dublin, Dublin, Ireland. [2]Dublin City University, Dublin, Ireland

Abstract

Soil is the foundation for life on land (Sustainable Development Goal #15) and provides essential ecosystem services such as food production, raw material reservoirs, and physical services for human activity. Ensuring long-term soil health is integral to achieving climate mitigation, renewing biodiversity, and ensuring future food production. Despite these essential functions, an estimated 61% of EU soils are degraded. The Irish Tellus programme has been mapping soil geophysical and geochemical properties since 2011, providing a baseline for soil monitoring. However, soil biological aspects such as biodiversity and biogeochemical cycling are lacking in such programmes globally. This project aims to establish bio- and biogeochemical measures of soil properties to supplement and advance the Tellus programme and national goals as part of the EU Soil Strategy. Here, the Autoclaved-Citrate Extractable (ACE) protein assay is reported. ACE is an established and validated technique as part of international Soil Health Assessment Frameworks (The Cornell Framework). The ACE assay uses a citrate buffer extraction with bicinchoninic acid assay measured at 562nm and quantification using bovine serum albumin standard. The sample set (219 Irish soils, sampled between September 2023 and May 2024) represents the main land use types (agriculture, wetlands, and forestry as per CORINE) and soil types in Ireland (Peat, Brown Earth, Luvisol, Gley, and Podzol). Brown Earths exhibited the lowest average value of 23.95 mg g-1 soil and Peat the highest of 48.49 mg g-1 soil. This reflects the high and low organic matter content of peat and brown earth soils, respectively. The next steps include measuring properties like CO2 respiration, active carbon, soil organic matter and integrating new data with Tellus data for pH, phosphorous, potassium, and minor element composition, developing new and/or validated soil health indicators for specific contexts and land uses.

Soil health, Indicators, Biogeochemistry, Protein, Autoclaved-Citrate Extractable, land use.

Presentation Types

Oral

Variation and factors influencing ammonia concentration levels in finishing pig facilities, Ireland.

Izuchukwu Martin Aroh ORCID iD[1,2], Louise Clarke[3], Gerard McCutcheon[1], Thomas Curran[2]

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Abstract

Estimating ammonia (NH_3) concentration and its influencing factor over a long period of time in finishing pig farms reveal the patterns and the drivers of the aerial pollutant. Monitoring NH_3 level is critical for safeguarding the health of farm staff and animals. This study monitored ammonia (NH_3) concentration, indoor temperature, and ventilation requirements in three Teagasc finishing pig rooms, over 76 days (9th August – 23rd October, 2024). Each room had the same dimensions, separate slurry tanks, and an equal number of pens but housed different numbers of pigs: 117 (Room A), 111 (Room B), and 102 (Room C). NH_3 concentrations were continuously measured using the Los Gatos Research sensor, while temperature and ventilation requirements were monitored with the Big Dutchman system. Average NH_3 concentrations were 3.98 ± 1.08 mg/m³ (Room A), 4.63 ± 1.34 mg/m³ (Room B), and 4.36 ± 1.05 mg/m³ (Room C). Average temperature and ventilation requirements were 21.33 ± 0.99°C and 84.84 ± 19.08% (Room A), 20.96 ± 1.07°C and 79.41 ± 16.92% (Room B), and 21.17 ± 0.94°C and 84.13 ± 17.19% (Room C). Results indicated a strong relationship between NH_3 concentration levels, ventilation requirement, and temperature. Higher NH_3 levels were noticed with lower ventilation and indoor temperatures. Room B, despite housing fewer pigs, recorded the highest NH_3 levels and lowest ventilation, showing the influence of factors beyond stocking density in influencing ammonia concentration levels in pig farms. All rooms maintained NH_3 concentrations within the 10 ppm (approximately 7.16 mg/m³) limit recommended by Best Available Techniques guidelines. Factors such as ventilation requirement and indoor temperature played a key role in influencing/determining NH_3 concentration levels in the rooms. This study proved that improving air quality in a finishing pig house can be achieved by examining several factors to monitor and reduce ammonia levels.

Keywords: ammonia, pigs, ventilation, temperature

Presentation Types

Oral

Assessing the Role of Integrated Constructed Wetlands (ICWs) in Shaping Environmental Antimicrobial Resistance Across Different Sectors

Gaia Streparola[1,2], Caolan Harrington[3], Aila Carty[3], Gillian Madigan[4], Finola Leonard[2], Catherine Burgess[1]

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Abstract

Antimicrobial resistance (AMR) is acknowledged as one of the greatest challenges to human health globally, with estimates that, by 2050, AMR will cause 10 million deaths a year, unless action is taken. Efforts to tackle AMR have commonly focused on clinical and veterinary practice but recently the role of the environment in transmitting antimicrobial resistant organisms (AROs) has gained greater attention. Conventional wastewater treatment is often considered a hotspot for AMR and release of AROs into the natural environment. However, less is known about the role alternative treatment options such as constructed wetlands may play in the dynamics of AROs transmission in the environment. This project specifically focuses on Integrated Constructed Wetlands (ICWs), a concept that integrates water management, landscape fit and biodiversity. ICW systems are shallow, free surface-water wetlands, which are densely vegetated with appropriate plant species to treat through-flowing waters. The objective of this study is to examine various microbial parameters in influents and effluents in ICWs serving different sectors, including agricultural and food processing sectors, on a monthly basis. The parameters being examined include total viable counts, extended-spectrum beta-lactamase producing Enterobacterales, fluoroquinolone resistant Enterobacterales, carbapenemase producing Enterobacterales, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*. Enterococci and *Escherichia coli* in the effluents are being enumerated as indicator of faecal pollution. Culture-based approaches are used to identify the target bacteria which are subsequently screened by MALDI-TOF.

To date, our findings indicate that ICWs have the potential to effectively lower the quantity of AROs present, with *Escherichia coli* being the predominant species isolated.

Presentation Types

Poster with 5 min oral presentation

Environmental monitoring for foodborne pathogens in horticultural production settings

Elena Anedda[1], Elena A. Alexa[2], Michael Arthur[1,2], Amy McKenna[1], Michael Gaffney[1], Catherine M. Burgess[1]

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Abstract

Due to the nature of their production horticultural crops are at risk of microbiological contamination from a range of sources. It is therefore imperative that growers are aware of where risks may arise on farm so that targeted interventions can be put in place to ensure produce safety by reducing the chance of transference of pathogens onto crops.

The objective of this study was to undertake a mapping exercise to identify potential sources of contamination and the areas most likely to harbour foodborne pathogens in commercial horticultural settings in Ireland. Produce, water and environmental swab samples were collected from commercial production units (n=9) for three crops, namely strawberries, carrots and lettuce, on four different occasions. Each sample was tested for the presence of *Listeria monocytogenes, Salmonella* spp. and Shiga toxin producing *E. coli* by standard methodologies.

In total 620 samples were collected, including 473 environmental swabs, 38 produce samples and 109 water samples. None of the fresh produce samples were positive for the target pathogens. *L. monocytogenes* (n = 29 isolates) was detected in 13 samples (2.1%). Samples from six out of the nine sites harboured *L. monocytogenes* on at least one occasion. Isolates were mainly recovered from floor swabs, but also from conveyor belts, processing equipment and water. No *Salmonella* was detected in any sample. In total eight enrichments from the 620 samples tested positive for *stx* genes. Whole genome sequencing was utilised to compare the *L. monocytogenes* isolates, as well as to provide information on their serotype and virulence gene properties.

This study indicated that the horticultural production and processing environment can harbour *L. monocytogenes,* particularly on surfaces, and therefore particular emphasis should be placed on rigorous cleaning and disinfection and minimising cross contamination of the crop.

Presentation Types

Oral

Theme: Green Chemistry and Sustainable Manufacturing

Sustainable recovery of rare earths using Ca-Mg-Fe carbonates and eggshell waste

Juan Diego Rodriguez-Blanco ORCID iD, Adrienn Maria Szucs ORCID iD, Melanie Maddin ORCID iD, Luca Terribili ORCID iD, Remi Rateau ORCID iD, Kristina Petra Zubovic ORCID iD

Trinity College Dublin, Dublin, Ireland

Abstract

In November 2023, the EU reached a provisional agreement on the European Critical Raw Materials Act to boost local production, processing, and recycling of critical raw materials, especially rare earth elements (REEs), essential for green energy. However, REE production is environmentally damaging, prompting efforts to minimize impact, such as using secondary REE sources or applying green chemistry principles.

This study examines the use of common Ca-Mg-Fe carbonates (calcite, aragonite, dolomite, siderite) and hen eggshell waste for REE extraction from industrial and waste streams. We exposed these minerals to 50 mM solutions of REEs at temperatures ranging from 25 to 205°C for up to 3 months. The products were analysed using powder X-ray diffraction, scanning electron microscopy, and laser ablation inductively coupled plasma mass spectrometry.

The minerals interacted with the REE solutions, leading to temperature-dependent surface precipitations and the gradual replacement of host minerals by REE carbonates. In experiments with eggshells, REEs diffused throughout the calcite, following pathways in the organic matrix and crystal boundaries, with no selective partitioning of La, Nd, or Dy. At 90°C, the host minerals dissolved and were replaced by kozoite spherulites. At higher temperatures (165-205°C), a dissolution-precipitation mechanism occurred, with kozoite transforming into bastnäsite, a stable REE hydroxycarbonate. Minor REE zoning at the eggshell grain scale suggested a potential method for REE separation.

The results show two potential applications for natural carbonates and eggshell waste in REE recovery: at lower temperatures, they act as mixed adsorbents, and at higher temperatures, they serve as sacrificial templates for rare earth hydroxycarbonate precipitation.

Keywords: rare earth, carbonates, eggshells, separation.

Presentation Types

Oral

Statistical Optimisation of recombinant Amycolatopsis mediterranei cutinase expression for polymer degradation

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Abstract

Biodegradable plastics, considered alternatives to conventional plastics, have gained significant attention due to their biodegradability. However, biodegradable plastics can persist in the environment for extended periods of time. The aim of this study was to optimise the expression of a recombinant cutinase-like enzyme from *Amycolatopsis mediterranei* (AML) and to examine its potential application in biodegradable plastics degradation, specifically polybutylene adipate-co-terephthalate (PBAT). Response surface methodology (RSM) was used to evaluate the influence of growth conditions and nutritional components on enzyme expression. Fructose, as the carbon source, increased AML epxression by 30%, while tryptone as the nitrogen source resulted in a 25% expression increase in Luria Bertani (LB) media supplemented with 0.5% (w/v) carbon source and 1% (w/v) nitrogen source. Further optimisation of fermentation conditions, through a Plackett-Burman experimental design, yielded temperature (°C), IPTG concentration (mM), and optical density (OD) as the most significant variables.

In comparison to the non-optimised expression conditions, the RSM-based optimisation of the screened significant parameters led to a 2.9-fold increase in AML expression. Purification of AML was subsequently performed, and the purified AML was evaluated for its polymer degradation capabilities. Qualitative assays showed that the purified AML could effectively degrade PBAT as evidenced by hydrolysis zones on PBAT agar plates. Future work will employ analytical techniques such as SEM, HPLC and LC-MS to further investigate the biodegradation. This study demonstrates effective recombinant AML expression optimisation and underscores AMLs potential as a green biocatalyst for sustainable depolymerisation of biodegradable polymer waste.

Presentation Types

Oral

Novel Alcohol Dehydrogenase Activation by the Choline Component of Deep Eutectic Solvents

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Abstract

Biocatalytic applications of alcohol dehydrogenases (ADHs) are aimed at oxidising alcohols to target aldehydes or in reducing aldehyde/ketones. However, to date, biocatalytic application of ADHs have been hindered by their incompatibility with organic solvents. Deep Eutectic Solvents (DESs) are a neoteric solvent medium that can stabilise both ADHs and their $NAD(P)^+$ cofactors and promote the solubility of hydrophobic substrates potentially allowing the wider application of ADHs in biocatalytic synthesis. Herein, we explored the effect of choline chloride (ChCl)/glycerol (Gly) based DES solutions on Horse Liver ADH (HLADH) activity over an extended concentration range. This study showed that HLADH was activated over a narrow range of DES inclusion levels. Examination of DES components showed that choline was responsible for this activation via its quaternary nitrogen moiety. This finding has potential applications in enhancing biocatalysis and is the first report of HLADH activation in the presence of DES components.

Presentation Types

Poster

β-glucosidase from *Streptomyces griseus*: alkyl glycoside synthesis- using Deep Eutectic Solvents

Adithya Vinod[1,2], Gemma Kinsella[1], Barry Ryan[1], Kieran Nolan[3], Gary Henehan[1]

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Abstract

Deep Eutectic Solvents (DES), recognized as green alternatives to conventional solvents, have gained significant attention in biocatalysis due to their biodegradability, low cost, and environmentally friendly properties. The complex behavior of enzymes in DES, where some are inhibited while others are activated, necessitates a detailed exploration of solvent-enzyme interactions. This study investigates using *Streptomyces griseus* beta-glucosidase for the synthesis of novel glycosides in DES systems, leveraging DES as a 'solvent engineering' approach to enhance enzyme stability and catalytic performance. Alkyl glycosides are valued for their non-toxic, biodegradable, and surface-active properties, making them highly sought after in industries such as pharmaceuticals, cosmetics, and detergents. By systematically varying the DES composition and sugar-to-alcohol ratios, we aim to understand the interplay between solvent properties, the role of individual DES components, and enzyme activity, focusing on optimizing yield and product specificity. The combined effects of DES optimization and enzyme engineering are evaluated to establish a robust platform for the sustainable production of alkyl glycosides, advancing their applications in green chemistry and biomanufacturing.

Keywords: glycoside synthesis, beta-glucosidase, alkyl glycosides

Presentation Types

Poster

An extracellular solvent stable lipase from *Acinetobacter guillouiae*: Isolation, characterization, and application

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Abstract

Increasing plastic pollution is a pressing environmental issue. Since lipases are one of the biocatalysts that can break down plastic polymers, isolating and utilising bacteria that produce robust organic solvent-stable lipases can be useful for this application. Such lipases also have a host of other biocatalytic applications such as chemo-, regio- and enantio-selective transformations. In this study, isolation and characterization of lipase producing microorganisms from soil samples (peatland and waterway) were carried out by screening on Rhodamine B plates. The selection of bacteria for further analysis was based on their resistance to organic solvents. One of the bacteria exhibiting good extracellular lipolytic activity and stability in organic solvents was identified through 16S rRNA sequencing as *Acinetobacter guillouiae*. The extracellular lipase demonstrated activity and stability across a pH range from 3 to 10 at both 4°C and 28°C over a 24 hour incubation period. Additionally, its stability was evaluated at temperatures ranging from 20°C to 80°C and demonstrated good thermostability and stability in the presence of several organic solvents, making it a promising biocatalyst for applications in plastic biodegradation and biocatalysis.

Keywords: *Acinetobacter*, lipase, isolation, solvent stability, plastic biodegradation, biocatalyst

Presentation Types

Poster

Advancing Nanofluid-Based Cooling Technologies for Energy-Efficient Data Centres

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Abstract

Within data centres, heating and cooling accounts for ~35% electricity used. The challenge is to reduce energy consumption and carbon emissions while maintaining data centre efficiency. NanoTherm, funded under the Disruptive Technologies Innovation Fund (DTIF), developed a graphene nanofluid as an additive for cooling systems, which enhances heat transfer, thus reducing energy consumption and environmental impact.

Graphene potentially addresses sedimentation and stability problems of commercial metal oxide nanofluids. Various carbon compositions and methodologies were tested to achieve a consistent and reliable nanofluid. The two types considered for development were MD (based on pre-milled synthetic graphite) and FL (flake-based). Accelerated ageing studies showed MD samples had stable performance, with unchanged particle size and thermal conductivity (613 to 612 mW/mK), zeta potential of -37.8mV, and pH of 6.5-7. In contrast, FL samples showed declining stability under similar ageing tests, with degraded pH (5), thermal conductivity (649 to 629 mW/mK), particle size, and zeta potential (-18.6mV).

Environmental impacts were calculated during product development so that informed design decisions could be made. LCA (Life Cycle Assessment) identified water consumption and use of acids as the principal environmental issues. The process was redesigned to reduce these effects. The final version of MD showed better water use (0.063 m^3 depriv.) in comparison to FL (1.28m^3). MD significantly outperformed FL in terms of climate change (0.051 kg CO_2 eq vs. 4.256 kg). Thermal-hydraulic performance was tested using energy efficiency analysis (EEA) based on coefficient of performance (COP) improvement, demonstrating average COP of 3.5% for FL and 9.2% for MD.

While the original focus was to develop fluids to improve HVAC performance for indirect cooling of data centres, the growth in Direct Liquid Cooling of high-performance chips has driven parallel development of fluids in this area.

Presentation Types

Oral

Theme: How Sustainable is my Food?

Using consumer insights to enhance the role of Irish seaweed SMEs in sustainable market innovation and product development.

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Abstract

Ireland's extensive coastline and unique marine environment position it as a potential leader in the seaweed industry, valued at €18 million annually. Historical seaweed applications and Ireland's favourable geographic conditions highlight the sector's growth potential in domestic and international markets. Government initiatives, such as *Food Wise 2025* and *Harnessing Our Ocean Wealth,* demonstrate strategic support for sustainable marine development. However, Irish seaweed SMEs face critical challenges, including limited R&D funding, scalability constraints, and complex regulatory frameworks. This study examines the role of consumer insights in driving sustainable, value-added new product development (NPD) within Irish seaweed SMEs. It underscores the importance of a market-oriented approach to enhance innovation success. Despite the recognised benefits of market integration in NPD, many Irish seaweed SMEs operate in isolation. By analysing how SMEs incorporate consumer feedback into product design and align offerings with global trends, the research identifies strategies to improve consumer acceptance and foster innovation. Findings reveal that SMEs primarily use informal, unstructured market research, relying on personal experimentation and ad-hoc responses to customer preferences rather than structured consumer insights. This approach results in missed opportunities for continuous product improvement. Additionally, SMEs report challenges in complying with EU and national regulatory frameworks for seaweed harvesting, processing, and food manufacturing. Uncertainty around compliance with bodies such as the HSE and FSAI further impedes growth. These findings are crucial for empowering Irish seaweed SMEs to capitalise on the growing global demand for sea vegetables, contributing to Ireland's sustainable development goals. The research provides a foundation for advancing Ireland's seaweed industry, enabling SMEs to thrive in EU and global markets. Future studies will evaluate the impact of EU and Irish policies on innovation and market development in this sector.

Keywords: Seaweed SMEs, sustainable development, new product development, market research, consumer insights, Irish seaweed industry

Presentation Types

Oral

Non-husbandry and climate-related food loss and waste in primary production: Identifying sources, estimating quantities, and understanding contributory factors

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Abstract

Food loss (pre-harvest) and waste (post-harvest) represents the material loss of food, loss of investment for food businesses, and inefficiencies in resource use that have broader social and environmental impacts in addition to financial costs. Primary producers are especially vulnerable to food loss due to their position in the supply chain, while food waste from primary production was estimated to account for 7% of Irish food waste in 2022. Irish research has identified that food loss and waste (FLW) predominantly arises in primary production due to agro-ecological conditions, e.g. husbandry, i.e. farm practices, and climate; and market conditions, e.g. purchasing specifications, which are regarded as "non-husbandry and climate-related" causes of FLW (NHC-FLW). Knowledge gaps persist concerning the nature and impacts of NHC-FLW, e.g. FLW arising due to market conditions; and how to reduce their impact in order to reduce overall FLW. In order to adequately address these issues at a national level, including in the next update of Ireland's Food Waste Roadmap after 2025, further research is required to understand NHC-FLW and their impacts, and develop relevant policy, practice and research recommendations.

This ongoing study is examining the incidence of NHC-FLW at primary production level, factors that contribute to NHC-FLW, and actions that can be taken to prevent NHC-FLW. Initial results from desk-based research indicate that fruit and vegetable products are particularly vulnerable to NHC-FLW, particularly potatoes, carrots, cauliflower and broccoli, mushrooms and strawberries. Statutory and non-statutory producer and retailer regulations and standards have been identified that can result in NHC-FLW. However, further research is required to better understand the range of factors contributing to NHC-FLW, and develop policy and practice recommendations to minimise NHC-FLW. This will be addressed in the next phase of the research, through interviews with food system stakeholders and subject matter experts, and producer Living Labs.

Presentation Types

Oral

Innovative Farming Practices along the Crop Cycle in Northwest Europe

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Abstract

Northwest Europe is facing several significant challenges including herbicide resistance, and over-reliance on herbicides and mineral fertilisers, therefore the need for sustainable agriculture techniques such as innovative crop establishment, weed management and nutrient use efficiency strategies are becoming increasingly essential to meeting these challenges. Traditional agricultural practice is dependent on synthetic fertilisers and herbicides which are becoming ever more environmentally (and socially) unsustainable because the demand for food security necessitates a balance with environmental sustainability. The EU Green Deal aims to cut chemical use to 50% by 2030, therefore, there is an increasing focus on sustainable agricultural practices leading to increased crop productivity while considering environmental sustainability. This study examines innovative methods along the crop cycle namely, crop establishment, weed management, and nutrient efficiency. Integrated weed management examines how to minimise dependence on herbicides by integrating mechanical, precision, and biological methods. Additionally, crop establishment practices such as conservation tillage direct seeding, and other techniques that help improve soil health and manage weeds are also examined. A key component for optimising resource use and minimising environmental degradation includes nutrient management strategies such as integrated nutrient management and precision agriculture as well as targeted nutrient application techniques. While these innovative practices are gaining traction in some areas, the wholesome adoption of these practices is essential. This requires policy support for key stakeholders, farmers' education and targeted research to achieve widespread acceptance. Overall, this review highlights the importance of adopting a multi-faceted approach to sustainable agricultural systems in Northwest Europe, integrating weed management (before and after) crop establishment and nutrient efficiency. Alternative cropping systems such as cover cropping, minimum tillage, integrated weed management (chemical, precision and biological), precision fertilisation and adopting biofertilisers have been identified to enhance crop establishment, manage weeds, improve nutrient use efficiency, reduce over-reliance on chemicals and promote environmental sustainability.

Presentation Types

Oral

A study of the relationship between silicon and Lettuce seedling root morphology.

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Abstract

The benefits of silicon fertiliser in crop production is associated with monocots such as rice and sugarcane. In recent years, the role of silicon as a biostimulant has demonstrably shown to improve plant vigour during growth and at post-harvest across a large range of eudicot plants. This provides a pathway for resilience from fark to fork, aligning with UN SDG 12.3 to reduce global food loss and waste.

Giordano et al. (2024) showed that foliar applications of silicon on leafy greens reduced respiration which in turn stabilised quality of harvested leaves across seven days shelf life. Statistical analysis indicated silicon reduced the respiration rate in harvested spinach by 15%. This reduced the risk of food loss for retail. Similarly, Guo et al. (2006) indicated that root morphology can be affected by silicon and there is a hypothesis that this same effect may be found in food crops. Preliminary data suggest silicon alters the root morphology of lettuce seedlings. Aqueous solutions enriched with silicon (50 ppm) were used to evaluate its effect on lettuce seedlings. The results show a statistically significant increase of up to 66% in the fresh weight of the seedlings compared to those grown with water alone. Silicon solutions promoted an increase of up to 155% in the number of secondary roots germinated compared to the control without silicon.

With more surface area on juvenile roots, there is a greater impetus to uptake water and nutrients during critical plant establishment stages. Next stage of the study will apply the same testing principle for silicon but extracting it from an organic form such as Equisetum arvensis. The vegetative form of this herb is rich in silicon. The main hypothesis is to test whether the results obtained with silicon solutions can be extrapolated to bioassays using extracts from silicon-rich plants.

Presentation Types

Poster

Life cycle assessment of an experimental barley cultivation combining reduced amounts of nitrogen fertiliser with different biostimulants

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Abstract

The application of chemical fertilisers and pesticides is a common practice in agriculture that allows farmers to increase soil fertility and control the spread of pests and weeds. Nevertheless, field emissions stemming from their widespread use are recognized as a pressing environmental issue. For this reason, alternative and effective products need to be evaluated and introduced in agriculture to limit emissions and resource use and foster sustainability, while maintaining farmers' profitability. Information and data collected over two-years from an experimental barley field in Ireland were fed into a life cycle assessment (LCA) software to develop inventories for each treatment, according to the experimental design. The LCA methodology was then applied to highlight potential differences between the field treatments for the following relevant impact categories: climate change, terrestrial and freshwater ecotoxicity, terrestrial acidification, eutrophication, fine particulate matter formation, and land use. Grain yield appeared to be the main driver of the results. Emissions due to the application of urea and certain pesticides were identified as the main direct contributors to the above impact categories. Direct field emissions, agricultural machine operations, urea and barley seed production were identified as relevant hotspots. Compared to the control treatments (reduced application of urea and water), the use of some biostimulants actually seems to slightly reduce the potential environmental impacts of the system, albeit with lower barley yields.

Presentation Types

Poster with 5 min oral presentation

The carbon footprint of cattle milk production in organic and conventional systems

Jacob Matovu ORCID iD[1,2], Sharon O'Rourke ORCID iD[1], Fionnuala Murphy ORCID iD[1,2]

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Abstract

A large number of life cycle assessment (LCA) studies have been published in recent years with the aim of identifying the production system that releases the lowest emissions per unit product. However, it's difficult to compare these studies because of the strong discrepancies between them mainly due to different methodological choices. Therefore, this study aims to optimise LCA modelling as far as possible to make a robust comparison of the carbon foot (CF) print of organic vs. conventional European dairy systems. Based on the established criteria different databases were searched using a combination of different search keywords resulting into 16 studies from 10 different countries used in this meta-analysis. Standardization was done and adjustments were applied to the functional unit and to the allocation method. The results were analysed using the t-test, and the relationship between the CF with most relevant parameters was evaluated through linear regression analysis. The findings demonstrate that, even with the large variation within each of the production systems, there are no differences in the average CF values for 1 kg of FPCM. There was a tendency of reduction in CF as result of increase in milk yield ($P = 0.07$) in the conventional systems, while as increases in milk yield decreased the CF of milk significantly in organic systems ($P < 0.05$). Feed efficiency and milk yield per kg metabolic weight had a significant negative effect on the CF in both systems ($P < 0.05$). The methodological approach of the present study enabled a comparison of the two production systems using absolute LCA values and demonstrated that improving milk production and feed efficiency on the farm can effectively reduce the CF.

Keywords: Organic dairy system; meta-analysis; Life cycle assessment; Carbon footprint

Presentation Types

Poster

Development and characterisation of co-encapsulated biological control agents, *Steinernema feltiae* and *Pseudomonas ogarae*, for enhancing plant health

Islam Ahmed Abdelalim Darwish[1], Daniel Martins[2], David Ryan[3], Thomais Kakouli-Duarte[1]

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Abstract

In pursuit of a sustainable alternative to chemical pesticides and mineral-based fertilisers, we developed a biological control product to enhance plant health and promote sustainable food security. This bioagent integrates Irish strains of the entomopathogenic nematode (EPN) *Steinernema feltiae* (SB12[1]) and the plant growth-promoting rhizobacterium (PGPR) *Pseudomonas ogarae* F113 *gfp*. Previous studies demonstrated a good relationship between EPN and *Pseudomonas* spp., where *Pseudomonas* positively influences the life cycle of *Xenorhabdus* spp., which are bacterial symbionts of EPN. Together, the nematode and its bacterial symbiont cause insect mortality. Calcium alginate formulation has been optimised to co-encapsulate the EPN and PGPR, ensuring the retention of EPN viability during storage and preserving the activity of both agents until application. Each bead contained approximately 4000 infective juveniles (IJ) of EPN and 100 million bacterial cells. These beads have been stored individually at 4°C, 10°C, and 20°C for both short- and long-term evaluations of shelf life. Nematode viability was tested by immersing beads in deionised water and monitoring IJ emergence. Laboratory assays using *S. feltiae-P. ogarae* bead suspensions were conducted to evaluate the nematode infectivity following short-term storage of the alginate-based biological product. The results demonstrated that the nematodes retained high virulence, achieving 100% mortality of *Galleria mellonella* larvae within 48 hours. The viability of PGPR was determined by selective plating on sucrose asparagine media with kanamycin, while colony fluorescence was confirmed under UV light. Results showed that beads stored at 4°C maintained high organism viability, while those at 10°C and 20°C were mostly affected by fungal contamination. *Steinernema feltiae* presence in beads enhanced the in vitro growth of *P. ogarae* compared to that from beads with only the bacterium.

Keywords: Biological control, entomopathogenic nematodes, plant growth promoting rhizobacteria, calcium alginate, UN-SDG

Presentation Types

Oral

The antioxidant effect of saltwater Nannochloropsis grown on anaerobic digestate water

Fangting Bai ORCID iD

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Abstract

Microalgae have emerged as a sustainable solution for treating wastewater by efficiently reducing nitrogen and phosphate levels while simultaneously generating biomass rich in valuable products. However, the challenge lies in effectively utilizing the biomass derived from wastewater. This study evaluates the antioxidant capacity, pigment profile, total phenolic content, and total flavonoid content of biomass from freshwater and marine microalgae species cultivated in liquid digestate (LD) and standard medium. The antioxidant activities of methanol extracts were assessed using DPPH, FRAP, and ABTS assays. Additionally, the cytotoxicity of the methanol extracts was tested to ensure their safety for potential applications. Results indicate that marine species biomass cultivated in LD exhibited significantly higher levels of pigments and total phenolic content compared to those grown in standard medium, with no observed cytotoxicity. These findings suggest the potential for safe and effective utilization of marine microalgae biomass grown on waste in various applications, highlighting its promise as a valuable byproduct of wastewater treatment processes.

Presentation Types

Oral

Theme: Marine and Coastal

A Robust AI Framework for Monitoring Dynamic Coastline Changes

Kathy Bannigan, Shagufta Henna

Atlantic Technological University, Donegal, Ireland

Abstract

Coastal areas are increasingly threatened by climate change, rising sea levels, and more frequent storms, posing significant risks to ecosystems, local economies, tourism, and communities. Monitoring dynamic coastline changes is essential for informed decision-making and effective protection strategies. However, current Artificial Intelligence (AI)-based approaches for tracking coastal changes face notable challenges, including limited adaptability to varied environments and a heavy reliance on large amounts of labeled data for training.

To address these challenges, we propose a novel AI approach using Supervised Contrastive Learning, an advanced machine learning technique that leverages labeled data to enhance model performance by grouping similar data points while distinguishing them from different ones, even with limited labeled data. This approach is further augmented with a Coordinate Attention mechanism, which integrates spatial positional information into the attention process. Unlike traditional methods that condense image features into a single vector, coordinate attention preserves long-range dependencies and precise positional details along both horizontal and vertical directions. This enables the AI to focus on critical features in coastal images, enhancing accuracy and robustness in detecting subtle changes.

Our method improves the ability to monitor coastal environments by making AI models more adaptable to diverse coastal landscapes, even with fewer labeled examples. By combining Supervised Contrastive Learning with Coordinate Attention, we achieve superior performance in coastal erosion classification. This advancement could significantly enhance coastal monitoring, empowering governments and organizations to develop more effective strategies for protecting vulnerable coastal areas from environmental changes.

Presentation Types

Poster

The Atlantic-Arctic Agora (A-A Agora) project for Ireland: studying beach and dune morphodynamics and engaging with communities to support sustainable coastal restoration and management in Co. Cork

Emma Verling ORCID iD[1], Melanie Biausque[2,1], Darragh Ó Súilleabháin[3], Lee Wah Pay[3]

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Abstract

The Atlantic-Arctic Agora (A-AAgora) project is a Horizon Europe-funded project aiming to identify innovative solutions to coastal restoration activities in collaboration with nature and citizens. In the Irish Demonstration area of the project (one of three; the others are in Norway and Portugal), coastal erosion-related challenges were identified along the Co. Cork coast and strategic study sites facing coastal erosion, tidal flooding and human activities were selected for local monitoring in East and West Cork. In a collaboration between UCC and Cork County Council, the ultimate aim of this work is to facilitate more sustainable decision-making for long-term management plans to tackle coastal erosion locally, and to evaluate the potential for these ideas to be replicated more broadly. Two main sites have been selected for DGPS surveys: Pilmore/Youghal (east Cork) and Inchydoney (west Cork). DGPS surveys are conducted at low tide to analyse beach and dune morphodynamics at different timescales and under various hydrodynamic forcing, including storms and post-storm recovery. To date, profiles collected at both sites are showing a signature of seasonal morphological changes, and this ongoing work will allow us to better understand sediment transport patterns and physical processes.

In addition, have combined DGPS surveys with a static camera at Inchydoney, overlooking the beach, the dune, and the nearshore waves. The images, collected every 30 minutes during daylight hours, will give us additional insight into physical processes under various hydrodynamic conditions. We are also combining this scientific data collection with community engagement, inviting citizens and communities to help us co-develop solutions for coastal erosion issues using education and survey tools such as Maptionnaire and CoastSnap in Youghal. The next step for the A-AAgora project in Ireland is to identify sustainable solutions (including the potentially Nature-based Solutions) and long-term management actions, to tackle coastal challenges in those areas

Presentation Types

Oral

Does the Infaunal Quality Index (IQI) reflect the true ecological status of coastal bays along the Northwestern Coast of Ireland?

Manoj Chand ORCID iD[1], Robert Kennedy[2], Nicholas Touzet ORCID iD[3], Roisin Nash ORCID iD[1]

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Abstract

The European Union Water Framework Directive (WFD 2000/60/EC) provides a comprehensive framework for water policy across the European Nation to achieve a 'good ecological status' for all the water bodies. This includes lakes, rivers, transitional, coastal, artificial & heavily modified, and surface waters.

Ireland's Environment Protection Agency (EPA) reports that some of the northwestern sites, such as Inner Clew Bay, Westport and Killybegs, have an ecological status of 'Bad' and are regularly failing the Infaunal Quality Index (IQI) which reflects the ecological health of the bay and comprises of the AZTI Marine Biotic Index (AMBI), Simpson's Evenness (1-λ'), and number of taxa (S). The sites within these bays that are failing are typically coarse mixed sediment types with high abundances of Oligochaeta species such as *Tubificoides benedii* and are thought not to be truly reflective of a bad status. Therefore, this research is exploring the IQI as a biotic index and working to adapt the index to be more inclusive and reflective of Irish habitat types including coarser and mixed sediment assemblages. The research will provide data and test to what extent the biological assemblages reflect the conditions. This will involve the analysis of both new and historic data, the adjustment of boundaries or proportions of metrics in the IQI to reflect the reference conditions identified. This research will inform both the EUNIS habitat classification and result in a new and improved IQI more reflective of differing habitat types.

Presentation Types

Poster with 5 min oral presentation

The impact of extreme weather events on plastic distribution and abundance in marine ecosystems.

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Abstract

In recent years, extreme weather events, such as storms and intense prolonged precipitation, have become more frequent as a result of human-induced climate change. At the same time, plastic pollution remains a significant global concern. The interactions of microplastics (MPs) with living organisms and their ecotoxicological effects have been extensively studied, while most research focused on MP abundance and distribution solely looks at a single moment in time. Notwithstanding the research to date, many questions remain unanswered, and targeted research on the temporal fluctuations of MPs is needed to mitigate their environmental impact. This study aims to estimate the impact of extreme weather events on plastic distribution and abundance in marine ecosystems using an intensive before and after sampling protocol.

Baseline data will be gathered by monitoring two corresponding spring and neap tides. Samples will be collected from four locations: three sandy beaches and one estuarine point sample within the inner Galway Bay. Further samples will be collected 24 hours, 48 hours, and 72 hours following the occurrence of a storm event to create a snapshot of the real-time distribution of MPs.

The baseline data will help determine the impact that extreme weather events such as storms can have on MP abundance and distribution. Storm events are expected to increase the number of MPs in intertidal sediments as high winds, tides, and heavy rainfall can resuspend and distribute plastics amongst sediments.

Presentation Types

Poster with 5 min oral presentation

What lurks in the mud? Using benthic invertebrate communities as a proxy for water quality to elucidate the effects of space and time within two natural harbours

Charlene Watters ORCID iD[1], Róisín Nash ORCID iD[1], Francis X. O Beirn[2], Fiona Kavanagh[1]

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Abstract

Marine benthic invertebrate communities have been routinely monitored around Irish coasts since 2014 to fulfil the requirements of the Water Framework Directive (WFD), resulting in a substantial dataset. These communities have a well-established relationship with overall ecological status and have therefore been adopted as a Biological Quality Element throughout the EU under the WFD. To facilitate monitoring these communities, several indices have been developed, with the Infaunal Quality Index (IQI) being adopted in Irish waters.

The relatively unexplored benthic invertebrate dataset has been analysed here to detect spatial and temporal changes and assess how these communities respond to potential pressures throughout space and time. Analyses were conducted in PRIMER 7 using multivariate techniques such as cluster analysis, nMDS, and PERMANOVA.

Benthic invertebrate communities in Waterford Harbour and Cork Harbour, both natural harbours in southern Ireland subject to pressures like industrialisation and nutrient enrichment, were examined. PERMANOVA revealed that space and time were significant factors in both harbours. For Waterford Harbour: Time (df = 3, pseudo-f = 3.1257, p(perm) = 0.003) and Space (df = 9, pseudo-f = 1.6239, p(perm) = 0.001). For Cork Harbour: Time (df = 2, pseudo-f = 5.9486, p(perm) = 0.001) and Space (df = 14, pseudo-f = 2.8402, p(perm) = 0.001).

However, estimated components of variation differed between waterbodies: Waterford Harbour (Time = 298.93, Space = 221.26) and Cork Harbour (Time = 472.58, Space = 914.45). These results suggest that in Waterford Harbour, temporal factors have driven community change, whereas in Cork Harbour, spatial factors dominate. This aligns with the IQI statuses of moderate and good for Waterford Harbour and Cork Harbour respectively.

The results here will inform future WFD monitoring, supporting the early detection of waterbodies that may require more frequent monitoring due to changes in benthic community status.

Presentation Types

Oral

Exploring Ireland's Blue Carbon Potential: Quantifying Lateral Fluxes of Dissolved Carbon in a Saltmarsh Ecosystem

Eliza Fairchild ORCID iD, Grace Cott ORCID iD

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Abstract

Coastal wetlands are highly productive blue carbon ecosystems that sequester large amounts of atmospheric carbon in soils. Lateral fluxes (i.e., outwelling) of dissolved carbon have been identified as an additional pathway for carbon sequestration. Carbon outwelling from saltmarshes is dominated by dissolved inorganic carbon (DIC), while dissolved organic carbon (DOC) accounts for a smaller proportion of the carbon exported. DIC as bicarbonate has a residence time of 100,000 years, making this a potential pathway for long-term carbon sequestration. Further investigation is needed to determine the significance of carbon outwelling and to integrate this information into blue carbon budgets and large-scale models.

Globally, research on lateral carbon fluxes is limited, and no studies have quantified carbon outwelling from Irish saltmarshes. To address this knowledge gap, we are monitoring carbon fluxes from a saltmarsh tidal creek in Co. Kerry, Ireland, using a tidal flux station deployed in July 2024. The station is located just inland from the main creek mouth and equipped with a multiparameter sonde, flowmeter, and automated water sampler. The station logs water quality (e.g., depth, temperature, DO, pH, ORP, conductivity, salinity, SSG, TDS, and CDOM) and flow rate, while the automated sampler collects discrete samples throughout tidal cycles for DOC and DIC analysis. Discrete samples form the basis for a model linking dissolved carbon fluxes with water quality, enabling the quantification of annual net carbon fluxes from an Irish saltmarsh.

This ongoing project contributes essential data to a broader initiative aimed at advancing scientific understanding of carbon dynamics in Irish coastal ecosystems. By establishing a robust scientific foundation, we aim to improve management practices, enhance carbon sequestration, and support climate mitigation and adaptation efforts. Our research underscores the importance of understanding local variations in carbon dynamics, which is crucial for developing informed environmental strategies and underpinning policy development.

Presentation Types

Oral

Coastal phytoplankton in a changing environment

Angéline Cariou ORCID iD[1,2], Dave Clarke[2], Cóilín Minto[1], Olga Lyashevska[1], Deirdre Brophy[1]

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Abstract

Recent climate reports have detailed the numerous potentials, observed and documented effects of climate change on coastal ecosystems. The environmental stressors expected to affect marine wildlife include rising water temperature, acidification, storminess, change in stratification, eutrophication and loss of habitat among others. Micro-algae are highly vulnerable and their responses to environmental changes have been described in the latest Irish Ocean Climate and Ecosystem Report (Nolan et al 2023). At the base of the marine trophic network, many species rely on and are affected by phytoplankton's diversity and productivity, including shellfish organisms. The national phytoplankton monitoring programme, co-ordinated by the Marine Institute, provides over two decades of data for most of Ireland's coastlines and bays, particularly in classified production areas designated for aquaculture production. This is a valuable resource for understanding past dynamics in phytoplankton communities and predicting future change. Through the Cli-PhI project (Ocean CLImate variability and Phytoplankton in Irish coastal waters), we will review long-term trends in phytoplankton dynamics and spatial distribution. Numerical approaches such as linear regression model and ordinations analysis will enable to access trends and seasonality of key phytoplankton groups, investigating also the timing and extent of annual spring and summer blooms. These approaches will enable to identify temporal changes, spatial differences, identify environmental drivers and build predictive models. The CliPhI project will build understanding of the effects of the climate change on phytoplankton dynamics in Irish waters, the consequences for the broader marine ecosystem and implications for human uses of the marine environment (e.g. aquaculture).

Presentation Types

Oral

Bioprospecting of bioactive lipids from intertidal microphytobenthic biofilms from the coast of Ireland

Sara Finnerty ORCID iD[1], Yunhai Li ORCID iD[2], Brian Kelleher ORCID iD[3], Nicolas Touzet ORCID iD[1], Shane O'Reilly ORCID iD[2]

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Abstract

Microphytobenthic biofilms are complex mixtures of marine microorganisms, embedded in a matrix of extracellular polymeric substances (EPS). They develop as a visible upper layer on intertidal sediment. Although generally considered a societal nuisance, novel cytotoxic compounds have been isolated from biofilm-derived microorganisms [1]. Intertidal biofilms were sampled from the coasts of Sligo, Mayo and North Bull Island, Dublin to explore their potential as natural product sources. Microscopic analysis revealed a complex microbial mixture of diatoms, cyanobacteria and dinoflagellates embedded in sediment. Freeze-dried biofilms (5-10 g) were extracted by ultrasonication-assisted extraction in dichloromethane:methanol (1:1, v/v at 35 °C). Crude extracts were concentrated after centrifugation and/or vacuum filtration (0.7 µm glass fibre filters). Crude yields ranged from 1.38 – 51.5 mg/g. Crude extracts (5% of total) were profiled by gas chromatography-mass spectrometry (GC-MS). Lipids were derivatised using sodium methoxide and N,O-Bis(trimethylsilyl)trifluoroacetamide/trimethylchlorosilane, prior to injection on an Agilent 7890 N gas chromatograph coupled to an Agilent 5973 N mass selective detector. Complex distributions of lipids were detected; free and ester-linked fatty acids, sterols and hopanoids. Lipids with known bioactive properties were detected, including polyunsaturated fatty acids (eicosapentaenoic acid, arachidonic acid), phytosterols (β-sitosterol, stigmasterol, cholesterol). A range of known (phytol) and unknown terpenoids were also detected. Ongoing bioactive screening of fractions, via 3-[4,5-dimethylthiazol-2-yl]-2,5 diphenyl tetrazolium bromide (MTT) assay, will identify bioactive fractions. Upcoming LC-MS analysis will elucidate the polar lipids present in the biofilms. This research can develop new natural products to contribute to the blue bioeconomy. Valorisation of this coastal natural resource can therein be achieved.

Keywords: biofilm, bioprospecting, microphytobenthos, natural product

[1] Wu C, Tang J, Limlingan Malit JJ, Wang R, Sung HHY, Williams ID, et al. Bathiapeptides: Polythiazole-Containing Peptides from a Marine Biofilm-Derived *Bacillus* sp. J Nat Prod. 2022;85(7):1751–62.

Presentation Types

Poster with 5 min oral presentation

Review of Assessment Methods for Seagrass-Induced Wave Attenuation

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Abstract

With the escalating demand for enhancing coastal resilience in response to sea level rise and increasingly destructive storm events, seagrass has emerged as a promising nature-based solution, offering multiple ecosystem benefits, including coastal protection. However, the mechanisms underlying seagrass-induced wave attenuation and their quantification remain inadequately understood. Moreover, inconsistencies in the methodologies for measuring and reporting wave attenuation hinder direct comparisons across studies conducted under different ecological and wave conditions. To address this, a systematic review was conducted of the 43 most relevant experimental studies published from 2000 to 2024. Six critical parameters in evaluating seagrass-induced wave attenuation are identified and discussed, including wave energy dissipation, drag coefficient, wave transmission coefficient, wave attenuation coefficient, wave-induced flow velocity, and turbulent kinetic energy. Among these, wave-induced flow, wave transmission coefficient and drag coefficient are found to be the most commonly employed parameters in experimental studies. Submergence ratio, blade flexibility and shoot density are considered essential parameters affecting wave attenuation. Although conflicting findings are reported in some studies, the majority indicate that higher submergence ratio and shoot density contribute to stronger wave attenuation. The relative velocity between blade motion and water particles is recognised as the most significant mechanism for the wave attenuation induced by seagrass. Notably, the studies employing rigid blade mimics tend to overestimate seagrass-induced wave attenuation. Finally, a novel framework for designing experimental studies on seagrass-induced wave attenuation is proposed. The findings of this study provide a basis and reference for future studies and projects and serve as a foundation for establishing a unified guidance framework to assess seagrass-induced wave attenuation.

Presentation Types

Oral

Theme: Micro and Nano Plastics and Animal/Human Health

Crystallisation of $CaCO_3$ polymorphs induced by PET-based microplastic particles

Kristina Petra Zubovic ORCID iD[1], Anna Horvath[1], Daniel Martin Brien[1], Remi Rateau[1], Luca Terribili[1], Saoirse Winters[1], Emeline Docaigne[1], Paul C. Guyett[1], Juan Diego Rodriguez-Blanco ORCID iD[1,2]

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Abstract

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Biomineralisation is a biological process where living organisms, such as plants and animals, form mineral aggregates to create exo- and endoskeleton structures (Veis, 2008, Demichelis et al., 2018) often with carbonate minerals (Addadi et al., 2003). Organisms are able to synthesize biominerals to create precise shapes, textures, and compositions (Demichelis et al., 2018). This research study examines the effects and interactions of microplastics during carbonate mineral formation. The emphasis of polyethylene terephthalate (PET), which is commonly used in plastic, is due to the research gap on layered PET (Tagg and Ivar do Sul, 2019) and the exotoxins it releases. In laboratory experiments, we mimicked seawater by synthesising Ca-Mg carbonate minerals with six PET layered microplastics colour variants at different ambient and near-ambient temperatures (21-60 °C), durations, and levels of supersaturation and Mg/Ca ratios to create specific Ca-Mg carbonate polymorph formations. We identified characteristics that support $CaCO_3$ nucleation (rough surfaces, textures, and deformities) using a combination of solid-state, microscopic, and spectroscopic techniques: scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS), Fourier transform infrared spectroscopy (FTIR), and powder X-Ray diffraction (XRD). Our results highlight a favoured attachment of calcite, aragonite, vaterite, and monohydrocalcite to PET surfaces with aragonite and vaterite forming weaker attachments on surface imperfections. We found that PET microplastics underwent degradation during carbonate mineral growth under ambient conditions, as evidenced by surface cracks and peeling of outer layers during calcite growth. This resulted in the release of PET nanoparticles. Our study highlights the ability for biogenic $CaCO_3$ to encapsulate, degrade, and attach to microplastic particles in marine environments. This highlights a potential impact on biomineralisation processes, the ecological toxins faced by marine organisms, and the complex mineral growth mechanisms in calcifying organisms.

Keywords: PET, microplastics, calcite, aragonite, monohydrocalcite, crystallisation, biomineralisation

Presentation Types

Oral

Investigation of Microplastic Release from Inhalers Used for Respiratory Conditions

Nazan Altun ORCID iD, Junli Xu

UCD School of Biosystems Engineering, University College Dublin, Dublin, Ireland

Abstract

Chronic respiratory diseases affect hundreds of millions of people annually, which contributes to the wide use of inhaler devices made of plastic materials. Users of these devices are likely to be directly exposed to microplastics through inhalation. However, there are currently no scientific or regulatory guidelines addressing the safety of microplastic exposure through the use of these devices.

In this study, a personal steam inhaler device was tested. The inhaler was run for different numbers of 15-minute cycles, in the presence of menthol vapor pads as steaming aid. A starting temperature of 95 °C was used for the hot water, which then decreased within the operation cycle. After the vapor pads were removed, the water content of the tank was filtered with 0.2 µm pore-sized alumina membrane filters. 300 x 300 µm sampling areas were imaged using optical photothermal infrared (OPTIR) spectroscopy at different wavenumbers in the fingerprint region (e.g. 1060, 1375, 1460, 1600 cm^{-1}) with 2 µm pixel size. Different image intersection masks were created as higher or lower values than the selected thresholds for different wavenumbers, using 2, 3, or 4 wavenumbers simultaneously, to isolate the particles on the filter. Full spectrum in 769-1799 cm^{-1} was also acquired from the selected locations which showed significantly higher OPTIR signal than the rest of the pixels. Eventually, it was found that some pixels and the related spectra had features that may potentially be linked to different types of plastic materials (e.g. PTFE, PS, PP, etc) which may be sourced from the vapor pads or the inhaler device. The outcomes of this study can improve our understanding of the potential for microplastic release from respiratory devices and raise awareness of its broader implications for both environmental and human health.

Keywords: microplastics, microparticles, inhalers, human health

Presentation Types

Poster

Evaluating UV-Induced Degradation Levels in Polyurethane and Polystyrene Using O-PTIR and Portable ATR-FTIR Combined with Machine Learning Classification Models

Cihang Yang, Jun-Li Xu, Aoife Gowen

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Abstract

Understanding UV-induced polymer degradation is critical to improving their durability and performance in practical applications. Polyurethane (PU) and polystyrene (PS) are two widely used polymer materials that exhibit different degradation behaviors due to their structural differences. In this study, we employed a portable ATR-FTIR spectrometer (ATR-FTIR) and Optical Photothermal IR (O-PTIR) microscope combined with machine learning classification models to comprehensively evaluate the chemical and structural changes that occur during the early stages of UV degradation. ATR-FTIR effectively captures the overall chemical changes, while O-PTIR provides higher spatial resolution, revealing local surface heterogeneity and degradation depth.

By integrating spectroscopic techniques with machine learning, in this study three classification models were evaluated: Partial Least Squares-Discriminant Analysis (PLS-DA), Support Vector Machine (SVM), and Random Forest using the collected spectral data to classify UV degradation stages. For the results, PLS-DA showed the highest accuracy, especially for O-PTIR data. SVM also performed well and was able to effectively capture complex spectral relationships. Random forests showed limitations when processing PU data. This approach provides a reliable method for classifying polymeric materials across degradation phases, offering critical insights for environmental impact assessments and recycling processes.

Keyword: Chemometric, Machine Learning; Spectroscopy; Fourier Transform Infrared Spectroscopy (ATR-FTIR); Optical Photothermal Infrared (O-PTIR); Multivariate analysis; Polymer characterization.

Presentation Types

Poster

Impact of microwave-treated polypropylene microplastics on caco-2 cells

Raphaela Ferreira ORCID iD[1,2], Aoife Gowen ORCID iD[1], Jun-Li Xu ORCID iD[1,2]

[1]UCD School of Biosystems & Food Engineering, Dublin, Ireland. [2]UCD Conway Institute, Dublin, Ireland

Abstract

Plastics are subject to various forms of deterioration, including photo, mechanical, and chemical degradation. These processes break plastics down into smaller particles known as microplastics. Due to their ubiquitous presence, microplastics can come into contact with human cells, particularly through ingestion. This is especially relevant for food containers made of polypropylene (PP) — one of the most widely produced plastics in Europe — which is commonly used for food storage and further microwave heating. PP microplastics has been detected in the human colon, but its health impacts remain unclear. This study examined the effects of microwave-treated PP particles on Caco-2 cells, an *in vitro* model for the intestinal barrier, focusing on cell viability, membrane damage, and oxidative stress. Caco-2 cells were exposed to PP (200µg/ml) under varying microwave treatments (3-minute cycles repeated 1, 5, 10 times, and 30-minute continuously at 1000 W) for 24 and 48 hours. Cell viability was assessed using the MTT assay, cytotoxicity/membrane damage was evaluated through the LDH assay, and oxidative stress levels were quantified using CellRox. Our results showed a 13–35% increase in cell viability after 24 hours, but a significant decline after 48 hours, especially in PP Pristine and PP treated for 30 minutes continuously (23% and 22% decreases, respectively). A slight increase in LDH levels after 24 hours indicates some level of membrane disruption, despite the lack of statistical significance. Oxidative stress levels increased by at least 74% in all conditions after 24 hours and remained elevated after 48 hours compared to controls. These findings indicate oxidative stress as a key mechanism affecting cell viability, emphasizing the need for further research on the health implications of plastic exposure.

Keywords: microplastics, polypropylene, caco-2 cell, human health

Presentation Types

Poster

Characterisation of polypropylene and nylon microplastics after microwave treatments

Emine Merve Canga, Aoife Gowen, Jun-Li Xu

University College Dublin, Dublin, Ireland

Abstract

The ageing of microplastics (MPs) is notably affected by temperature, as these materials are prone to thermal degradation during activities like heating, drying, and cooking. Household microwave (MW) ovens, commonly used to heat or cook food in plastic containers, may influence the properties of MPs. In this study, we examined polypropylene (PP) MPs and Nylon (polyamide), two polymers frequently employed in the food industry. MP solutions were prepared in deionized water and deposited on glass slides for analysis using optical photo-thermal infrared spectroscopy (O-PTIR). This advanced technique allows for the detection of submicron particles with a spatial resolution of 500 nm, overcoming the fluorescence interference in Raman spectroscopy and the spatial limitations of FTIR. After initial characterization, the samples underwent MW treatment for 3 to 15 minutes at 1000 W. The C-C bond stretching intensity at 1016 cm^{-1} in PP MPs increased following 9 and 15 minutes of MW exposure, indicating potential bond breakage caused by MW energy. Additionally, spectral shifts within the 1500–1350 cm^{-1} range after 15 minutes suggested molecular rearrangements in the polymer structure due to MW radiation. Key peaks in Nylon, including those at 1640 cm^{-1} (amide I), 1536 cm^{-1} (N-mono-substituted amide), and 1260 cm^{-1} (C-O stretching), highlighted its composition. The overall spectral intensity of the samples diminished with prolonged MW exposure, reflecting the impact of MW energy. Principal Component Analysis (PCA) plots for PP and Nylon MPs revealed clear distinctions between untreated and MW-treated samples. In summary, this study demonstrates that MW treatment can induce structural modifications in MPs, potentially altering their interactions with other molecules. These findings emphasize the need to account for process parameters when investigating the chemical changes in MPs caused by MW treatment.

Keywords: Microplastics, Microwave, Polypropylene, Nylon

Presentation Types

Oral

Spectral Identification of Environmental Microplastics by Open Set Convolutional Neural Networks

Junhao Xie ORCID iD, Aoife Gowen, Jun-Li Xu

University College Dublin, Dublin, Ireland

Abstract

Infrared (IR) spectroscopy has long been a cornerstone for identifying and analyzing microplastics (MPs), which are globally pervasive pollutants. Recently, convolutional neural networks (CNNs) have been increasingly applied to spectral classification tasks in MP research due to their high throughput and remarkable accuracy. Here, we developed a CNN model tailored for IR spectral classification of MPs from the environment. Considering the open-world nature of environmental MP detection, we incorporated OpenMax, an open set recognition technique, to address the closed-set limitation of traditional CNN models, where inputs are invariably forced into known classes (i.e., classes included during model training). To enhance the model's generalization, we focused on increasing intra-class variation by incorporating data collected using various IR instruments ourselves and publicly available resources. Additionally, we designed a targeted data augmentation strategy to improve model performance across different spectral ranges, further enhancing intra-class diversity, hence generalization. Results: the trained model achieved a classification accuracy of 98.3% on a test set containing 23,000+ spectra from known classes, and 0% on a test set comprising 9,000+ spectra from unknown classes. By integrating OpenMax, the model attained an accuracy of 67.1% on the test set of data of unknown classes (categorizing them into a "unknown" class). When applied an uncertainty threshold: between 0 and 0.7, OpenMax demonstrated superior open set recognition performance. At 0.7, the model achieved balanced classification accuracy for both known and unknown classes at 95%. However, between 0.7 and 0.9, OpenMax did not exhibit a significant advantage in identifying unknown classes. Furthermore, the targeted data augmentation strategy improved the classification accuracy for narrow spectral ranges by up to 3.1%. Our study advances the application of CNNs in the spectral identification of MPs from the environment. The ideas proposed here are potentially transferable to Raman spectral identification of MPs from the environment.

Presentation Types

Oral

Theme: One Health and Biodiversity Conservation and Ecosystem Restoration

Investigating the Effects of Glyphosate Exposure on Survival, Reproduction, and Development in *Drosophila melanogaster*.

Tolulope Olusegun Ajayi, Dr. Caitriona Collins

Technological University of the Shannon: Midlands Midwest, Athlone, Ireland

Abstract

Increasing reliance on chemical pesticides has caused a sharp decline in insect populations over the past three decades, threatening biodiversity and ecosystem stability. Glyphosate, the active ingredient in widely used herbicides like Gallup and Roundup, is effective for plant control but persists in soil and water, posing toxic risks to humans and non-target species. Sublethal glyphosate doses have shown to negatively impact insect development and fertility, reducing egg viability, altering sperm production and disrupting embryonic development.

This study investigates the molecular mechanisms of glyphosate-based herbicides (GBH) toxicity on insect fertility and development, using the fruit fly *Drosophila melanogaster* as a model. Wild-type Oregon-R flies were orally exposed to sublethal GBH concentrations. Egg development was monitored by tracking the progress of eggs laid on treated medium, while fertility was evaluated by crossing exposed virgin flies with control virgins and counting progeny over 15 days.

For adults, the LC_{50} values of GBH Gallup were 6.53mg/mL for females and 6.97mg/mL for males, while for GBH Roundup they were 5.9mg/mL for females and 5.65mg/mL for males. Eggs exposed to sublethal doses (0.01–5 mg/mL) of Gallup and Roundup showed dose-dependent declines in egg and larval survival, with 5mg/mL causing 100% and 61% lethality, respectively, and 1mg/mL causing 75% and 35% lethality, respectively. Additionally, exposure to sublethal GBH doses during development reduced adult fertility. Females exposed to 1mg/mL of Gallup or Roundup during development showed fertility declines of 34% and 40%, respectively, while males showed reductions of 75% and 57%, respectively. Sublethal doses of GBHs significantly impact Drosophila development and fertility, with Gallup exhibiting higher toxicity than Roundup. Sex-specific differences in GBH exposure responses were observed. Ongoing experiments aim to uncover the molecular mechanisms of this reproductive toxicity, enhancing understanding of glyphosate-induced effects and sublethal pesticide exposure on insects.

Keywords: Glyphosate, *Drosophila melanogaster,* Fertility.

Presentation Types

Poster

Soil Compaction and Plant Biodiversity in Green Spaces Along the Urbanisation Gradient

Freddie Fallon ORCID iD[1,2], Marcus Collier ORCID iD[1]

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Abstract

In an age of increased awareness about environmental health, urban green spaces are lauded as bastions of biodiversity and habitat restoration. Many of these spaces experience some level of disturbance, like parks and sports fields experience heavy foot traffic, and others are formerly developed either by roads or buildings. When soil is compacted by human activities or structures, the individual grains of soil are closer together, creating less space between the soil grains for water and air, essential ingredients for plant life. Despite the evident links between these factors, no studies exist relating urban soil structure and urban land's capacity to support a diverse and robust ecosystem. Here we show that there is no statistically significant correlation between the level of urbanisation, bulk density of the soil, and plant biodiversity. Taking the average of the bulk density, a measure of compaction, for rural, peri-urban, and urban samples, we see that the higher average bulk density in urban samples supports our hypothesis. However, due to the high standard deviation, a correlation could not be established. This contradicts previous assumptions and indicates that more rigorous experimentation is needed.

Presentation Types

Poster with 5 min oral presentation

Mapping the Drainage Status of Ireland's Peatland through Drones, Vegetation, and Hydrology

Muhammad Inam Bari[1], Eoin McCarthy[1], Owen Fenton[2], Patrick Tuohy[3], Eilish Broderick[1]

[1]Department of Biological and Pharmaceutical Sciences, Munster Technological University, Kerry, Co., Kerry, Ireland, Tralee, Ireland. [2]Environment Research Centre, Teagasc, Johnstown Castle, Wexford, Co., Wexford, Ireland, Wexford, Ireland. [3]Animal and Grassland Research and Innovation Centre, Teagasc, Moorepark, Fermoy, Co., Cork, Ireland, Fermoy, Ireland

Abstract

Intact peatlands play a vital role in maintaining ecosystem balance like biodiversity livelihood, regulating water, and acting as a carbon sink. Unfortunately, significant degradation of peatlands is caused due to anthropogenic activities such as artificial drainage, peat extraction, and land use for agriculture. Degraded peatlands become the source of GHG emissions, especially those that are overshadowed by grasslands. Following the EU Paris Agreement to mitigate GHG emissions, several initiatives were taken for managing, restoring, and reporting emissions of Ireland's peatlands. However, an information gap about peatland drainage conditions poses a significant challenge for mapping Ireland's Peatlands.

This research aims to enhance the assessment and mapping of peatland drainage status (shallow or deep) through a combination of high-resolution drone imagery, vegetation surveys, and hydrological monitoring. Peatland sites will be evaluated through ground-based surveys and high-resolution drones during both summer and winter to create a digital twin. A scorecard system will be developed to indicate drainage status based on key vegetation indicators, such as Sphagnum mosses, with species weighted according to their correlation with drainage conditions. Dip wells and soil moisture sensors will be installed to monitor the water dynamics. Additionally, a field drainage survey will update historical methodologies to an electronic format, collecting data on drainage conditions, soil types, geology, and other relevant factors to create detailed drainage class maps. The ground-based vegetation and hydrology data will be integrated with drone imagery for digital mapping to facilitate machine learning, leading to more accurate peat drainage assessments. The outcome of the research will be an efficient, accurate, and cost-effective method for assessing and mapping peatland drainage status over large areas.

Presentation Types

Poster with 5 min oral presentation

Agricultural Land Optimization for Ecosystem Services and Its Implications for Food Production in Inner Mongolia

Yawen Kang, Ainhoa Gonzalez Del Campo

University College Dublin, Dublin, Ireland

Abstract

Food systems play a significant role in supporting societal and human progress. As the world's most populous country, China has consistently prioritized food security in policy and planning. Over the past two decades, there has been a sustained increase in food demand, particularly in the consumption of animal-based foods, placing greater pressure on the environment through expansion and intensification of cultivated land and grassland resources. As a result, provisioning, supporting and regulating ecosystem services such as habitats for wildlife/biodiversity, water supply and cycling, and carbon storage are significantly impacted. These issues are magnified in Inner Mongolia, a significant base for both grain production and animal husbandry in China, due to its vulnerable ecological environment. This presentation will introduce a methodological framework to explore land-use optimization layouts that consider multiple ecosystem service protection objectives and examine trade-offs between food production and ecosystem service protection in this region. This research ultimately aims to provide valuable insights to inform future policies that address the dual challenges of food and ecological security in China.

Presentation Types

Oral

How effective is the invasive quagga mussel at colonising the deep lake habitats of Lough Ree, and how do the quagga mussel populations of lake and river habitats compare?

Kelly Macken

University College Dublin (UCD), Dublin, Ireland

Abstract

Fifteen grab samples were taken at a depth of 5 meters, 10 meters, 15 meters, and 20 meters from two sites on Lough Ree (LR), Athlone. Fifteen grab samples were taken at four downstream sites on the Shannon River (SR) at 5 meters. All samples were sorted for quagga mussels (*Dreissena bugensis*), zebra mussels (*Dreissena polymorpha*), and Asian clams (*Corbicula fluminea*). Quagga mussel (QM) biomass was generally found to decrease with depth in LR, with an average biomass of 850.322 g/m^2 at 5 meters compared to 22.325 g/m^2 at 20 meters. The SR sites possessed a higher mean QM biomass (1099.846 g/m^2) compared to LR at 5 meters (850.322 g/m^2). Shell length was measured to infer the age composition of each population. Compared with data collected in 2022, the QM population has increased at 5 meter depths, and the 20 meter population at one LR site increased from 4.765 g/m^2 in 2022 to 44.651 g/m^2 in 2024. The Asian clam was recorded at two SR sites and remains absent from LR. Zebra mussel biomass has declined since 2022, as in 2024 this species was not recorded in LR. The QM has not at present effectively colonised the deeper substrates of LR, possibly due to the fine soft sediments present. This limits the potential max population of this invasive species and its subsequent impacts on native taxa and water quality. However continued monitoring of these populations is needed. Accurate information on the QM and other invasive bivalve species' distribution is vital in creating effective management strategies to conserve vulnerable freshwater ecosystems and their native taxa. This is especially crucial as the effects of climate change are predicted to promote further freshwater ecosystem destabilizations in the future.

Keywords: quagga mussel, depth, invasive species.

Presentation Types

Oral

Firmly Rooted: Using host trees to predict new pest invasions.

Ultan O'Donnell ORCID iD[1], Conor Francis McGee ORCID iD[2], Andy Bourke ORCID iD[2], Jon Yearsley ORCID iD[1]

[1]University College Dublin, Dublin, Ireland. [2]Department of Agriculture, Food & The Marine, Kildare, Ireland

Abstract

Species Distribution Models (SDMs) are tools commonly used to predict the establishment of an individual invasive species. We wanted to develop an evidence-based SDM approach to compare the establishment risk of many invasive tree pest species, in order to guide national and regional pest management initiatives. However, invasive species present unique challenges that can affect the accuracy of these models.

Evidence shows that niches shift between a species' native range and their invaded range, compromising the capability of SDMs to accurately predict an invaded range using native records. Furthermore, a lack of data in the study area, which is a certainty when predicting a pest's establishment before they arrive, violates the equilibrium assumption, a key component of the modelling approach. These limitations result in poor or incomplete predictions.

This research introduces a novel, host-centric modelling approach to mitigate these challenges. By modelling the distributions of pests' host tree species rather than invasive pests, we use a dataset that should minimise these challenges. Tree species are abundant, and adults are inherently well-established in their environment, which aligns with the equilibrium assumption of SDMs. In addition, a pest species' host must be in an invaded range for the pest to establish, minimising the risk of partial niche predictions. Using oak and pine pest species as a guide, we modelled the risk of establishment using ensembles of host tree species in Ireland and Sweden under current and future climate scenarios based on CMIP6 projections. We use our method to explore how pest-risk rankings are affected under future climate change scenarios and identify what tree pests are most likely to establish. Our method demonstrates the potential for more reliable invasion risk predictions, informing surveillance programs and national plant protection strategies to safeguard forest ecosystems.

Presentation Types

Oral

Investigating seagrass restoration potential in Irish restored habitats

Olivia Philo[1], Pedro Beca-Carretero[1,2], Dagmar Stengel[1]

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Abstract

As part of the United Nations Decade on Ecosystem Restoration (2021-2030) and the European Union's recently enacted Nature Restoration Law, Nature-based Solutions (NbS) have gained recognition as a viable approach to ensuring the sustainable development of coastal habitats. Of these Nature-based Solutions, seagrass restoration is viewed as a vital mitigation strategy against the adverse effects of climate change.

Seagrass beds in Ireland, largely comprised of Eelgrass (*Zostera marina* L.) and Dwarf Eelgrass (*Zostera* [*Nanozostera*] *noltei* H.), are experiencing multiple anthropogenically induced threats, including ecological degradation, eutrophication, and shifting temperature regimes. Successful restoration would not only ensure the sustainable functioning of these habitats but also reestablish the various ecosystem services that their presence provides including carbon sequestration, sediment stabilisation, and improvement of water quality. Enhancing the integrity of seagrass beds is therefore crucial in ensuring the health of these vulnerable environments, as well as the health of people and animals who depend on them.

This project aims to evaluate the restorative capacity of seagrass meadows in Irish restored habitats. As well as utilising pre-established shoot and seed-based methods, a novel approach incorporating the use of biodegradable mats in shoot transplantations is assessed. Laboratory-based trials evaluating the potential of this innovative approach, as well as the germinative capacity of both *Z. marina* and *Z. noltei* seeds under varying abiotic conditions, are underway. These trials are designed to inform the experimental design of field experiments. On a broader scale, this research will fundamentally contribute to advancing knowledge of seagrass restoration practises in restored habitats and will evaluate its capacity as an effective Nature-based Solution.

This project is funded by the Environmental Protection Agency (EPA).

Keywords: abiotic factors, Nature-based Solutions (NbS), seagrass restoration, transplants

Presentation Types

Poster with 5 min oral presentation

Sampling for "saproxylic" and "other woodland using beetles" in one of Ireland's most important surviving ancient woodlands.

aoife crowe ORCID iD[1], Mike Gormally[1], Caitriona Carlin[1], Aidan O'Hanlon[2], Christopher Williams[3]

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Abstract

The term “saproxylic” describes species which are involved in or dependant on; dead and/or decaying woody tissues, the process of the fungal decay of wood, and/or the products of that decay (e.g. fungi, wood mould). These woody resources can occur on dead trees, but also on/within living trees.

Saproxylic beetles (Coleoptera) are an insect group that can be found across a number of different taxonomic families, all of which display an array of interesting life strategies centred around their dependence on woody substrates. These beetles are ecologically important as they make up a very large proportion of the European forest insect biodiversity. Additionally, they bring balance to healthy, woody habitats through the provision of beneficial ecosystem services, including; pollination, deadwood decomposition, nutrient cycling, ecosystem engineering and prey provision.

Unfortunately, saproxylic beetle populations are in decline in Europe and many species are threatened with extinction. This is largely due to the change and loss of the woody habitats and microhabitats that these beetles depend upon. Furthermore, the study of saproxylic beetle ecology is currently lacking, particularly in Ireland where knowledge gaps remain regarding the conservation status and ecological requirements of many species. Given their status, mitigating further declines in saproxylic beetle biodiversity and increasing the knowledge of their ecology is imperative.

The current presentation will discuss the creation of a robust sampling strategy for “saproxylic” and “other woodland using beetles” in one of Ireland’s most important surviving ancient woodlands. Sampling involved a combination of three trap types (Intercept, Emergence and Pan), along with the evaluation of various surrounding environmental variables known to be important for saproxylic beetle populations. Insights into the main findings of the study will be discussed, particularly the effectiveness of trapping methods for saproxylic species.

Presentation Types

Oral

Composition, Structure, and Dynamics of Ant Communities in Ireland and Ukraine

Nataliia Kosiuk ORCID iD[1,2], Audrey O'Grady ORCID iD[1], Ronan Courtney ORCID iD[1,3]

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Abstract

This research investigates the comparative analysis of ant assemblages in both natural and anthropogenically altered biotopes across two distinct regions: Ukraine and Ireland. In Ukraine, the study focuses on ant communities in various habitats, including virgin forests, grasslands, alpine meadows, and disturbed environments such as woodcut plots of different ages. Key findings indicate that ant species abundance and diversity are highest in 4-10-year-old afforestations, with the lowest diversity observed in recently cut and mature forests. Ecotones, such as abandoned tractor passes and river terraces, support distinct ant species compositions. Ant assemblages also vary with altitude and are influenced by geological structure, soil composition, and moisture levels. The alpine meadow ant fauna is dominated by *Manica rubida* and *Formica lemani*.

The study extends to Ireland, where ant communities are surveyed in biotopes including Burren limestone pavements, Atlantic rain forests, pine forests, grasslands, bogs, and wetlands. The research aims to compare ant assemblage structure and succession patterns across these diverse habitats.

By combining fieldwork in both regions, this study aims to enrich the understanding of Irish ant fauna, offering a contemporary faunistic overview and a robust ecological index for monitoring ecosystem health. The findings are expected to advance ecological knowledge of ant communities and their responses to habitat disturbance, contributing to broader ecological assessments of habitat changes in both Ukrainian and Irish ecosystems.

Presentation Types

Poster with 5 min oral presentation

Enhancing Soil Literacy in Ireland: Insights from the EU funded LOESS Project

Saurabh Singh ORCID iD, Claire McDonnell ORCID iD

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Abstract

Soil quality has deteriorated in Ireland and worldwide in recent decades. Literacy Boost through an Operational Educational Ecosystem of Societal actors on Soil health (LOESS), involving 16 countries with 20 partnering organisations, aims to enhance soil health awareness and soil literacy through educational offerings, training programmes, and skill development initiatives.

This presentation highlights the Irish context of LOESS, which involves a multi-tiered approach to integrate soil health education into formal and informal learning spaces. In the initial scoping phase, the existing content for soil health awareness in the Irish context was explored. Gaps were found to exist particularly concerning the explicit integration of soil health objectives from EU Mission Soil. While tertiary and vocational education offerings incorporate them to some extent, they only feature rarely in primary and secondary education curricula. This may be in part due to the relatively short timeframe since these objectives were established. However, there are some very effective xamples of soil health education resources developed as optional 'add-ons' for school curricula such as the Choill Bheag learning programme from An Taisce which includes soil testing activities.

In the current phase, interactive workshops, app co-creation with secondary school students, the development of a module on soil health for college students by college students and the design of a workshop on community engaged research and learning for soil health for lecturers are in progress. These activities and overall the project align with EU Mission Soil and the UN SDGs. At the end of the current activities phase, the project aims to integrate experiential learning modules and participatory co-design processes connecting students, educators, and civil society in understanding the significance of soil. By fostering soil literacy, LOESS not only aims to deepen awareness but also inspire actionable change, creating pathways toward a more sustainable and resilient future.

Presentation Types

Oral

Presenting the findings of a One Health PhD research project investigating Lyme borreliosis risk in Ireland

Ríona Walsh[1,2], Mike Gormally[2], Christopher Williams[3], Annetta Zintl[4], Caitríona Carlin[2]

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Abstract

Lyme borreliosis (or Lyme disease) is caused by the bite of a tick carrying a pathogenic bacterial genospecies of the *Borrelia burgdorferi* sensu lato complex. A One Health approach is necessary to fully understand the risk of this zoonotic infection in humans. Because of differences in the geographic distributions of pathogen genospecies, as well as regional differences in vector species, host assemblages, and habitats, the disease ecology of Lyme borreliosis varies between countries. In Ireland, knowledge gaps have been identified which pertain to the demographics of Lyme borreliosis infection in humans; the relationship between environmental factors and ecological markers of disease risk; and the how at-risk groups perceive the infection.

A One Health, trans-disciplinary PhD research project was therefore undertaken to address these knowledge gaps. A meta-analysis and an ecological field study were undertaken to define the ecological markers of Lyme borreliosis risk. Results from these analyses suggest that woodland habitat size and type can affect nymphal infection prevalence. Nymphal tick abundance (indicating bite risk to humans) was found to be highest in April. An inverse and seasonal relationship between nymphal abundance and deer activity, and an inverse relationship between nymphal abundance and robin activity have also been identified. Finally, a survey of at-risk individuals has yielded information regarding perceptions, disease knowledge, and training pertaining to Lyme borreliosis risk amongst this group. This work has identified that perceived risk does not vary geographically within Ireland. A dearth of training amongst at-risk individuals, and knowledge gaps relating to symptom identification and risk habitat awareness have also been identified.

The findings of this PhD research have important implications for future studies on Lyme borreliosis ecology and epidemiology in Ireland. These findings should also inform the timing and structure of future campaigns and policies aimed at addressing Lyme borreliosis in Ireland.

Presentation Types

Oral

Marine restoration and willingness to pay: do the risks matter?

Geraldine Doolan ORCID iD, Stephen Hynes

University of Galway, Galway, Ireland

Abstract

Anthropogenic change has accelerated the rate of degradation of marine ecosystems globally, meaning that large areas of key habitat-forming ecosystems, such as seagrasses, have been lost. Given that these ecosystems provide essential services which impact human wellbeing, the international community has recognised the need to restore these ecosystems. For instance, the EU Nature Restoration Law makes reference to the need for marine restoration and refers to seagrass specifically. Interest in restoring seagrass is growing internationally, as its carbon sequestration capabilities mean that it is a possible nature-based solution to mitigate climate change. However, as with all marine restoration projects, seagrass restoration is costly, and the ecological complexity of the marine environment means there is a high level of risk associated with the outcomes – globally, the median success rate of seagrass restoration projects is 38%. While stated preference studies have estimated the non-use value of marine restoration projects, it is unclear how these preferences may change in the presence of risk. Understanding the impact of uncertainty and risk on preferences for marine restoration is necessary as the outcome of many of these projects is uncertain, given the conditions that they take place in. In this study, the contingent valuation method is used to estimate willingness to pay for a hypothetical nationwide seagrass restoration project in Ireland, and the impact of providing information on risk on willingness to pay is analysed. The results not only provide important information for policymakers making decisions on marine restoration projects, but also offer insights into social demand for policies in settings characterized by environmental uncertainty.

Presentation Types

Oral

Public perceptions and knowledge of Irish biodiversity – establishing a baseline

Grace Nolan ORCID iD, Dara Stanley ORCID iD, Abey Campbell ORCID iD, Adam Kane ORCID iD

University College Dublin, Dublin, Ireland

Abstract

Globally, biodiversity loss has been acknowledged to be one of the most pressing environmental challenges that we are facing. Legislation at both the national and international scale demands that Ireland addresses biodiversity loss and adopts pro-active conservation policy to protect and restore native biodiversity. Simultaneously, it has become widely accepted that to achieve these goals a 'whole of society' approach to biodiversity conservation is needed. Whilst Ireland has been pioneering in this 'whole of society' approach with the establishment of the 2022 Citizens' Assembly on Biodiversity Loss, this forum was limited to only 100 members of the public. Current legislation and policy is geared towards engaging more of the Irish public into pro-environmental actions. However, we are currently lacking any baseline evidence on what the Irish public know and think about biodiversity, their perceptions of biodiversity conservation and whose responsibility this is, as well as their knowledge of what is and what is not native in Ireland. Education and outreach initiatives are currently limited by this lack of baseline knowledge, building on assumptions about what the public know and think about biodiversity in Ireland. Through a national survey and gamified knowledge experiment, the purpose of this project is to establish what people's perceptions of biodiversity are, as well as their current knowledge levels. Through a representative sample of the population of Ireland, we are exploring how different demographics (age, gender, occupation, locality, education level) understand and perceive biodiversity as well as their willingness to engage proactively in conservation efforts. Combined with this, we will be testing the ability of the public to identify native and non-native species through the format of a video game. Results from this study will be used to inform national conservation and education policy, including life-long learning needs.

Keywords: biodiversity, conservation, environmental attitudes and values

Presentation Types

Oral

Ambient ammonia concentrations from cattle (the MACCa model) and their potential risk to Ireland's Natura 2000 Network

Katie Ward ORCID iD, Thomas Curran ORCID iD, David Kelleghan ORCID iD

University College Dublin, Dublin, Ireland

Abstract

Ammonia (NH_3) is a pollutant primarily released from agriculture. In Ireland, the national cattle herd is the predominant source of NH_3 emissions. The ability of NH_3 to negatively impact Europe's most sensitive habitats and species protected under the Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EC) has been of increasing concern in recent years. Currently in Ireland there are no assessments carried out to determine the impact of agricultural NH_3 from cattle on biodiversity within these sensitive sites.

The Mapping Ammonia Concentrations from Cattle (MACCa) model is a simple land use regression model which has been developed using ArcGIS. The MACCa model allows for an assessment of the potential impacts to Ireland's Special Areas of Conservation (SAC) and Special Protected Areas (SPA) from NH_3 as a result of the national cattle herd for the first time. The MACCa model estimates that over 60% of Ireland's land mass is exceeding critical limits designated to protect our most sensitive species from impacts due to ammonia. The application of a designation weighted indicator (DWI) for the potential area at risk within the Natura 2000 Network in Ireland found that between 37% and 62% of SAC and SPA sites are at risk of negative impacts respectively from NH_3 as a result of the national cattle herd. The Dutch nitrogen case (C293/17 & C294/17) (CJEU 2019) stated that the current strategy for reducing excess nitrogen in vulnerable areas was in breach of EU law, and highlighted the need to include grazing animals and the spreading of slurry in assessments for impacts on Natura 2000 sites. Application of the MACCa model in future Appropriate Assessment (AA) analyses allows for a better level of protection for Ireland's Natura 2000 network and the biodiversity found on these sites.

Keywords: ammonia, national cattle herd, biodiversity, Natura 2000 network

Presentation Types

Oral

Advancing island restoration techniques using technology: a LoRaWAN case study from the LIFE Raft project

David Tosh ORCID iD[1], Michael Rafferty[2], Fionnbharr Butler[2], Ulf Keller[2], Jordan Hunt[2], James Crymble[3], John Kelly[4], Gillian Gilbert[2], Claire Barnett[2], Sophie Thomas[5], Mike Little[6], Elizabeth (Biz) Bell[7]

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Abstract

Invasive Non-Native Species (INNS) are one of the greatest threats to global biodiversity. When introduced to islands either deliberately or accidentally, INNS pose a major problem to the unique biodiversity for which islands are known. Efforts to reverse the negative impacts of INNS worldwide, particularly mammals, accelerated in the 1960s with the development of island restoration techniques involving toxicants. We are now at a point where standard approaches have been developed, and refined, over hundreds of islands across the world leading to tried and tested methods that work. Despite the development of effective techniques, the cost of island restoration projects remains high, largely due to the amount of labour required. In an attempt to explore how technology could be used to make eradication programmes involving trapping a more affordable option for island managers we developed a Long-Range Wide Area Network (LoRaWAN) to assist the eradication of feral ferrets (*Mustela furo*) from Rathlin Island. Located 10 km/6 miles off the Co. Antrim coast, Rathlin has internationally important seabird colonies where the introduction of ferrets to the island in the 1980s has contributed to the decline of ground nesting land-bird and seabird populations there. In 2023, the LIFE Raft project set out to eradicate feral ferrets from Rathlin using a trapping network of over 400 live and kill traps. We report on how we adapted existing LoRaWAN sensors to improve the efficiency of the operation and determined the costs and benefits when compared to a traditional trapping approach. We hope the outcome of this project can contribute to the continued adoption of technology to assist INNS management, particularly if ambitions to reverse biodiversity declines like New Zealand's Predator Free by 2050 are to be realised.

Presentation Types

Oral

Forests Beyond Timber: A Tool to Help Balance Nature, Climate, People, and Wood

Matheus Etges ORCID iD[1], Kathleen Conroy[2], Jane Stout ORCID iD[2], Yvonne Buckley ORCID iD[3], Mary Kelly-Quinn ORCID iD[1,4]

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Abstract

Forests provide vital ecosystem services and are central to sustainable forest management efforts. In Ireland, centuries of deforestation reduced forest cover from 80% to 1% by the 19th century. Strategic reforestation and afforestation efforts have since increased forest cover to 11%, primarily using non-native species, with ambitious targets to reach 18% in the coming decades. Guided by Ireland's Forest Strategy, modern forestry seeks to balance economic productivity with ecological and social benefits, requiring innovative tools to support evidence-based decision-making. We introduce a web-based decision support tool developed in the ForES project (https://www.for-es.ie/) to aid forestry managers in understanding and enhancing ecosystem services contributed by different forestry systems and management interventions. The tool, developed using R Shiny and based on a Bayesian Belief Network (BBN) model, allows users to select environmental and structural characteristics along with management decisions to explore different forest site management scenarios. It then informs, based on the BBN model, the probability that the forest site provides different levels of selected ecosystem services, such as climate regulation, biodiversity, recreation, and wood production. Co-developed with forestry experts, the tool aligns with practitioner needs and ecosystem services priorities. Its user-friendly design incorporates contextual guidance, example scenarios, and step-by-step workflows, making it an accessible yet technically robust resource. While developed for Irish forestry contexts, the tool's adaptable structure and data-driven approach enable its application to diverse forest ecosystems and management contexts. By empowering forestry professionals to create and evaluate evidence-based management strategies, the tool aims to support decision-making concerning sustainable forestry practices and optimise the provision of ecosystem services. Future testing and telemetry will assess its feasibility and usability through simulated and real-world applications and collect user metrics to guide iterative improvements. This planned evaluation will help demonstrate how practical tools can support the forestry sector in addressing today's challenges.

Presentation Types

Oral

Theme: Policy, Governance, and Sustainable Development

Agribusiness scenarios 2035 for valorization of biodiversity and ecosystem services in the agri-food value chain

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Abstract

Changing framework conditions play a crucial role in selecting specific measures to promote biodiversity and ecosystem services (BES), as well as in choosing the right options for their valorization. The agri-food system faces numerous challenges, including climate change and resource scarcity important for food production. Additionally, it is influenced by various technological, political, environmental, and socio-economic drivers. A future-oriented perspective that applies foresight methods can help anticipate and respond to these changes. At the same time, farmers struggle because they do not receive adequate recognition for their work or for producing high-quality sustainable food. In addition, there is a lack of coverage of private options versus conventional, public policy options. Therefore, a new decision support system is under development in the project Digital Agricultural Knowledge and Information System (DAKIS), which enables the management of the non-commodity products, such as ecosystem services and biodiversity as 'products' of agricultural activities with a visible value.

We define the term valorization of BES, as distinguished from their valuation. Valorization incentivizes measures for promoting BES, while valuation refers to its quantification. We identified four clusters (markets for voluntary services, labelling/certification, environmental management/CSR, and tradable permits/quotas). The viability of selected valorization options was examined in four different scenarios 'Agribusiness in 2035'. The analysis revealed a wide range of private valorization options. In contrast to public policy options, which focus almost entirely on the production stage, these private options are distributed across the agri-food value chain. An example within the cluster 'labelling/certificationis' the initiative 'larch bread' that supports local and regional actors. Producers of grain on fields with larch breeding habitats receive a remuneration for grain yield reduction by higher prices paid by the processing partner in addition to price adaptation along processing and sales.

Keywords: scenarios, ecosystem services; valorization; agri-food value chain

Presentation Types

Poster with 5 min oral presentation

Building a collaborative future: stakeholder involvement in the HOLOSEU agricultural platform

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Abstract

The EU project HOLOSEU aims to develop an advanced decision-support tool for European agriculture, addressing the limitations of traditional digital platforms that fail to integrate critical variables such as soils, climate, and environmental impacts. A key component of this initiative is the involvement of relevant stakeholders - including farmers, advisors, researchers, government agencies, and private organizations within the agrifood industry - through systematic engagement and requirement gathering. To facilitate this process, two field experimental sites in Poland and Romania will serve as living labs, where stakeholder engagement will be pivotal in understanding the diverse needs, expectations, and challenges faced by all participants in the project.

A holistic approach requires explicitly linking the socio-ecological systems perspective to the relevance of stakeholder engagement. Recognizing the dynamic relationships between stakeholders and the evolving socioeconomic contexts is essential, as this understanding can significantly inform the development of the decision-support tool. By incorporating the extended innovation system approach, HOLOSEU can ensure that its approach to stakeholder engagement is not only comprehensive but also responsive to the complexities of European agriculture, ultimately leading to more effective and sustainable outcomes. Scholars from a socio-ecological systems perspective emphasize the importance of a nuanced approach, arguing that merely focusing on obvious stakeholders can lead to the oversight of transformational actors. These overlooked stakeholders often hold the potential to influence key leverage points within the system, thus driving necessary transformations. This perspective underscores the need to capture changing stakeholder perceptions, agendas, and influences over time, framing stakeholder analysis as a dynamic rather than static process. Additionally, considering stakeholders along the agri-food value chain is critical, as stakeholder types can vary significantly across different sites. Developing a flexible stakeholder typology that can be adapted throughout the project is essential to ensure relevant engagement and effective collaboration.

Presentation Types

Poster with 5 min oral presentation

Using agent-based models to simulate environmental behavior and policy intervention scenarios: A case study of private well users in Ireland

Rabia Asghar[1,2], Simon Mooney[3], Eoin Oneill[3], Paul Hynds[2,1]

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Abstract

Approximately 50% of Ireland's rural population depends on unregulated private wells, which are susceptible to contamination by agricultural runoff and untreated domestic wastewater. Elevated national rates of enteric infection are increasingly linked with well water exposure, making periodic water testing vital to safeguarding rural public health. The absence of financially incentivised water quality testing necessitates household expenditure, thus understanding environmental, cognitive, and material factors underlying well-testing behaviours is crucial. Existing studies have assigned little attention to the impacts of conjectural, policy-based changes and inter-agent interactions (e.g., well users, government agencies). Empirically informed future scenarios with population-level data may identify top-down strategies conducive to favourable outcomes. Accordingly, the authors adopted agent-based modelling (ABM) to simulate and characterise well testing behaviours via national survey data i.e., a behavioural and legislative "sandbox". ABMs were parameterized to simulate private groundwater well-testing behaviours and assess interventions encouraging more frequent testing. Recursive Feature Elimination (RFE) with 10-fold cross-validation identified key features, including weather, self-efficacy, and penalization/reward structures, with SHAP employed to enhance ABM interpretability.

The ABM framework utilized a Deep Q-network, a reinforcement learning model, simulating agents' decisions in an environment reflecting typical Irish seasonal variations. Over 1,000 episodes of simulations with 561 agents were trained. Among 14 hypothetical scenarios evaluated, "Free Well Testing + Communication Campaign" was the most effective future intervention, with 435 agents participating in testing and the highest learning accuracy (77.23%). "Free Well Testing + Regulation" also performed well, with 433 agents and 77.11% accuracy, though with a high error value. "Free Well Testing" alone resulted in 430 agents participating, with high accuracy (76.67%) and low error. Findings demonstrate that free testing will lead to significantly increased testing frequency (from 5% to >75%), with many residents testing multiple times a year.

Keywords: ABM, well testing, well owners, public health, reinforcement learning.

Presentation Types

Poster with 5 min oral presentation

Sustainable Air Travel Strategies in Practice: Waterford Airport's Contribution to Regional Resilience, Heritage, and Sustainability in Ireland 2040

Amy Whelan[1], Simona Elena Șerban[2]

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Abstract

The aviation industry is a significant contributor to global carbon emissions, driving calls for sustainable practices across all levels of airport operations. As Ireland's oldest city and the closest point to mainland Europe, Waterford stands at a strategic crossroads for shaping sustainable air travel. In alignment with the goals of Ireland 2040—the country's ambitious national development plan—Waterford Airport can play a crucial role in both advancing regional resilience and promoting sustainable practices in aviation. Through architectural innovation and strategic infrastructure investments, Waterford Airport is poised to become a model of sustainability while respecting its rich heritage. The article showcases the intersection of architectural design and sustainability within airport infrastructure, focusing on the integral role that Waterford Airport can play in contributing to Ireland's environmental and regional development objectives. Drawing on case studies of the three largest airports in the Republic of Ireland — Dublin, Cork, and Shannon — the article examines how airports with heritage elements balance modern environmental goals with the preservation of cultural identity. These case studies highlight how strategic design, energy-efficient systems, and sustainable maintenance practices are vital in reducing the carbon footprint of airport operations. Waterford Airport, through its focus on sustainable air travel strategies and its alignment with Ireland 2040's vision for regional development, offers a unique example of how infrastructure can foster environmental resilience. This article outlines how Waterford's heritage can be seamlessly integrated into sustainable strategies, ensuring that it remains a vital hub for both national and international connectivity, all while contributing to Ireland's long-term sustainability and regional prosperity.

Keywords: Environmental sustainability in aviation, heritage architecture, historical adaptation, regional aviation, sustainable air travel

Presentation Types

Poster

Informing Policy and Empowering Society: Research Impact Driving Transformative Environmental Policies

Robert Ludgate ORCID iD, Hillary Cronin ORCID iD, Niall Smith ORCID iD

Munster Technological University, Cork, Ireland

Abstract

Munster Technological University (MTU) is dedicated to promoting sustainable development throughout the southern region by creation of a comprehensive multidisciplinary research and innovation (R&I) ecosystem. The underlying principle guiding this approach emphasises inclusivity and collaboration with regional stakeholders (enterprise, communities, and public bodies) to establish the region as a global leader in sustainability. MTU will combine internal operational expertise along with regional impact to cultivate an ecosystem that empowers all stakeholders to collaboratively create solutions to tackle the urgent societal challenges we face.

MTU's research to impact ambition aligns with the Irish Regional Spatial and Economic Strategy (RSES) for the Southern Region to inform policy, improve governance mechanisms, and promote regional sustainable development. By utilising evidence-based decision-making, we will contribute to the development of coherent policies that will integrate economic, social, and environmental dimensions to address governance gaps. These research insights will aid in the development of measurable indicators designed to monitor progress towards the sustainable development goals (SDGs), promoting accountability and inclusivity in future governance frameworks.

The establishment of an R&I ecosystem that prioritises multidisciplinary approaches at its core will greatly enhance policy integration and governance. MTU's transformation has included scaling up of advisory functions, ensuring impactful and meaningful outcomes. With training in multidisciplinary aspects, MTU's research community will be better equipped to more effectively address industry and community defined needs. This approach acknowledges that sustainable solutions need collaborative and holistic input from a diverse range of stakeholders and fosters One Health for a Sustainable Future. This perspective also highlights the synergy between policy interventions, effective governance structures, and the pursuit of sustainable outcomes that MTU aims to achieve.

Presentation Types

Oral

BioCultúr: Integrating Irish Culture, Heritage, and Language into Bioeconomy Strategies for a Sustainable Future.

Jamie Murray[1], Máire Nic an Bhaird[1], Laoise Ní Chléirigh[1], Tom Curran[2, 3]

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Abstract

The bioeconomy, as a strategy for sustainable development, often emphasises technological innovation and resource efficiency. However, its potential to address global challenges may remain unrealised without including cultural, linguistic, and heritage factors. BioCultúr is a transdisciplinary research initiative exploring how these dimensions can inform and enhance bioeconomy strategies, particularly within the Irish context.

A notable initiative of this project is developing the song An Talamh Bhláfar ("The Fertile Land"). The song was created collaboratively with musician Liam Curran, who appeared on the Late Late Toy Show and intertwines traditional Irish culture with contemporary sustainability themes. It was released alongside a dance video shared widely via YouTube, social media, and newsletters. Positive feedback from audiences highlights the song's resonance with cultural identity and sustainability.

This presentation examines the theoretical intersections of bioeconomy policies with Ireland's cultural heritage, linguistic diversity, and intangible cultural assets. Drawing from literature and the success of An Talamh Bhláfar, and social media, it highlights the importance of social engagement tools in promoting bioeconomy awareness and policy uptake. It further emphasises the ethical responsibility of respecting indigenous knowledge systems and linguistic plurality while fostering sustainability.

By demonstrating how Ireland's unique cultural assets and creative media can drive bioeconomy innovation, this research contributes to a broader understanding of how localised, culturally integrated approaches can inspire global sustainability practices.

Presentation Types

Oral

Geographic information systems-based household food waste mapping across Ireland

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Abstract

The generation of food waste is a complex and dynamic process influenced by numerous interlinked/overlapping demographic, socioeconomic and behavioural factors at the household level, including household composition, size, and income. This study aims to investigate household food waste generation across Ireland, using data collected from diverse geographic regions and socio-demographic groups including ENVIRON 2025 conference participants as a highly educated demographic subgroup. By integrating geographic information systems (GIS)-based food waste mapping with spatial analysis, the study will provide locational data on household food waste and identify spatiotemporal patterns of household food waste generation.

Data collection will involve by daily tracking participants household food waste behaviour using a designed diary over durations of 3, 5, or 7 days. The analysis will examine the spatial associations between socio-demographic variables and household food waste generation providing insights into diverse geographic and socioeconomic regions across Ireland. Preliminary findings from weekly surveys suggest that factors including spatial disparities, sociodemographic factors such as household composition, educational and income levels significantly influence the volume and composition of food waste, in addition to segregation and eventual disposal.

Research findings will be presented during the conference, providing spatial insights pertaining to household food waste generation patterns, with additional insights among a highly educated sub-population. This study aims to enhance current understanding of household food waste generation through the application of GIS at multiple scales, including province, county, city, urban, and rural levels and to inform sustainable waste reduction strategies based on spatially derived insights.

Presentation Types

Poster with 5 min oral presentation

Aarhus Convention Rights and Climate Planning: Enabling democracy in a time of planetary crisis

Alison Hough ORCID iD

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Abstract

The multiple planetary crisis of intertwined planetary heating, biodiversity loss, pollution and increasingly de-stablised weather patterns is putting pressure on societies globally. These factors impact on basic infrastructure, food security, access to water, housing and other basic social necessities, straining emergency response capacity and health services.

The growing urgency of both climate mitigation and climate adaptation, and responding to the other intertwined aspects of breakdown of the planets ecological systems caused by unsustainable economic growth, is now being used as a justification for reducing public debate, access to information on and public participation in climate decision making.

At the same time cutting public participation and accountability from climate decision making leads to poorer, less well informed decision making, often dominated by industrial lobbying interests.

This research looks at the rationales for increased and reduced participation in climate decision making and the direction of travel of legal frameworks in Europe and Ireland and Ireland for facilitating democratic debate on climate change and climate adaptation.

The provision for public participation in EU legal frameworks and how these manifest at national level are examined. Gaps in the frameworks that have emerged from research in the area are highlighted, and pathways forward are scoped out.

This study will focus primarily on the climate planning mechanisms under the Governance Regulation and the EU Climate Law, as well as some related mechanisms such as those in the area of climate finance, just transition and the Social Climate Fund.

Presentation Types

Oral

Communication Breakdown or Disconnect? Investigating the Role of Communication in Addressing Climate Change in Ireland's Agricultural Sector

Eimear Winters, Immanuel Darkwa ORCID iD

University of Limerick, LImerick, Ireland

Abstract

This study examines the awareness, communication methods, and barriers to the adoption of climate change policies in the agricultural sector by farmers.

Climate change is one of the major challenges of our generation and agriculture has contributed to altered global temperatures by increasing the concentration of greenhouse gases (GHG) such as carbon dioxide, methane and nitrous oxide. Agriculture thus plays a crucial role in climate change mitigation.

However, implementing climate mitigation related policies within this sector can be complex due to a variety of factors including farmers' perception of climate change and communication strategies. To better understand causalities, this study examined Irish farmers' perceptions of climate mitigation policies, focusing on their awareness of regulations, the effectiveness of communication strategies employed by policymakers and other emerging barriers Irish farmers face in adopting these policies.

Using qualitative data collected through semi-structured interviews with Irish farmers, the research identifies three key themes: 1) Irish Farmer's Awareness of Climate Change Policies, 2) Communication Methods and Accessibility and 3) Barriers to Policy Adoption.

The findings reveal significant differences in farmer's awareness levels, with younger and more educated individuals displaying a greater understanding. Communication methods remain primarily traditional, with farmers relying on newspapers, such as The Farmer's Journal, for policy updates. However, these methods are often seen as delayed and insufficient, with a lack of clear engagement from policymakers.

The study highlights the need for improved communication strategies, including more interactive, timely and farmer-centred approaches. Additionally, addressing financial and technological barriers will be crucial to facilitating the successful implementation of climate policies. By offering these insights into the experiences of Irish farmers, this study provides recommendations for enhancing policy communication strategies that support policy adoption and support effective implementation of sustainable agricultural practices within the context of climate change mitigation in Ireland.

Presentation Types

Oral

Theme: Sustainable Design Challenge

Living Systems Design and Environmental Science: Transforming the Future Through Trans-disciplinary Collaboration

Lorraine Archer ORCID iD

University of Cambridge, Cambridge, United Kingdom. University of the Arts London, London, United Kingdom

Abstract

This session investigates the transformative potential of living systems bio-design and environmental science in addressing global challenges through innovative design practices. Merging biological processes with creativity, living systems bio-design fosters regenerative, adaptive solutions that redefine relationship with the living world while aiming to enhance ecological resilience. One example that demonstrates innovation in this emerging field is novel microalgae biotechnologies, offering breakthrough designs in cleantech, biofabrication, novel food and feeds, biomaterials, regenerative systems, bioenergy, and carbon capture. Realising this collaborative vision requires a commitment to complex systems thinking and a transdisciplinary approach. Transdisciplinary pedagogies must firstly foster collaboration across diverse fields, encouraging designers and scientists to work collectively. Dismantling traditional silos, this approach promotes innovation and "more-than-human" design perspectives. This expanded view provides relational contextual insights, emphasizing the inter-dependencies and complexities of human and ecological systems. Grounding living systems bio-design in the rigors of environmental science supports a potential for integrating stakeholders into regenerative solutions. The inclusion of disruptive creative processes is essential to enable innovations that include contextual relational information, and, reflect the nuances of human and ecological systems vital for understanding and designing within complex, dynamic environments. As today's interconnected crises framed as a "design emergency" intensify, diverse disciplines spanning arts, design, architecture, regenerative agriculture, and natural sciences are converging. With this emerging field gaining international traction as a transdisciplinary space for transformative innovation. Positioning living systems bio-design and environmental science as essential tools for addressing aspects of the poly-crises.

This session looks at microalgal innovation and celebrates the creative endeavors which employ microalgae as collaborative living dynamic bio-design tool, illustrating the profound potential of living systems and bio-design to shape sustainable, regenerative futures for our shared world.

Presentation Types

Oral

Effects of Curing Regimes on Hardened Properties of Sustainable Concrete Solutions Containing Supplementary Cementitious Materials

Seyedalireza Mohammadirad[1], Jenny Harmon O'Driscoll[1], Michael O'Shea[1], Eoghan Clifford[2], Páraic Ryan[1,3]

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Abstract

The cement production industry is a significant contributor to CO_2 emissions, accounting for 8–10% of global CO_2 emissions. This underscores the urgent need for sustainable alternatives for ordinary Portland cement (OPC) to reduce the embodied carbon footprint of concrete. Supplementary cementitious materials (SCMs) present a promising solution, offering environmental benefits. However, their slower reactivity compared to OPC, particularly in terms of early strength development, remains a challenge. This issue is exacerbated under practical curing conditions for cast in situ concrete, which often deviate substantially from idealised laboratory water curing. Previous research in literature have mainly focused on the performance of SCM-based concrete under water tank curing, neglecting the impact of practical curing for cast in situ concrete. As a result, there is limited understanding of the SCM-concrete performance under practical curing, particularly with respect to strength development and durability. This study addresses this gap by investigating the performance of SCM blended-cement concrete under ambient curing and wet burlap covering, in comparison to standard water tank curing. Key parameters evaluated include compressive strength, water absorption, resistance to chloride ion penetration, and susceptibility to chemical attack. The experimental program assesses multiple SCMs to explore their potential for enhancing the sustainability and durability. The findings aim to provide practical insights for optimising SCM-concrete production under practical curing regimes, thereby developing sustainable concrete.

Presentation Types

Oral

Resealable Reusable Packaging: Bridging Performance and Sustainability for Long Shelf-Life Applications in Reusable Food Packaging

Yvonne Cortese ORCID iD, Golnoosh Abdeali ORCID iD, Ronan Farrell ORCID iD, Alison Reid ORCID iD, Declan Devine ORCID iD, Romina Pezzoli ORCID iD

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Abstract

The transition to reusable packaging systems offers a promising pathway toward reducing the environmental impact of plastics and advancing circular economy goals. By extending the lifecycle of materials, these systems minimise waste generation and lower the demand for raw resources. While reusable packaging is gaining traction, most existing solutions cater to short shelf-life foods, takeaways, or on-the-spot consumption. This research advances the field by developing a reusable vacuum skin packaging (VSP) system specifically designed for long shelf-life applications, a novel contribution to reusable packaging technology.

VSP, widely used for fresh meat due to its long shelf-life, is currently limited to single-use packaging. This project focuses on creating a reusable alternative that maintains the technical and functional performance of VSP while addressing the reusability challenges of resealability and extended shelf-life. As there was limited research dedicated to investigating the influence of repeated use on the material properties of packaging, initial investigations assessed the impact of repeated use on mechanical and thermophysical properties, surface integrity, and microbial colonisation. These studies guided the material selection and prototype development, resulting in a reusable tray capable of meeting the stringent requirements for resealability and shelf-life.

PETG was identified as the preferred material for thermoformed trays due to its transparency, resistance to thermal and mechanical degradation, and ease of integration with established manufacturing processes as well as seal compatibility with currently used commercial lidding films. Work is ongoing to optimise sealing and resealing technologies to further extend the lifecycle of the packaging system while maintaining commercial scalability.

This research, conducted as part of the Horizon Europe-funded BUDDIE-PACK project, demonstrates the feasibility of developing reusable VSP systems for long shelf-life applications. Beyond meat packaging, this work lays the foundation for broader advancements in extended shelf-life sealable, reusable packaging solutions, offering transformative potential across the food packaging industry.

Presentation Types

Oral

Beach Clean 2.0: a transdisciplinary, civic approach to tackling marine plastic pollution in Northern Ireland (NI)

Susann Power ORCID iD[1], Bronagh Millar ORCID iD[2], Justin Magee ORCID iD[1], Jonny Weir[3]

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Abstract

Marine plastic pollution and beach litter remain a complex obstacle – or 'wicked problem' (Rittel & Webber 1973) – to oceanic health and societal wellbeing; thus, requiring a transdisciplinary approach. This research combines the social-psychology theory of 'Enviro-Leisure Activism' (Power 2022), 'Positive Design' (Desmet & Pohlmeyer 2013) and polymer processing material science converting 36%-75% of beach plastics from objects of waste to materials of use.

This green transition activates environmental, community-oriented and leisure motives of coastal communities, and through design-led approaches equips people with knowledge, opportunity and capability to carry out a circular beach clean. Materials harvested through community-organised beach clean events may be transformed into materials of use; repurposing potential landfill waste, into circular beach plastics; creating 3D print filament, and mixed material plastics as feedstock for the polymer processing supply chain.

The Beach Clean 2.0 circular plastics method has been trialled three times in NI. In February 2024 a stock-take characterisation beach clean (n=28) on Rathlin Island assessed the composition of beach litter (29.6kg). In May 2024, Rathlin volunteers (n=21) trialled the Beach Clean 2.0 methodology, where compliance rates for litter (9.9kg) sorting were 82.7%-100% across three material categories. The methodology was scaled-up in September 2024 including 7 beach cleaning groups across the province (n=96) collecting 172.3kg of waste.

This research reimagines purposeful beach cleaning and circular waste management, combining community participation, material science and design. It has the potential to significantly transform ocean stewardship, supporting policies and education, and encouraging infrastructure investments for circular beach litter processing.

Desmet, P. M., & Pohlmeyer, A. E. (2013). Positive design: An introduction to design for subjective well-being. *International Journal of Design*, *7*(3), 5-19.

Power, S. (2022). Enjoying your beach and cleaning it too: a Grounded Theory Ethnography of enviro-leisure activism. *Journal of Sustainable Tourism*, *30*(6), 1438-1457.

Presentation Types

Oral

Theme: Sustainable Water: Management and Water Conservation

Creating a framework for the Circular Economy of Water in Ireland - Reduce / Reuse / Recycle / Recover

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Abstract

This research argues that a fundamental review of the traditional approach to water infrastructure is required to meet survival goals for a post climate change society. The underlying philosophy of this research is the circular economy of water (CEW), where water use is minimised (Reduce), rainwater is reused (Reuse), used greywater is collected, treated and recycled (Recycle), and valuable products embedded within the used water stream are recovered (Recover). The primary aims of this study were to evaluate the efficiency of reusing harvested rainwater (rwh) in this CEW framework.

This study generated water use data from a network of living labs which monitored the efficiency of rainwater harvesting (rwh) in domestic, agricultural and school systems in Ireland. Monitoring of water quantity in the rwh systems showed that they reduced household mains water use by an average of 18% and reduced stormwater from roof catchments by an average of 78%. This has the potential to reduce the average household per capita consumption rate in Ireland from a current national average of 129 L/hd/d to an estimated 105 L/hd/d. Expanding the results of this study further, if rwh was implemented as standard in every new build house constructed in the Republic of Ireland (ROI) from 2012-2021, it could have generated enough mains water savings to supply the total annual household water needs of an additional 38,180 houses. The stormwater reduction would be the equivalent of removing 165,447 roof catchments from the surface water network. If a national program to retrofit rwh as standard in every occupied house in the ROI it could generate enough mains water savings to supply the total annual household water needs of an additional 382,426 houses. The stormwater reduction would be the equivalent of removing 1,657,180 roof catchments from the surface water network.

Presentation Types

Oral

Identifying perceptual and material barriers to management of domestic wastewater treatment systems: A behavioural survey of Irish households

Simon Mooney[1], Rabia Ashgar[2], Linda Fox-Rogers[1], Paul Hynds[2]

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Abstract

Domestic wastewater treatment systems (DWWTSs) in the Republic of Ireland (ROI) co-occur with private domestic groundwater wells on 97% of well-reliant properties and are often located adjacent to surface water body margins. Continual voluntary system maintenance via periodic desludging is thus integral to minimising contamination of private drinking water supplies and public watercourses. Despite recent consolidation of national DWWTS management regulations via targeted system inspections and ancillary public engagement, behavioural studies indicate inadequate system desludging rates. Improper domestic wastewater discharges impact approximately 9% of low status Irish waterbodies and jeopardise private groundwater quality in locally dense rural neighbourhoods. Renewed focus on determinants of system maintenance actions among Irish households is thus necessary to safeguard public and ecological health. Accordingly, a national online survey (hosted by SurveyMonkey) was developed to identify and measure key cross-thematic precursors to household DWWTS maintenance measures. The survey considered both actual and conjectural reactions to household DWWTS inspection in addition to behaviour change (i.e., commencement vs. cessation of system maintenance). Preliminary analysis of 489 survey responses found that 71% of Irish system users reported previous system desludging. However, of serviced systems reported to exceed 5 years in age (i.e. warranting ≥ 1 historical desludging events), 20.2% were desludged infrequently. Reported adoption and historical continuity of general system maintenance (including repairs/upgrades) were both significantly associated with property occupancy during system installation and perceived behavioural self-efficacy ($p < 0.001$, respectively). Adoption of system maintenance after initial inaction was significantly more likely where prior system issues were cited ($p < 0.001$), highlighting “before-the-fact” intangibility of system malfunction/contamination risk as a likely behavioural barrier. Subsequent analysis of respondent policy preferences will seek to identify optimal intervention strategies via predictive agent-based modelling (ABM) of system maintenance behaviours.

Keywords: behaviour change · domestic wastewater treatment system · environmental policy · risk management · survey study · water contamination

Presentation Types

Oral

Predicting River Water Temperature using Machine Learning

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Abstract

River water temperature (RWT) is a vital parameter influencing aquatic ecosystem health and is particularly critical for fish species, which are sensitive to thermal changes. Therefore, accurate RWT prediction is essential for biodiversity conservation, mitigating climate change impacts, and guiding water resource management. Traditional empirical models often struggle to capture the nonlinear interactions between meteorological and hydrological variables, especially in data-scarce regions. In contrast, machine learning (ML) offers a powerful data-driven approach, effectively modelling these complexities to enhance our understanding of river thermal regimes and support actionable ecological strategies.

This study develops a novel ML model to enhance RWT predictive accuracy, focusing on ecologically significant and thermally sensitive rivers. A network of river sites were selected based on hydrological features, topographical and geographical diversity, ensuring both the study's relevance and robust model performance. Key meteorological data, including air temperature, solar radiation, and precipitation, were sourced from Met Éireann synoptic weather stations, while hydrological parameters such as river discharge and stream depth were obtained from OPW hydrometric stations. Historical daily RWT records were compiled as target variables for model training and validation, ensuring comprehensive input coverage needed to develop robust and accurate predictive models.

A decision tree-based ML algorithm was used to develop a RWT predictive model which simulated the complex interactions between climatic and hydrological factors. Model performance was assessed using metrics such as Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and R-squared (R^2). In addition, a sensitivity analysis identified the most critical predictors of RWT, providing insights into the drivers of river thermal dynamics.

This study highlights the transformative potential of ML in predicting RWT and informing ecological conservation strategies, particularly under climate-induced thermal stress, offering a valuable tool for managing aquatic ecosystems and protecting thermally sensitive species.

Presentation Types

Oral

A Systematic Literature Review of Nitrate Leaching Models Focusing on Cover Crops

Vasileios Daimonakos[1,2], Fiachra O'Loughlin[1], Russell Adams[2]

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Abstract

Nitrate (NO_3^-) leaching from agriculture deteriorates soil fertility while posing significant threats to both the environment and human health. Winter cover crops are effective in mitigating NO_3^- leaching mainly by taking up residual nitrogen. Although field studies provide valuable insights into NO_3^- leaching and the effectiveness of mitigation measures, they are expensive, time-consuming, and limited in spatial and temporal scope. Simulation models can overcome these limitations of field studies by allowing the investigation of effects on NO_3^- leaching across larger spatial and temporal scales, in diverse environmental conditions, and by enabling scenario analysis to evaluate the impact of different management practices without the need for costly and time-consuming experiments. However, selecting an appropriate model can be challenging due to differences in purpose, accuracy, data requirements, scalability, user-friendliness, and capability to simulate mitigation measures. The objective of this study is to conduct a systematic review of the models that are suitable and efficient to predict NO_3^- leaching and to simulate mitigation measures such as cover crops. This is investigated by identifying the most commonly used NO_3^- leaching models and the specific conditions that they are used in the literature. Furthermore, their differences in accuracy in predicting NO_3^- leaching, input data requirements, scalability, user-friendliness, and capability to incorporate mitigation measures are evaluated. Finally, the potential strengths and weaknesses of the most widely used NO_3^- leaching models for simulating mitigation measures, such as cover crops, are highlighted, and their ability to incorporate diverse agricultural practices and environmental conditions is explored. These are conducted following the PRISMA framework for including and excluding studies, such as irrelevant or outdated studies. The findings aim to guide researchers and practitioners in selecting suitable and efficient NO_3^- leaching models for diverse agricultural and environmental contexts.

Keywords: NO_3^- leaching, modelling, cover crops, systematic review, PRISMA framework

Presentation Types

Poster with 5 min oral presentation

Integrated strategies for drinking water quality: bridging source protection and treatment

Dr. Usman Ali Khan ORCID iD, Déborah Sousa ORCID iD, Seán Bradshaw, Dr. Maebh Grace

Ryan Hanley Consulting Engineers, Dublin, Ireland

Abstract

The recast Drinking Water Directive (S.I. 99 of 2023) emphasizes a risk-based approach to source protection, incorporating comprehensive risk assessment and management under the drinking water safety plans framework. Concurrently, the Irish government's River Basin Management Plan aims to achieve sustainable water management by 2027. These efforts occur amid growing challenges posed by climate change and emerging pollutants, which significantly affect river and lake catchments and strain the cost and performance of existing drinking water treatment systems. Addressing these complexities requires integrated strategies that combine source protection measures with advanced treatment technologies.

This research investigates an innovative approach to assessing the potential for improving drinking water quality by integrating the comparative assessment of source protection measures and advanced treatment options. The study focuses on six raw water abstraction point configurations, acknowledging the interdependence between source protection and treatment systems. A structured methodology, involving both coarse and fine screening, was developed to identify optimal raw water improvement strategies tailored to the unique social, technical, environmental, and economic contexts of each case study.

Key findings include actionable recommendations for implementing source protection through catchment risk assessment and management, complemented by additional drinking water treatment measures. The study considers the indicative capital and operational costs of both strategies, alongside environmental and technological constraints linked to specific source water characteristics. The outcomes provide a robust framework for guiding future funding priorities and the targeted implementation of water quality measures.

By integrating source protection and treatment strategies, this research highlights the importance of holistic approaches to safeguarding drinking water quality in the face of emerging challenges.

Presentation Types

Poster with 5 min oral presentation

An open source workflow for monitoring hydrodynamic events in small rivers using temporary continuous monitoring stations

Lisa Cronin ORCID iD[1,2], Cian M. Taylor[2], Ciprian Briciu-Burghina[1,3], Frances E. Lucy[2], Fiona Regan[1,3]

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Abstract

Twenty five years since the EU Water Framework Directive (WFD) was adopted, surface water quality across Europe continues to decline. Sources of diffuse pollution are one of the key impediments to the restoration of water quality with climate driven increases in the frequency and intensity of hydrodynamic events a key driver of water quality decline.

Ireland has over 84,800 km of river channel, with more than 2,200 waterbodies requiring improvement of the 4,842 waterbodies assessed under the WFD. Evidence based decisions to identify 'right measure in the right place' requires adequate data, with 583 waterbodies requiring more data to identify the significant pressures.

The significant increase in the use of high frequency instruments for water quality monitoring over the past 10 years has aided the detection of temporal fluctuations and variation in pollutant loads, but the need for 'robust deployment, maintenance, and data management protocols'[1] has been highlighted, along with the challenges for non-experts including citizen scientists in maintaining metadata integrity and interpreting millions of datapoints.

The aim of this research was to develop an open-source workflow for monitoring hydrodynamic events in small rivers using temporary continuous monitoring stations which can be moved and adapted as water quality pressures shift and change over time.

This workflow provides detailed procedures on the deployment methods for the water quality sondes used, a user-guide and worked example for the use of R to visualise large water quality time series datasets, the use of CANARY event detection software to identify potential water quality events, and the configuration of CANARY using site specific data for monitoring stations on two different rivers.

[1] (Bieroza, 2023) Advances in Catchment Science, Hydrochemistry, and Aquatic Ecology Enabled by High-Frequency Water Quality Measurements. *Environmental Science & Technology*.

Presentation Types

Oral

Assessing the microbial community composition of harvested rainwater from different settings

Michael Arthur[1,2], Elena-Alexandra Alexa[2], Amy McKenna[3], Michael Gaffney[3], Jesus Maria Frias Celayeta[4], Catherine Burgess[1]

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Abstract

Irrigation water is essential for horticultural production, ensuring both crop yield and quality. However, climate change-induced seasonal droughts and weather variability have increasingly threatened water availability, prompting interest in alternative sources such as harvested rainwater. Despite its benefits, harvested rainwater is susceptible to microbial contamination from environmental and anthropogenic sources, posing potential food safety risks when used for irrigation.

This study evaluated the microbial quality of roof-harvested rainwater collected from various roof types in rural and urban locations along Ireland's east coast. Over two six-week periods (August–September 2023 and March–April 2024), 84 rainwater samples were collected from seven sites and analysed for total viable counts (TVC), *Escherichia coli*, and enterococci using standard culture-based methods, following ISO standards. Shotgun metagenomic sequencing was also performed to characterise and assess the abundance of microbial communities.

Results showed that 90% of the samples tested positive for *E. coli* and enterococci during the first sampling period. In the second period, concentrations of these organisms decreased by 1–2 log units. Variations in microbial concentrations were observed across sampling weeks and periods at all sites. Metagenomic analysis revealed diverse microbial communities in rainwater tanks, with changes in the relative abundance of dominant microorganisms across sampling weeks.

These findings emphasize the importance of effective treatment of harvested rainwater prior to irrigation to mitigate risks of crop contamination and ensure food safety.

Presentation Types

Poster

Theme: Water and Nature in a Changing Climate

land use-based regression model to track nitrate concentration in groundwater: a buffer-based approach

Arghadyuti Banerjee ORCID iD[1], Aonghus ÓDomhnaill[1], Leo Creedon ORCID iD[1], Noelle Jones[2], Salem Gharbia ORCID iD[1]

[1]Atlantic Technological University, Sligo, Ireland. [2]Atlantic Technological University, Galway, Ireland

Abstract

Assessing regional-scale groundwater contamination is essential for managing water resources, ensuring clean water availability, and informing policy decisions. Challenges in groundwater contamination assessment include data availability, limited sample size, and establishing the relationship between contamination levels and land use characteristics. Linear regression helps relate observed concentrations to physical and human-influenced factors. This longstanding predictive model is particularly reliable with small sample sizes. However, the main difficulty lies in selecting a set of predictors that meet all the model's criteria when multiple potential predictors are available. This study introduced a buffer-based land-use linear regression (LUR) modelling method to create a groundwater quality model for nitrate concentration at a catchment scale. A supervised stepwise approach was adopted as a feature reduction tool to refine the predictor variables based on predefined criteria. Then, a multilinear regression was employed with selected land use variables to predict the nitrate concentrations. The validation results from 32 training sites indicated that the model successfully captured 85% of the spatial variability in nitrate across the study area. During the model development and validation, the LUR model demonstrated good prediction capability and the ability to capture the spatial variability of nitrate concentration (R^2 80%). The accuracy assessment resulted in a good performance of the model (NSE = 0.89) with low error estimation (RMSE = 0.025 and MAE = 0.02). For future studies, the LUR model can be executed with the latest available time series information to showcase its ability to capture climate change scenarios. Additionally, the model can be expanded to other parts of the catchment(s) with different land use scenarios to test its accuracy in predicting nitrate concentration with new sets of information in a given space and time.

Presentation Types

Oral

Exploring Historical and Future Changes of Lake Surface Water Temperature in South America

Dieu Anh Dinh[1], R. Iestyn Woolway[2], Valerie McCarthy[3], Eleanor Jennings[1], Siobhan Jordan[1]

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Abstract

South America (SA) has a large number of freshwater lakes, which are under pressure from climate change and human activities. However, our understanding of lake surface water temperature (LSWT) changes across the continent over the past decade is inadequate. In this study, we analysed the interannual and diurnal LSWT variability using the modelled-derived Global LAke Surface water Temperature (GLAST) dataset for the historical (1981-2020) and future (2021-2099) periods. The relative contributions between meteorological drivers and LSWT using ERA-5 LAND reanalysis data were also evaluated. The results showed that 97.5% of the studied lakes (n = 2,347) experienced an LSWT warming trend over the last 40 years, at an average rate of +0.11 K decade^{-1}. Overall, diurnal LSWT of 2,046 (85%) lakes have increasing trends with a rate of +0.02 K decade^{-1}. Air temperature was the dominant driver of warming LSWT (1,226 lakes~ 51%) in northern (10°N–20°S) and southern (40°S–50°S) regions, whereas shortwave radiation was the primary one (759 lakes~ 31.5%) in central SA (20°S–40°S). Diurnal LSWT variations were mainly influenced by shortwave radiation (1,607 lakes~ 66.8%). LSWT is expected to increase by 0.5±0.7 K, 1.7±0.8 K, and 2.9±1.0 K by the end of the 21st century under RCP2.6, RCP6.0, and RCP8.5 scenarios respectively. Furthermore, we calculated changes in four lake heatwave metrics (number of heatwave days, average duration, average intensity and cumulative intensity). Under RCP 8.5, the average heatwave intensity anomaly is forecasted to increase by 3.2 K by 2099, with an average duration anomaly of 365 days. This study provides a comprehensive understanding of LSWT variability in SA and valuable information for policy-makers to mitigate the effects of climate change on these critical freshwater resources.

Presentation Types

Oral

Combining Machine Learning and Numerical Models for Groundwater Flooding Prediction in Cork City

Mohamad Soboh ORCID iD, Michael O'Shea

University College Cork, Cork, Ireland

Abstract

Cork City has experienced an increasing frequency of significant flood events since the early 21st century. These flooding issues are multifactorial and complex, influenced by regional topography, riverine systems, and proximity to tidal waters, leading to frequent pluvial and fluvial flooding. Additionally, the city's geological setting over a glacial riverbed with deep gravel deposits makes it vulnerable to groundwater flooding driven by fluvial and tidal forces. While extensive studies have addressed fluvial and tidal flooding, groundwater flooding remains underexplored, particularly regarding flood pathways beneath the city and the relationships between river and groundwater levels. Understanding these dynamics is critical to mitigating flood risks and managing groundwater resources as they become increasingly strained.

This study develops and validates predictive models using transfer functions, machine learning algorithms, and a three-dimensional hydrogeological model constructed in FEFLOW to simulate and forecast groundwater responses during and after flooding events. The FEFLOW model was calibrated using groundwater observations from six wells, achieving root mean square error (RMSE) values ranging from 0.07 to 0.29, coefficients of determination (R^2) between 0.69 and 0.99, and mean absolute error (MAE) values from 0.05 to 0.23. Additionally, a machine learning model created for groundwater level prediction in a specific well demonstrated strong accuracy, achieving a mean squared error (MSE) of 0.0144, MAE of 0.0938, and R^2 of 0.9787.

These integrated modelling approaches, underpinned by the FEFLOW model, provide a detailed understanding of groundwater flow dynamics and flooding mechanisms in Cork City. These tools will enable city planners and engineers to effectively address groundwater flooding risks, safeguard infrastructure, and enhance urban resilience against hydrological challenges by offering accurate predictions and insights into subsurface hydrology.

Presentation Types

Oral

Hydrological Modelling of Droughts: Performance versus Catchment Characteristics

Sri Gowthami Vengana, Fiachra O'Loughlin

University College Dublin, Dublin, Ireland

Abstract

This study evaluates the performance of 46 hydrological models to simulate low flow conditions across 216 catchments in the Republic of Ireland. Two different objective functions, Log Nash-Sutcliffe Efficiency (Log NSE) and Inverse Kling-Gupta Efficiency (KGE) were used to determine the best performing models and the Shuffled Complex Evolution (SCE) calibration scheme was used to determine the calibrated parameter values. The results identifies that GR4J, Hymod, and Xinanjiang are the best performing models in calibration and validation. These models demonstrated consistent accuracy and robust generalizability, making them suitable candidates for national-scale drought prediction. The analysis into performance versus catchment characteristics reveals that drainage density and base flow influences model performance most, while urbanization introduces complexity. This research by exploring model generalizability, establishes the foundational building block for developing a national hydrological modelling framework for drought management across Ireland.

Presentation Types

Poster

Defining Groundwater Drought in Ireland: A Comparative Study of Threshold Level and Standardized Groundwater Methods

Tarig Mohamed, Ahmed Nasr, Paul Hynds

Technological University Dublin, Dublin, Ireland

Abstract

Groundwater drought in temperate regions remains a neglected area of research despite its significant implications for drinking water supply, ecosystem health, and agricultural productivity. Projected changes in precipitation intensity, frequency, and duration will increase drought risk. however, a review of groundwater drought indicators reveals limitations in their applicability across diverse hydrological and hydrogeological regimes.

The current study focuses on the efficacy of using existing drought indicators to define, identify and understand historical groundwater drought events. Initially, groundwater level data from 100 monitoring stations. Thereafter, we examined the Threshold Level Method (TLM) and Standardized Groundwater Index (SGI) over differing thresholds and compared drought characteristics using the 2018 summer drought for validation. The TLM identifies drought events when groundwater levels fall below predefined thresholds, facilitating an analysis of drought duration and severity. In contrast, the SGI transforms groundwater levels to a normal distribution, enabling comparison across stations with differing subsurface hydrology.

Findings indicate that the TLM exhibits low sensitivity for drought detection, with the SGI tends to overestimate the occurrence of short-duration droughts. During the summer 2018 drought, the TLM identified significant groundwater drought in 45 stations, compared to 53 stations identified by the SGI; 38 stations were analogously classified by both methods. Both approaches also detected short-term droughts during 2010 and 2014, mirroring reported heatwave events. Analyses revealed mixed drought responses across groundwater stations i.e., some responded quickly, while others were affected later- highlighting the variability of Irish groundwater sources to drought.

Findings also, emphasize the importance of method selection for drought characterisation, particularly since both approaches were originally developed for arid and semi-climates.

Future work should focus on developing new indicators for groundwater drought in temperate regions, where droughts may have a higher social impact (e.g., significant disruption of water supplies for consumption and irrigation) based on low historical frequency.

Presentation Types

Poster with 5 min oral presentation

Determining the Potential of Domestic Rainwater Harvesting to Decrease Pollution in Coastal Areas

Muteeb Ahmad Sheikh ORCID iD, Ruth Quinn

Atlantic Technological University, Sligo, Ireland

Abstract

This research investigates the potential of domestic Rainwater Harvesting (RWH) systems in coastal areas of Ireland to mitigate flooding and provide non-potable water. Given Ireland's high rainfall rates, averaging 750 -1400 mm annually, RWH is proposed as a viable solution for reducing stormwater runoff and alleviating pressure on urban drainage systems.

This study will develop and refine methods to analyze RWH system behavior, assessing their long-term and event-based performance. Factors influencing RWH efficiency will be evaluated, including tank size, roof catchment area, and rainfall intensity. Sustainable manufacturing techniques for RWH tanks will be explored, focusing on durable and eco-friendly materials. Stakeholder engagement will identify barriers to RWH adoption and inform strategies for widespread implementation.

The outcome will provide a framework facilitating the adoption of RWH in Ireland, enhancing urban resilience, and contributing to climate change mitigation efforts. This research will contribute to the development of sustainable urban water management practices, aligning with Ireland's climate change adaptation and mitigation goals. The findings will inform policymakers, practitioners, and homeowners on the benefits and implementation of RWH systems.

Keywords: Domestic RWH, Combined Sewer Overflows (CSO)s, Pollution Prevention, SuDs

Presentation Types

Poster

Advancing Land Cover Classification for Hydrological Modelling and Flood Resilience in Ireland Using Sentinel-2 Imagery

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Munster Technological University, Cork, Ireland

Abstract

Land-cover classification is a crucial component of hydrological modelling, significantly influencing the accuracy of runoff analysis, floodplain mapping and flood-risk management. This study investigates the application of different available land-cover datasets in Ireland and applies 10m resolution Copernicus Sentinel-2 imagery for land-cover classification in one Irish catchment near Crookstown, County Cork. The National Land Cover Map (NLC2018) with thematic detail for Ireland's unique landscape developed by the Irish-EPA uses a 20m spatial resolution Sentinel-2 data and outperforms the widely used 100m resolution Corine Land-Cover (CLC) dataset. This analysis reveals that the usage of the Red-Green-Blue (R-G-B), Near-Infrared (NIR), Shortwave Infrareds (SWIR1 and SWIR2) bands of the atmospherically corrected Sentinel-2, with a 10m spatial resolution demonstrates a clear advantage over both NLC and CLC. The analysis results in higher accuracy in detecting mixed land-cover zones when compared to CORINE's database. Initial methodology is developed using unsupervised K-means and Global K-means clustering algorithms for pixel segmentation, to classify land-cover in the Crookstown catchment. Sentinel-2-based classifications achieved a preliminary accuracy of 72% using limited ground-control-points, compared to CLC map's accuracy of 64%. Global K-Means clustering provided more accurate classification achieving 14% higher matching in mixed zones over K-Means clustering, especially in detecting waterbodies and vegetation class. Multispectral feature indices such as Normalized Difference Vegetation and Water Index (NDVI and NDWI) were derived from Sentinel-2 bands and integrated into the classification, which improved the detection of vegetative and water-related features essential for accurate floodplain delineation and modelling. The research findings support the hypothesis that higher-resolution land-cover data is required for improved hydrological models for flood forecasting. This approach will facilitate the comprehensive assessment of climate change impacts on flooding in Irish river basins, contributing to the development of robust flood resilience strategies for Ireland.

Keywords: land cover; hydrological modelling; Sentinel-2; K-means clustering; climate change

Presentation Types

Oral

The Impact of Temperature Changes on the Survival of Clinically Significant Carbapenemase-Producing *E. coli* in Coastal Waters

Niamh Cahill ORCID iD[1,2], Dearbháile Morris[1,2]

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Abstract

Coastal ecosystems are increasingly at risk of microbial contamination from anthropogenic sources such as wastewater discharges and agricultural runoff. These contaminants can introduce harmful pathogens and antimicrobial-resistant organisms (AROs), resulting in potential public health risks in recreational waters. Climate change, particularly rising temperatures, may further influence the behaviour, survival and spread of these pathogens and AROs. This study investigated the impact of temperature changes on the survival of clinically significant carbapenemase producing *E. coli* (CPE) in an artificial seawater environment.

Artificial seawater, containing 7.5% OECD synthetic sewage as a nutrient source, was spiked with 10^5 CFU/100 mL of NDM-5 and OXA-48-producing *E. coli*. Samples were incubated at temperatures ranging from 11.0°C-29.8°C, representing predicted median and maximum temperatures for current (2020–2030) and future (2089–2099) timepoints across Northern and Southern Europe. The Most Probable Number of *E. coli* was quantified using the Colilert®-18 test (IDEXX) at 0, 24, 48, and 72 hours to evaluate survival over time.

Both strains exhibited temperature-dependent declines in survival, with decay rates accelerating as temperature increased. At lower temperatures (11.0°C-14.8°C), a higher percentage of bacterial survival at 72 hours was observed, with ~13%-15% NDM-5 and ~11-13% OXA-48 producing *E. coli* remaining viable. In contrast, at higher temperatures (26.0°C-29.8°C), survival decreased dramatically, with only 0.6% NDM-5 and 0.7% OXA-48-producing *E. coli* remaining after 72 hours at 29.8°C.

This study highlights the significant influence of temperature on CPE survival in seawater environments. Cooler temperatures were associated with prolonged bacterial survival, while higher temperatures accelerated decay rates. The findings emphasise the importance of understanding the impact of climate change on microbial survival and persistence in coastal ecosystems, particularly in cooler regions where such bacteria may survive longer. These insights are crucial for informing management strategies to mitigate public health risks.

Presentation Types

Oral

Quantifying and Capitalising on Eco-Activism in Irish Water Sports for Planetary Health.

Beth Brown, Ruth Quinn

ATU, Sligo, Ireland

Abstract

Modern society is increasingly disconnected from nature, a trend that many argue has contributed to the planet's environmental degradation. As a result, fostering a deeper connection to nature has become more important than ever. Using a planetary health approach, this research explores the potential of water-based activities in promoting both human and environmental health. Ireland, with its growing popularity of activities like surfing and cold-water dipping, offers an ideal setting for this study. Over the past 20 years, the West Coast has become a key destination for surfers worldwide, significantly contributing to the national economy. Additionally, over 40% of Ireland's population lives within 5 km of the coast. Despite this, the role of water-based activities in strengthening nature connection remains largely unexplored. Within the field of Blue Health the impacts of water-use have primarily focused on health and well-being benefits, and impacts on environmental health have received little attention. This research aims to address this gap by examining how regular engagement with water influences individuals' attitudes and behaviours toward the environment. The hypothesis aligns with research on green spaces and nature exposure, suggesting that closer contact with nature can lead to more environmentally conscious actions. The study will identify key pathways through which water-based activities enhance nature connection and collaborate with local stakeholders to co-design the project. Case studies from communities in North-West Ireland will offer valuable insights into how regular water use affects both individual well-being and environmental attitudes. These findings will contribute to the development of a community water-engagement framework, empowering local communities with strategies to foster nature connection and environmental stewardship. In light of the interconnected challenges of climate change, health, and environmental degradation, strategies that benefit both people and the planet are more crucial than ever.

Presentation Types

Poster

Predictive analysis of groundwater quality index with advanced machine learning approaches

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University College Dublin, Dublin, Ireland

Abstract

The diminishing quality of groundwater and the depletion of water levels are exacerbated by the extensive use of groundwater in diverse sectors, including domestic, agricultural, and industrial supply. A variety of factors, such as rising temperatures, extreme flood and drought conditions, and various contaminants, contribute to the degradation of groundwater quality. The intricate structure of groundwater further complicates the direct identification of the invisible hazard posed by contaminated water. Hence, the assessment of groundwater quality is essential to prevent detrimental effects on human health and aquatic ecosystems. Recent advancements have shifted groundwater quality analysis from traditional computing systems to sophisticated Machine Learning (ML) models, offering improved accuracy and efficiency by identifying nonlinear patterns between inputs and outputs. This study aims to evaluate and predict the groundwater quality index within the Irish context by employing five ML algorithms (both kernel-based and decision support trees), including Support Vector Machines (SVM), Artificial Neural Networks (ANNs), Random Forest (RF), Gradient Boosting (GBoost), and K-nearest neighbours (KNNs). The performance of ML models in forecasting groundwater quality was assessed using different error metrics, including Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and the Coefficient of Determination (R^2). It is anticipated that based on the selected parameters such as pH, temperature, rainfall, sulphate, nitrate, phosphate, ammonia, cadmium, lead and E. coli, the ML models would accurately forecast the critical factors affecting polluted groundwater quality. The developed ML models would also be able to illustrate the groundwater quality parameters that contribute the most, such as nitrate, phosphate, and E. coli, in deriving the groundwater quality index for the studied case. The machine learning models developed in this study will improve the understanding of the current state of groundwater quality in Ireland and explore additional opportunities for enhanced groundwater management and pollution control.

Presentation Types

Oral

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