Environ 2021

32nd Irish Environmental Researchers Colloquium

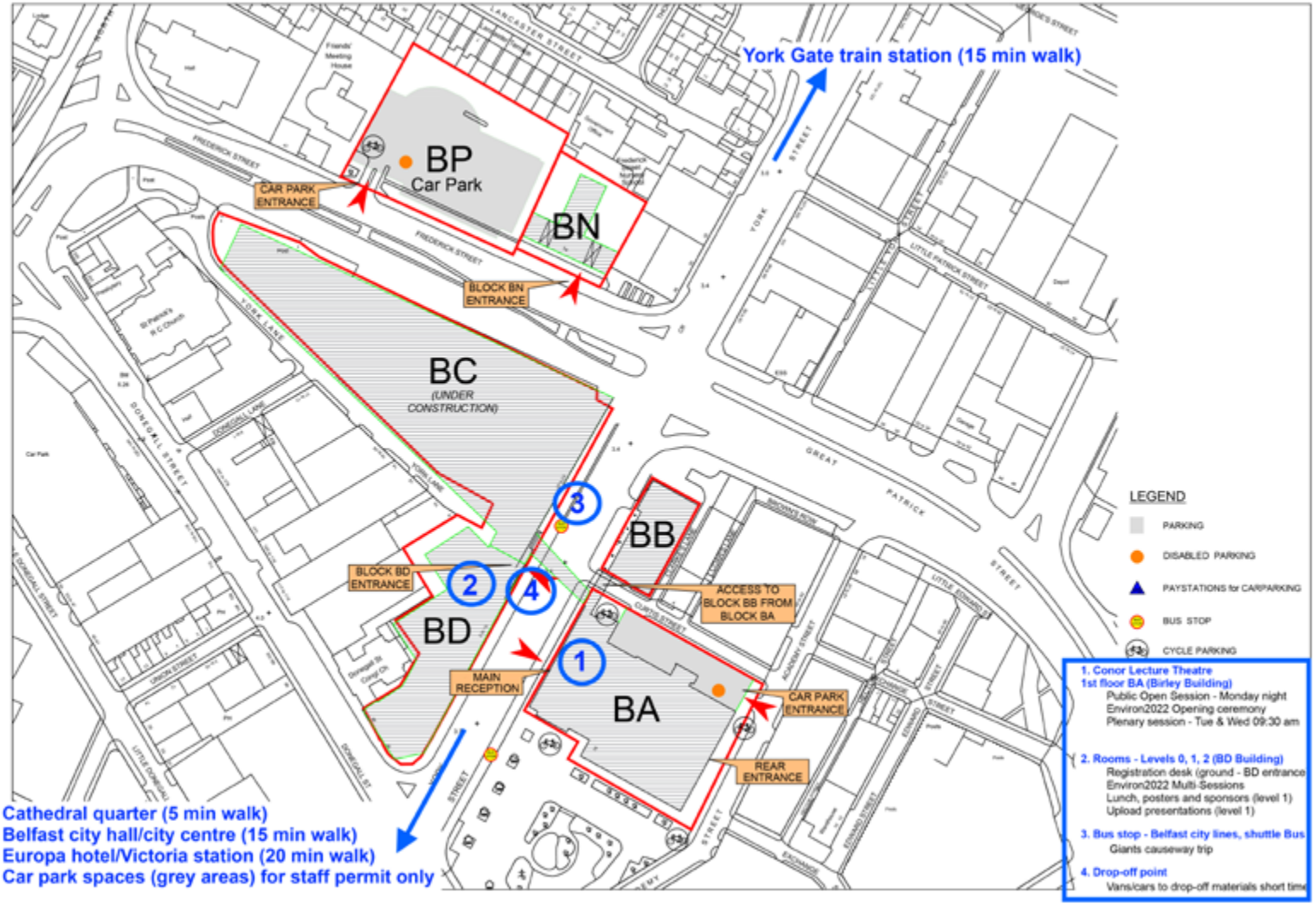
"Unlocking Sustainability"

20th – 22nd June 2022

Ulster University, Belfast

Ulster University

esai
Environmental Sciences Association of Ireland


York Gate train station (15 min walk)
BP
Car Park
BN
CAR PARK ENTRANCE
BLOCK BN ENTRANCE
BC
(UNDER CONSTRUCTION)
BB
BD
BA
BLOCK BD ENTRANCE
ACCESS TO BLOCK BB FROM BLOCK BA
MAIN RECEPTION
CAR PARK ENTRANCE
REAR ENTRANCE
1
2
3
4
LEGEND
PARKING
DISABLED PARKING
PAYSTATIONS for CARPARKING
BUS STOP
CYCLE PARKING
1. Conor Lecture Theatre
1st floor BA (Birley Building)
Public Open Session - Monday night
Environ2022 Opening ceremony
Plenary session - Tue & Wed 09:30 am
2. Rooms - Levels 0, 1, 2 (BD Building)
Registration desk (ground - BD entrance
Environ2022 Multi-Sessions
Lunch, posters and sponsors (level 1)
Upload presentations (level 1)
3. Bus stop - Belfast city lines, shuttle Bus
Giants causeway trip
4. Drop-off point
Vans/cars to drop-off materials short time
Cathedral quarter (5 min walk)
Belfast city hall/city centre (15 min walk)
Europa hotel/Victoria station (20 min walk)
Car park spaces (grey areas) for staff permit only

Contents

Welcome to ENVIRON 2022 Delegates

Ulster University Organising Committee Welcome to ENVIRON 2022 Delegates

Dear Delegate,

The ENVIRON 2022 Organising Committee welcomes you to the 32nd Irish Environmental Researchers Colloquium at Ulster University. The ENVIRON colloquium is the largest gathering of environmental researchers in Ireland. This event is a wonderful opportunity for environmental researchers both new and experienced to share their research with an audience drawn from academia, government bodies, industry and perhaps most importantly, the community and general public.

The world in 2022 is at a critical juncture regarding issues such as global food security, pollution, waste at an unprecedented scale, access to clean water, biodiversity loss, soil degradation, loss of natural resources and, associated to all the above, socioeconomic and geopolitical issues. Added to these challenges, climate action is required to address fossil fuel combustion emissions to help the World achieve net zero and at the same time, we are facing an energy crises with increasing costs. Put together, there is a complex interplay between these challenges which is referred to as the food, water and energy nexus.

The conference will begin on Monday 20th of June with a morning field trip to the Giants Causeway which is a UNESCO World Heritage Site. In the afternoon delegates may participate in the 'Our Place in Space' following the solar system through an 8.4 km trail along Divis and Black Mountain, guided by an interactive App. There is also a dedicated workshop to citizen science. On Monday evening at 7 pm we will have a public engagement event 'Ireland towards the net zero challenge' where our experts will present on the complex interplay between climate action, energy needs and the cost of living. This is followed by a wine reception at 8 pm.

The formal conference opening will take on the morning of Tuesday 21st June in the brand-new Ulster University Belfast campus. The first plenary lecture will be from Professor Jane Stout from Trinity College Dublin on Climate Change and Biodiversity in Ireland. This is followed by the first of three poster sessions and meet the exhibitors, along with refreshments. The conference will then break into four parallel sessions focusing on key themes reflecting the diversity of outstanding research that is taking place on the island of Ireland and beyond.

The conference dinner will take place on the evening of Tuesday 21st June in the Hilton Hotel Belfast, beginning with a reception followed by dinner and dancing.

On Wednesday 22nd June, the second plenary will be presented by Professor Neil Hewitt, Ulster University, focusing on Emerging Technologies Towards Net Zero. Then delegates break into parallel sessions before coming together again at 2 pm for the closing and awards.

This year we have added some international dimensions with delegates from Colombia, Mexico and Brazil to present at a session dedicated to addressing the challenge of Water for the Global South. A second international session will focus on the Water Energy Nexus with eight PhD researchers from the H2020 MSCA EID REWATERGY project presenting their research. With 2 plenary, 5 keynote, 77 oral and 44 poster presentations, there is something for everyone and a wide diversity of energy and environmental challenges to be discussed.

We hope that you will find ENVIRON 2022 stimulating for your own research interests and that you also enjoy the various social activities in vibrant Belfast.

On behalf of the ENVIRON 2022 Organising Committee

Environmental Sciences Association of Ireland (ESAI) Welcome to ENVIRON 2022 Delegates

On behalf of the ESAI Council, we wish to extend a warm welcome to all delegates to the 32st Irish Environmental Researchers Colloquium (Environ) taking place in Belfast from the 20th to 22nd June 2022. This year we are partnering with Ulster University to host the event in their impressive new state of the art Belfast city centre campus. Environ provides an annual platform for members to showcase their research and to engage with peers, industry partners and the general public. This is our first in person conference since the Covid19 pandemic and we look forward meeting all our members in Belfast to focus on the theme of this year's Environ, "*Unlocking Sustainability*".

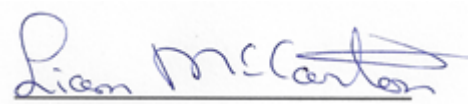
Environ 2022 will commence on the afternoon of Monday 20th June with a series of interactive workshops and field trips. We will host a public event on Monday evening focusing on "Ireland towards the Net Zero Challenge". A series of short keynotes will be given followed by an interactive session where the audience will have the opportunity to engage with the panel. The aim of this public event is to grow awareness of the links between green politics, net-zero energy technologies and biodiversity in Ireland.

Environ will then formally open on Tuesday 21st with an opening address by Prof Paul Seawright, Deputy Vice Chancellor of Ulster University, Tim Brundle, Directory of Research & Impact at Ulster University, Liam McCarton Chairperson of the ESAI, and Prof. Jane Stout of Trinity College Dublin. The plenary lecture on Tuesday will be delivered by Prof. Jane Stout who will focus on "*Climate Change and Biodiversity in Ireland*". The plenary lecture on Wednesday will be delivered by Prof. Neill Hewitt who will present on "*Emerging Technologies towards Net Zero*". Several events will take place over the two days, including a variety of oral and poster presentations, plenary speakers and social evenings. This year we also have two "Flash Presentation" sessions on Wednesday (10:15am and 12.15pm). These are designed to be rapid dynamic sessions which offer poster presenters an opportunity to bring their research to life. Environ will culminate on Wednesday 22nd with our prizegiving ceremony.

The ESAI will host a stand for the first time at this year's Environ, where you can find out more information about all of the initiatives that we have developed for the benefit of our members. The stand will be hosted by the coordinator of our postgraduate network, Sean O'Connor. We encourage everyone to drop by and say hi and find out more about this network, our grassroots funding scheme, the prestigious postgraduate researcher of the year award and loads more. We are also offering free membership to all undergraduates in relevant courses in each college.

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

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



Liam McCarton
ESAI Chairperson

Environ 2022 Organising Committee

Co-Chairs	Dr Pilar Fernandez-Ibanez & Professor John Anthony Byrne, Ulster University
Organizing Committee (Ulster University unless otherwise indicated)	Dr Farshad Amiraslani Dr Caterina Brandoni Mrs SInead Macken, ESAI Dr Stuart McMichael Dr Trudy McMurray, NIEA Dr Svetlana Tretsiakova-Mcnally
Scientific Committee	Prof Ye Huang, Ulster University, United Kingdom Prof Alberto Longo, Queens University Belfast, United Kingdom Prof. Javier Marugan Aguado, University Rey Juan Carlos, Spain Dr Anne Morrissey, Dublin City University, Ireland Prof Fiona Reagan, Dublin City University, Ireland Prof Paul Dunlop, Ulster University, United Kingdom Prof Richard Douglas, Ulster University, United Kingdom Prof. Andrew Cooper, Ulster University, United Kingdom Prof Neil Hewitt, Ulster University, United Kingdom
ENVIRON Assistants	Dr Valentina Gogulancea Salem Alkharabsheh Seila Couso-Perez Oisin De Priall Dr Mohammad Musaab Jaffar Adriana Rioja Cabanillas A K M Khabirul Islam Md Mokim Hamed Rasouli Sadabad Muhammad Umer Nicola Watson

Thanks to the ENVIRON 2022 Sponsors

Thanks to the ENVIRON 2022
DIAMOND SPONSORS

Ulster University

epa Research

Thanks to the ENVIRON 2022
PLATINUM SPONSORS

Foras na Mara Marine Institute

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

CEMENT MANUFACTURERS IRELAND

UCD Earth Institute

National Parks & Wildlife Service of

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

Thanks to the ENVIRON 2022 Sponsors

Thanks to the ENVIRON 2022
GOLD SPONSORS

COILLTE

MAST CONSTRUCTION LTD

Premier Scientific

InterTradeIreland
Discover what's possible

ZWAI
ZERO WASTE ALLIANCE IRELAND

IEN
Irish Environmental Network

CIEEM
Chartered Institute of Ecology and Environmental Management

Thanks to the ENVIRON 2022
SILVER SPONSORS

Comhairle Cathrach Chorca.
Cork City Council

iCRAG
IRISH CENTRE FOR RESEARCH IN APPLIED GEOSCIENCES

Thanks to the ENVIRON 2022 Sponsors

Thanks to the ENVIRON 2022

PRIZE SPONSORS

esai
Environmental Sciences Association of Ireland

CIWM

RSC LOCAL SECTION
NORTHERN IRELAND

The Irish Naturalists' Journal

ENVIRONMENTAL SERVICES
IRELAND

AQUATT
Science. Communication. Knowledge. Innovation.

Eurachem
Ireland

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

RSC INTEREST GROUP
CHEMICAL NANOSCIENCE
AND NANOTECHNOLOGY

Environ 2022

Ulster University Belfast

20th – 22nd June 2022

32nd Irish Environmental Researchers Colloquium

"Unlocking Sustainability"

INFORMATION FOR DELEGATES

Registration

The registration desk is situated in the entrance foyer to the BD building, just beside the coffee shop. The registration desk will be open at the following times;

Monday 20th June	10:30 – 11:00
	13:30 – 17:30
	18:00 – 19:00
Tuesday 21st June	08:30 - 17:00
Wednesday 22nd June	08:45 - 13:00

COVID-19

While it is not mandatory to wear face masks, you may wish to do so to protect yourself and others. Please try to maintain social distancing of 1 m where possible. If you develop symptoms of COVID-19 please isolate and take a test.

Environ Assistants

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

First Aid or Emergencies

For life threatening emergency call 999
For first aid or other emergencies please call Ulster University security
Using internal phone extension 22222
Using external or personal phone 028 70123456
Security staff are stationed at the reception of BA building ground floor, left of main entrance.

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.

Access to Ulster Campus

Ulster operates a swipe card system for access to the campus. Due to the inability of the system to issue a large number of visitor passes, a barrier will remain open in both BD and BA buildings to allow access for Environ delegates (with name badges). If you have problems accessing, please ask security stationed at these entrances or an Environ Assistant (wearing Environ T-shirt).

Locations

Registration	Entrance foyer to BD building beside the coffee shop
Presentation upload	BD01-014 (BD building level 1) at presentation management desk signposted. Staffed from 08:45 on Tuesday, access on Monday by request at registration. This room may also be used for bag drop.
'Our Place in Space'	Monday 20th June – meet at the registration desk/coffee shop at 1400 – will be welcomed by Environ Assistants
'Walking with Giants'	Monday 20th June – meet at 11:00 at the registration desk
'Citizen Science Workshop'	Monday 20th June – 14:00-17:00 in BD02-009 (level 2)
'Public Session Panel'	Monday 20th June – 19:00-20:00 'Ireland towards the net zero challenge' Conor Lecture Theatre, BA01-009 (level 1 in the Birley building, just across the road from the BD building).
Monday Reception	20:00-21:00 in BD01-014 (1st floor BD building).
Plenary Sessions	Tue 21st and Wed 22nd – Conor Lecture Theatre BA01-009
Parallel Sessions	Tue and Wed – BD00-011A (ground floor), BD00-011B (ground floor), BD02-008 (level 2) and BD02-009 (level 2), BD building.
Posters & Exhibitors	Tue and Wed – BD01-014 (level 1)
Coffee breaks	Tue and Wed – BD01-014 (level 1)
Lunch	Tue and Wed – BD01-014 (level 1). Overspill room in BD01-006 (level 1) where delegates may sit for lunch or chat.
Tuesday Reception and Conference Dinner	19:00-midnight in The Hilton Hotel Belfast
ESAI College Liaisons Meeting	Tuesday 21st – 1615-1715 in BD02-008 (level 2)
ESAI AGM	Tuesday 21st – 17:30-18:00 in Conor Lecture Theatre BA01-009

Delegates giving oral presentations

After registering for the colloquium, delegates giving oral presentations should upload their presentation in the presentation management desk in **BD01-014 (level 1)**. All presentations for oral sessions should be uploaded well in advance of the session in which the presentation is being given (no later than 2 hours before the session begins). Presentation titles should start with the submitting author's surname for easy identification. Presenters are asked to introduce themselves to the session chairs in the assigned session room at least 10 minutes before the session begins.

Delegates presenting posters

The poster presentation area is located in BD01-014 (BD building level 1). 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 20th June (13:30- 17:30) or on Tuesday morning (08:15 -09:00). The first poster session is at 10:15 on Tuesday 21st June. Please do not remove your poster until the end of the poster session at 12:15 on Wednesday. There will be 3 poster sessions throughout the colloquium. To ensure the colloquium delegates can meet poster presenters we would strongly encourage poster presenters to be by their posters for these sessions to answer any questions. Each presenter is assigned a unique poster ID number (check your poster ID number in poster abstract section). Your poster must be mounted on the poster board assigned to your ID.

Wifi Access

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

If you do not have Eduroam then you can request Guest access to the Ulster wireless network by following the steps below;
Step1: Click on the wireless icon to reveal networks and click on "Guest"
Step 2: Select "Create Account"
Step 3: Enter the information requested on the form.
Your "sponsor's email" must be an Ulster University email address [Provided on request at registration desk].
The email address you provide will become your guest account username.
When all fields have been completed click the accept terms of use box, and then click the register button.

At this point your sponsor will receive an e-mail asking them to confirm your account creation. The Account status below will change from disabled to enabled once the sponsor has confirmed creation.

NB: The screen will refresh every 30 seconds automatically

Social Media

Please use **#Environ2022**, **@UlsterUni** and **@Esai_Environ** for your social media posts during and after the event if you post event material.

ATM

There is an ATM located in the foyer of the BA building

Parking

There is very limited parking available within the campus. There are a number of multistorey car parks close to the campus, closest is St Anne's Square. There is also on-street parking with meters (time limited). Best to use public transport if at all possible.

Safety in Belfast

Belfast is a relatively safe city, but like all cities everyone needs to take care. Please don't walk alone through the city centre at night if you can avoid it. Stick together and look after each other. Get taxis back to your hotel if out late.

Useful Taxi numbers - both have apps for download

Fonacab 02890 33 33 33	www.fonacab.com/app.php
Valuecabs 02890 80 90 80	www.valuecabs.co.uk/app

Environ 2022 - 32nd Irish Environmental Researchers Colloquium 20 - 22 Jun 2022 *All times in BST*

Monday, 20 June

10:30am

REGISTRATION
Registration desk, BD Building, Main Entrance, Ground Floor

11am

Day Trip to Giants Causeway inc. lunch & Visitors Centre Experience - Walking with Giants
Registration desk, BD Building, Main Entrance, Ground Floor

1:30pm

REGISTRATION
Registration desk, BD Building, Main Entrance, Ground Floor

2pm

Citizen Science Workshop
Room BD-02-009 (Second Floor), BD Building

Our Place in Space
10km trail along Divis and the Black Mountain

6pm

REGISTRATION
Registration desk, BD Building, Main Entrance, Ground Floor

7pm

Public Session Panel - Ireland Towards the Net Zero Challenge
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

8pm

Drinks Reception
Room BD-01-014 (First Floor), BD Building

Tuesday, 21 June

8:30am

REGISTRATION
Registration desk, BD Building, Main Entrance, Ground Floor

9:15am

Environ2022 Opening Session
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

9:30am

Plenary Lecture 1
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

10:15am

Refreshments, Poster Session and Meet The Exhibitors
Room BD-01-014 (First Floor), BD Building

11:15am

S1-Water for the Global South
Room BD-02-009 (Second Floor), BD Building

S4 - Marine and Coastal
Room BD-02-008 (Second Floor), BD Building

S7- Environmental Policy & Communication
Room BD-00-011A (Ground Floor), BD Building

S10 - Water Quality Monitoring
Room BD-00-011B (Ground Floor), BD Building

12:45pm

Lunch
Room BD-01-014 (First Floor), BD Building

1:45pm

S2-Water for the Global South
Room BD-02-009 (Second Floor), BD Building

S5 - Climate in the Balance
Room BD-02-008 (Second Floor), BD Building

S8 - Air Pollution
Room BD-00-011A (Ground Floor), BD Building

S11 - Water and Wastewater Treatment
Room BD-00-011B (Ground Floor), BD Building

3:15pm

Refreshments, Poster Session and Meet The Exhibitors
Room BD-01-014 (First Floor), BD Building

ESAI College Liaison Meeting (restricted)
Room BD-02-009 (Second Floor), BD Building

4:15pm

S3 - Water for the Global South
Room BD-02-009 (Second Floor), BD Building

S6 - Wetland & Peatland Management
Room BD-02-008 (Second Floor), BD Building

S9 - Environmental Challenges
Room BD-00-011A (Ground Floor), BD Building

S12 - Water Pollution and Risks
Room BD-00-011B (Ground Floor), BD Building

5:30pm

ESAI AGM & Postgraduate Researcher 2022 Award Winner
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

7pm

Prosecco Reception & Live music
Lagan Suite, Hilton Hotel Belfast

Environ 2022 - 32nd Irish Environmental Researchers Colloquium 20 - 22 Jun 2022 *All times in BST*

Continued from **Tuesday, 21 June**

8pm

Conference Dinner - DJ & Dancing
Lagan Suite, Hilton Hotel Belfast

Wednesday, 22 June

8:45am

REGISTRATION
Registration desk, BD Building, Main Entrance, Ground Floor

9:15am

Plenary Lecture 2
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

10:15am

S13 - Water-Energy Nexus
Room BD-02-009 (Second Floor), BD Building

S15 - Sustainable Land Use, Agriculture and Food
Room BD-02-008 (Second Floor), BD Building

S17- Net Zero Challenge
Room BD-00-011A (Ground Floor), BD Building

S19 - Flash Presentations
Room BD-00-011B (Ground Floor), BD Building

11:15am

Refreshment, Poster Session and Meet the Exhibitors
Room BD-01-014 (First Floor), BD Building

12:15pm

S14 - Water-Energy Nexus
Room BD-02-009 (Second Floor), BD Building

S16 - Sustainable Land Use, Agriculture and Food
Room BD-02-008 (Second Floor), BD Building

S18 - Biodiversity, Ecosystems and Ecotoxicology
Room BD-00-011A (Ground Floor), BD Building

S20 - Flash Presentations
Room BD-00-011B (Ground Floor), BD Building

1:15pm

Lunch
Room BD-01-014 (First Floor), BD Building

2pm

Prize Giving & Environ 2022 Closing Ceremony
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

3:30pm

POSTERS (only) list

Environ 2022

Ulster University Belfast

20th – 22nd June 2022

32nd Irish Environmental Researchers Colloquium

"Unlocking Sustainability"

BIOGRAPHIES

Ulster University Co-Convenors

Prof John Anthony (Tony) Byrne is a Professor in the School of Engineering, Ulster University (UK). Tony obtained his DPhil from Ulster in 1997 with research on photocatalytic water treatment. He is a Fellow of the Royal Society of Chemistry, a committee member of the RSC Northern Ireland Section and the RSC Chemical Nanosciences and Nanotechnology Special Interest Group. He is a Board Member of the Northern Ireland Science Festival. Tony's main research interests relate to the development of novel photocatalytic materials for applications including environmental remediation (water treatment and disinfection) and solar energy harvesting (water splitting and CO2 conversion to fuels). He is PI on the SAFEWATER Project funded under the Global Challenges Research Fund UKRI. This is a large transdisciplinary project focused on technologies for safe drinking water in the Global South. He has given several keynote lectures and is a member of the scientific committee of a number of key international conferences. He has published widely and was awarded Senior Distinguished Research Fellow at Ulster in 2015.

Dr Pilar Fernandez-Ibañez is a lecturer in Engineering Science at Ulster University. Previously Head of Group at Plataforma Solar de Almería of CIEMAT (Spain). Her research focuses on low-cost technologies for water purification, photochemical and advanced oxidation processes for the removal of microbiological and hazardous chemical pollutants from water. Pilar is an experienced researcher in the areas of low-cost drinking water disinfection solutions for the Global South and solar water treatment. She has authored key publications in these areas of research (168 peer-reviewed papers, H-index=59, citations=14,000). Fellow of the Institute of Physics, representative of Ireland in the International Union of Pure and Applied Physics, and member of the committees of Climate Change and Environmental Sciences of the Royal Irish Academy and the committee of Physics for Development. Editor of the Journal of Photochemistry & Photobiology, Process Safety and Environmental Protection and Chemical Engineering Journal (Elsevier). Finalist in the WISE awards 2019 (gender balance in science, technology, and engineering) to her contribution in solar technology research and Distinguished Research Awards University Champion (2021).

Workshop at Environ: Citizen science — Monday 20th June 2022

Facilitator:
Elizabeth O'Reilly, CIEEM

Elizabeth O'Reilly is the Irish Project Officer of the Chartered Institute of Ecology and Environmental Management (CIEEM). CIEEMs role is to support and raise standards in the ecology and environmental management professions. Elizabeth has been supporting this work in Ireland for almost 5 years.

Dave Wall, National Biodiversity Data Centre

Dave Wall is is Citizen Science Officer at the National Biodiversity Data Centre. After completing a degree in Natural Sciences (Zoology) from Trinity College Dublin, he spent 24 years working in the areas of ecology and conservation. He has worked as an ecological consultant in the areas of terrestrial ecology, and marine mammal monitoring and mitigation. Prior to his current role at the National Biodiversity Data Centre, he was Living Seas Officer at Ulster Wildlife, working on community engagement and marine awareness.

Damian McFerran, CEDaR

Damian McFerran has managed CEDaR for a long time and been involved with numerous recording projects, the production of several books and web sites. He is currently managing the delivery of a variety of surveillance/ monitoring programs for Northern Ireland Environment Agency (NIEA).

Workshop at Environ: Citizen science — Monday 20th June 2022

Niamh Fitzgerald, Birdwatch Ireland

Niamh Fitzgerald works for BirdWatch Ireland as the National Organiser of the Irish Wetland Bird Survey (I-WeBS). She coordinates the survey and its 400 plus participants – largely consisting of volunteers. This work is instrumental in monitoring Ireland's wintering waterbird populations and protecting the wetlands they rely on.

Public Session and Q&A Discussion: Ireland Towards The Net Zero Challenge — Monday 20th June 2022

Chairperson: Louise Cullen, BBC

Louise Cullen has worked in journalism in Northern Ireland for more than 20 years, becoming the Agriculture & Environment Correspondent at BBCNI in 2021, a month evidently COP26 arrived in Glasgow. Before taking up the role, she was part of the Health team, reporting on the pandemic. Her career began with Reuters in Belfast, shortly after graduating from Queen's University Belfast in Law & Accounting. She relocated from Belfast to Enniskillen with work in 2002, launching a Radio Ulster news service for the West and later becoming the district journalist for County Tyrone. Along the way she imported her husband from England and adopted several cats. Outside of work, Louise is a keen reader and puzzler, enjoying cryptic crosswords, sudoku and word games. She is also a Zumba instructor and occasional baker.

Public Session and Q&A Discussion: Ireland Towards The Net Zero Challenge

Monday 20th June 2022

Prof Neil Hewitt, Ulster University

Prof Neil J Hewitt is Ulster University's Chair in Energy and is Head of School, Belfast School of Architecture and Built Environment as well Director of the Centre for Sustainable Technologies. He is a World Renewable Energy Network Lifetime Pioneer and has attracted over £22M in external funding including EPSRC, EU and international sources. With over 140 publications ranging from large scale power generation to heat pumps and demand side management, he has graduated 17 PhD students.

Prof Jane Stout, Trinity College Dublin

Prof Jane Stout is a Professor at Trinity College Dublin whose work focusses on understanding the complexities of natural ecosystems and the interactions between nature and people. An internationally renowned expert on pollinator and pollination ecology, Jane is a prominent voice for biodiversity and its value. Her research helps to identify societal and business risks associated with biodiversity loss, and development of habitat management solutions, which has significant implications for some of the poorest communities in the world.

In Trinity College, Jane has just taken on the new role of Vice President for Biodiversity and Climate Action, embedding sustainability as a key priority throughout operations, education and research. Prior to this, she was co-Director of the Nature+, the Trinity Centre for Biodiversity & Sustainable Nature Based Solutions, and led a large team in the Plant-Animal Interactions Research Group.

Beyond Trinity, Jane works across many disciplines, and with a broad range of public and private organisations, to improve environmental policy and practice. She is co-founder of the All-Ireland Pollinator Plan, one of the most successful conservation projects in Ireland. Jane is also co-founder and former Chair of Natural Capital Ireland, a not-for-profit organisation with a vision for a future where nature, and the benefits humanity derive from it, are valued, protected and restored.

Public Session and Q&A Discussion: Ireland Towards The Net Zero Challenge

Monday 20th June 2022

Prof John Barry, Queens University Belfast

Prof John Barry is a father, a recovering politician, Professor of Green Political Economy and Co-Director of the Centre for Sustainability, Equality and Climate Action at Queens University Belfast. He is also co-chair of the Belfast Climate Commission.

What keeps him awake at night is the future wellbeing of his children in this age of the planetary crisis and why it is easier for most people to believe in the end of the world than the end of capitalism and economic growth. His areas of academic research include post-growth and heterodox political economy; the politics, policy and political economy of climate breakdown and climate resilience; socio-technical analyses of low carbon just energy and sustainability transitions; and the overlap between conflict transformation and these sustainability and energy transitions.

Opening Event

Tuesday 21st June 2022

Ulster University Deputy Vice-Chancellor

Prof Paul Seawright

Prof Paul Seawright is Deputy Vice Chancellor at Ulster University since April 21 and was formerly Executive Dean of the Faculty of Arts, Humanities and Social Sciences, the largest Faculty in the University including a diverse range of world-leading disciplines including Law, Education, Social Work, Politics, humanities, the arts and the rapidly expanding film and screen subjects. He currently sits on the advisory board of the Imperial War Museum, having previously served as a Board member of the Arts Council of Northern Ireland and the British Council Arts and Creative Economy Advisory Group. He was awarded an OBE in 2020 for his service to Higher Education and the Arts. Paul has an international profile as an artist and researcher. His work is held in many museum collections including the Irish Museum of Modern Art, the Tate, San Francisco Museum of Modern Art, International Centre of Photography New York, Arts Councils of Ireland, England and Northern Ireland, the UK Government Collection and the Museum of Contemporary Art in Rome. In 2002 he was commissioned by the Imperial War Museum London as War Artist for Afghanistan and was awarded the Irish Museum of Modern Art/ Glen Dimplex award for a major contribution to Irish Art. His most recent work looking at reconciliation in post-genocide Rwanda is published in April by Strzelecki Books Cologne.

Ulster University Director of Research & Impact

Tim Brundle

Tim Brundle is Director of Research & Impact at Ulster University. He directs Ulster's research strategy, governance and administration, and guides its commercial output through knowledge transfer and intellectual property commercialisation. He also holds the position of Executive Director of Innovation Ulster Ltd, Ulster's venturing and investment company. Tim has worked throughout his career in research-led organisations, with a focus on developing their customer-orientation, economic impact, business outcomes and shareholder value. He has led the establishment of more than 40 high tech start up companies, secured over £400m of Venture Capital, managed a profitable investment fund and ensured investor value from company acquisitions and a stock market floatation. He is an experienced and skilled member of the Board of both young companies and mature public Institutions, including serving as a Director of many of Ulster's spin out companies, Invest NI and the UK Knowledge Transfer Network.

Opening Event — Tuesday 21st June 2022

Environmental Sciences Association of Ireland Chairperson

Liam McCarton

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

Plenary Session Keynote Speaker — Tuesday 21st June 2022

Climate Action & Biodiversity, Implications for Ireland

Prof Jane Stout, Trinity College Dublin

Prof Jane Stout is Jane Stout is a Professor at Trinity College Dublin whose work focusses on understanding the complexities of natural ecosystems and the interactions between nature and people. An internationally renowned expert on pollinator and pollination ecology, Jane is a prominent voice for biodiversity and its value. Her research helps to identify societal and business risks associated with biodiversity loss, and development of habitat management solutions, which has significant implications for some of the poorest communities in the world.

In Trinity College, Jane has just taken on the new role of Vice President for Biodiversity and Climate Action, embedding sustainability as a key priority throughout operations, education and research. Prior to this, she was co-Director of the Nature+, the Trinity Centre for Biodiversity & Sustainable Nature Based Solutions, and led a large team in the Plant-Animal Interactions Research Group.

Beyond Trinity, Jane works across many disciplines, and with a broad range of public and private organisations, to improve environmental policy and practice. She is co-founder of the All-Ireland Pollinator Plan, one of the most successful conservation projects in Ireland. Jane is also co-founder and former Chair of Natural Capital Ireland, a not-for-profit organisation with a vision for a future where nature.

Keynote Speakers

Tuesday 21st June 2022

Water For The Global South

Prof Kevin McGuigan, Royal College of Surgeons Ireland

Prof Kevin McGuigan is the director of the RCSI Solar Disinfection Research Group and Professor of Medical Physics in the Dept. of Physiology & Medical Physics where he teaches on the Medicine, Pharmacy and Physiotherapy programs. His research focusses on developing appropriate technology interventions against waterborne disease for use in low-to-medium-income-countries and resource-poor environments. His research specializes in running field studies to evaluate these technologies and has conducted field studies in India, Ethiopia, Malawi, Uganda, Kenya, Zimbabwe, S. Africa and Cambodia. Kevin is the recipient of the 2019 UNESCO-Equatorial Guinea International Prize for Research in the Life Sciences which "rewards the projects and activities of an individual which have led to improving the quality of human life." He is a Fellow of the Institute of Physics (FInstP) and the Royal Society of Chemistry (FRSC), has published over 80 peer-reviewed articles.

Water For The Global South

Dr Ester Guimaraes, SABESP Water and Sanitation Company of Sao Paulo State

Dr Ester Guimaraes Holds a PhD in Environmental Engineering Sciences from the University of São Paulo, MBA from the OHIO College of Business with the School of Economics of FGV-SP and IBE Business Institute (2010), specialization in Sanitary Engineering from the School of Public Health, University of São Paulo (1993), graduation in Electrical Engineer Fundação Armando Hairstyle Alvares (1985). Engineer at SABESP - Basic Sanitation Company of the State of São Paulo - since 1988, like Advisor Regulatory Affairs in tariffs and regulatory studies in São Paulo pro-poor programs since 2006. Regulation Courses from PURC - University of Florida, Pro-Reg and UNESCO-IHE Institute for Water Education. I am researcher at the Center for Research Support Climate Change - NapMC / TILT - Interdisciplinary Climate Investigation Center at the University of São Paulo. He is currently director project of Association of University Professionals of SABESP, member of the Technical Chamber of Rates and Regulation of the Brazilian Association of Sanitary and Environmental Engineering - National, member of the Technical Chamber of Basin Plan Committee PCJ, member of the Technical Chamber of Basin Plan Committee Alto Tietê, the Environmental Audit IEMA / EMAS Institute of Environmental Management and Assessment in UK for The European Union's Eco Management and Audit Scheme (2007).

Keynote Speakers

Tuesday 21st June 2022

Water For The Global South

Prof Sumantra (ShRay), University of Cambridge

Professor Sumantra Ray RNutr is NNEdPro Founding Chair and Executive Director.

University affiliations: University of Cambridge | Ulster University | Imperial College London | University of Wollongong.

Sumantra (Shumone) Ray is a Licensed Medical Doctor as well as a Registered Nutritionist (Public Health), with special interests in Cardiovascular Disease Prevention and Nutrition Education in Health Systems.He is cross-appointed in Cambridge as a Director of Research at the University of Cambridge and Co-Lead for the Food, Nutrition and Education Work Package for the TIGR2ESS Programme in India (2017-21) led from Cambridge and supported by UK Research and Innovation's Global Challenges Research Fund (GCRF). Shumone is a Bye-Fellow of Fitzwilliam College at the University of Cambridge, and, additionally, holds a fractional personal chair appointment as Professor of Global Nutrition, Health and Disease at Ulster University where he is also an Advisory Board Member to the high-impact GCRF Latin American SAFEWATER programme (2017-22). In addition he has a number of honorary/visiting professorial appointments more widely, including Imperial College London in the UK, and the University of Wollongong in Australia.

Marine & Coastal

Dr Jane Kilcoyne, Marine Institute

Dr. Jane Kilcoyne is an analytical chemist at the Marine Institute in Galway. She works in the Marine Environment and Food Safety Section, specialising in the monitoring and research of marine biotoxins, produced by phytoplankton that can accumulate in shellfish, and are harmful to human health.

Jane is an advocate for climate and biodiversity activism, sustainability, and greening laboratories. She is co-chair of the Get Greener team at the Marine Institute and is a member of the Irish Green Labs network. Her recent work highlights how laboratories can reduce environmental impacts by adopting more sustainable procedures and behaviours.

ESAI AGM

Guest Speaker: ESAI Postgraduate Researcher of the Year 2021

Irene O'Callaghan, University College Cork

Irene O'Callaghan is a PhD candidate at University College Cork, funded by a joint Irish Research Council and EPA Government of Ireland Postgraduate Scholarship, and supervised by Dr Timothy Sullivan. She graduated with a BSc (Hons) in Chemistry, and a subsequent MSc in Analytical Chemistry. Her research focus has been the development of a technique to quantify freshwater contaminants with greater accuracy and reduced cost.

This novel approach takes advantage of the natural process of bioaccumulation, by which fauna internalize and accumulate environmental chemicals, to amplify target contaminants. She has identified that the specificity of this technique and, therefore, the behaviour of contaminants towards organic matter in freshwaters, relates to the fundamental chemical concept of thiophilicity, with implications for predicting contaminant-specific environmental fate. Furthermore, she has, for the first time, determined the importance of moulting in reducing toxicity, its contribution to bioaccumulation parameter error, and a methodological solution.

Irene has disseminated her research in peer-reviewed journals and at national and international conferences, symposia and colloquia, as well as to the wider community through outreach events. She has carried out policy research for An Fóram Uisce on the topic of legacy sediment contamination in freshwaters. She has served on the Scientific Committee of the SETAC Europe Annual Meeting, and currently serves on the Board of Directors of the Irish Naturalists' Journal and the committee of the Royal Society of Chemistry's Environmental Chemistry Group, where she is also a member of the editorial board of the group's Bulletin.

Plenary Session: Keynote Speaker — Wednesday 22nd June 2022

Emerging Technologies Towards Net Zero

Prof Neil Hewitt, Ulster University

Prof Neil Hewitt is Ulster University's Chair in Energy and is Head of School, Belfast School of Architecture and Built Environment as well Director of the Centre for Sustainable Technologies. He is a World Renewable Energy Network Lifetime Pioneer and has attracted over £22M in external funding including EPSRC, EU and international sources. With over 140 publications ranging from large scale power generation to heat pumps and demand side management, he has graduated 17 PhD students.

Water-Energy-Nexus

Dr Nathan Skillen, Queen's University Belfast

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

ESAI Student Competition 2022

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 14:00-14:30 on Wednesday 22nd June. Best of luck to everyone!

The prizes and categories this year are:

- ESAI Best Oral Presentation (€500 or £420) sponsored by Environmental Sciences Association of Ireland
- ESAI Best Poster Presentation (€250 or £210) sponsored by Environmental Sciences Association of Ireland
- Best Wastes & Resources Management Presentation (€250 or £210 & 12 month CIWM student membership) sponsored by Chartered Institution of Wastes Management (CIWM)
- Best Water Related Presentation (€250 or £210) sponsored by Chartered Institution of Water and Environmental Management (CIWEM)
- Best Social Engagement Presentation (€250 or £210) sponsored by Environmental Services Ireland
- Best Natural History Presentation (€250 or £210) sponsored by Irish Naturalists' Journal
- Best Nano-Related Presentation (€250 or £210) sponsored by the Royal Society of Chemistry Chemical Nanoscience and Nanotechnology Interest Group
- Best Early Career Researcher Oral Presentation in Chemical Sciences (€250 or £210) sponsored by Royal Society of Chemistry
- Best Analytical Chemistry Poster (€250 or £210) sponsored by Eurachem Ireland
- Richard Fitzgerald Memorial Prize Best Aquatic Environment Poster (€250 or £210) sponsored by AquaTT

Dr. Richard D. Fitzgerald

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

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

ESAI ANNUAL REVIEW 2021

ESAI Chairpersons Address from Liam McCarton

2021 was a busy year for the Environmental Sciences Association of Ireland (ESAI). This end of year report summarises some of the key events and activities throughout the year.

Environ 2021: The highlight of the year was our Environmental Researchers Colloquium (Environ). The 2021 Environ conference was hosted in collaboration between the ESAI and the Environmental Research Institute (ERI) at University College Cork (UCC) from the 16th to 18th June. The theme of the conference was 'Healthy Planet, Healthy Communities'. This was our second "virtual" Environ building on our previous successful online event. In 2021 the ESAI and UCC joined forces with ExOrdo to deliver an exciting and engaging online conference experience. Registered delegates had access to a suite of conference tools which enabled them to participate in virtual workshops, engage with keynote and plenary speakers and liaise with researchers and industry practitioners across the country during icebreaker sessions. The goal was to deliver the full Environ experience from the comfort of your own home.

Environ 2021 officially opened on Wednesday 16th June with an opening address by UCC Interim College President Prof. John O'Halloran, ERI Director Prof. Sarah Culloty, Dr. Jonathan Derham, EPA and ESAI Chairperson Liam McCarton. Later in the day from 5pm-6.30pm there was a public event featuring a keynote from Kate Raworth (author of Doughnut Economics), environment economist focused on exploring the economic mindset needed to address the 21st century's social and ecological challenges & Roisin Markham, founder and network steward of the Irish Doughnut Economics Network. Several online events took place over the three days, including a variety of oral and poster presentations, plenary speakers and virtual social evenings. Environ culminated on Friday 18th with our prizegiving ceremony.
The quality of research presented was exceptional. The fact that the vast majority were delivered by young scientists and engineers bodes well for the future of environmental sciences in Ireland. On behalf of all the team at ESAI we would like to acknowledge and sincerely thank Environ 2021 conference co-convenors Dr Jean O'Dwyer, Dr Timothy Sullivan, Dr Paul Bolger, Dr Aoife Corcoran and all the ERI team for hosting ENVIRON and for assembling a very comprehensive programme. We also wish to thank Ms Sinead Macken for providing excellent administrative support to the event as always. Congratulations to all the winners in the ESAI Environ Student Presentation competition which featured nine awards this year with a special mention to Molly Williams, and Adrian Delgado Ollero winner of the best oral presentation and best poster presentation respectively at Environ 2021.

Annual Review 2021

2021 Nominee to the ESAI Honours List : In 2020 as part of our 30 years celebrations we announced our first honours list. This is to acknowledge those who have contributed greatly to the success of ESAI and Environ and indeed have been at the forefront of environmental research, debate and policy in Ireland for over 30 years. In 2021 we nominated Professor Emer Colleran to the Honours List. Emer was a leading microbiologist and one of the State's foremost advocates for the environment, combining a radical energy with scientific discipline and expertise. She was known as a brilliant academic colleague and inspirational teacher and a mentor to a generation of students.

ESAI Researcher Awards & Sponsorship Programs

At the heart of great science lies a creative and moral instinct to explore and to question in order to create a better world. ESAI continue to recognise the excellence of young researchers in this regard at both undergraduate and postgraduate level.

Postgraduate Researcher of the Year Award: Irene O'Callaghan from University College Cork is the 2021 winner of the prestigious ESAI Postgraduate Researcher of the Year Award. Irene's research is focused on the development of a technique to quantify freshwater contaminants by studying the natural process of bioaccumulation. This novel approach takes advantage of the natural process of bioaccumulation, by which fauna internalize and accumulate environmental chemicals. This research was funded by a joint Irish Research Council and EPA Government of Ireland Postgraduate Scholarship, and supervised by Dr Timothy Sullivan, UCC.

Undergraduate Researcher of the Year 2020/2021: The ESAI continues to recognise the excellence of young researchers through our Undergraduate of the Year Awards. This is the 5th year of the competition. 2020-2021 Winners include: Victoria Decristoforo (Level 8, LIT), Jennifer Burke (DKIT), Aylis Emerit (GMIT), Robert Morrow (IT Sligo), Fay Clohessey (Level 8, MTU), Kate Mulligan (Level 7, MTU), Katy Beckett (TCD), Gavin Fowler (TU Dublin), Niall Murray (UL), Anna Kavanagh (Level 8, WIT), Zak Dunphy (Level 7, WIT), Sean Brennan (Level 8, IT Carlow), Shane O'Neill (Level 7, IT Carlow). Special thanks to Niamh Power for managing this on behalf of the ESAI.

Annual Review 2021

ESAI / EPA Grassroots Award Scheme: The ESAI / EPA Grassroots Award Scheme funded two live evens which ran in tandem with a 10 week podcast series "Tales from the Land" each Saturday 7-9pm commencing June 4th 2021. Over ten weeks, Green Step engaged with different contributors to weave a vision for the future of Ireland. The two live events allowed for meetings with a wider group of people and discussions around Ireland's agri-food policy. The grassroots award scheme has been relaunched in 2022. Special thanks to the EPA for their continued support.

ESAI College Liaison Officers & ESAI Postgraduate Network: ESAI has a network of liaisons working in each of the HEI's that offer Environmental Science related courses. Their role is to promote specific ESAI's activities of relevance to students engaging in environmental science study within their organisation. We would also like to acknowledge all our ESAI Liaison officers. We are also offering free membership to all undergraduates in relevant courses in each college. During 2021 to further improve our engagement with the early-stage research community, the ESAI council formed a Postgraduate Network. The Postgraduate Network will work alongside the ESAI council to help bring together new and innovative ideas and concepts from ESAI stakeholders on how to improve our overall activities and spread the word of ESAI's awards and projects to the wider environmental science community.

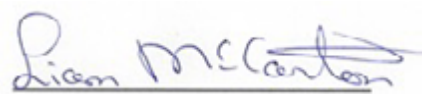
ESAI Communications: ESAI members are the core of the organisation and special thanks to the comms team lead by John Gallagher, TCD for his outstanding work in managing the communications resources for our members. We welcome your input and participation through our social media channels whether through our Listserver, LinkedIn, Facebook, Twitter or by subscribing to our Newsletters. At the end of 2021 the ESAI had 1086 members, comprising of 266 full members and 817 student members.

ESAI Council Meetings and AGM June 2021: The ESAI held a total of 4 council meetings during 2021. The AGM was convened online to coincide with Environ in June 2021. Members re-elected included Dr. Tasman Crowe, UCD, Dr. Tom Curran, UCD and Dr. Anne Morrissey, DCU. Postgrad of Year 2020 Sean O'Connor, IT Sligo joined us to give a short presentation on his research.

Annual Review 2021

The Council wish to sincerely thank ESAI administrator, Sinead Macken, for her excellent work, dedication and support over the past year with all our diverse activities. As chair of the ESAI I would also like to acknowledge the passion, professionalism and commitment of the entire ESAI council during the past year.

ESAI will continue to adapt to national and global challenges and seek ways in which we can continue to serve our members and the wider the environmental community in Ireland though this coming year



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

Making the most of your membership

Benefits of Membership

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

- Discounted rates at Environ, the annual Irish Environmental Researchers Colloquium, one of the major activities of the Association. It is now one of the largest national scientific meetings in Ireland attracting over 300 delegates each year.
- Discounted rates for selected workshops, seminars, further education courses and conferences.
- Access to ESAI 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/

2021 Events

Date	Event
February 28th	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
April 30th	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
May 1st	**ESAI Environews Spring/Summer Edition available**
June	**ESAI Undergraduate of Year Awards 2019/2020** Review with HEI's commencesw
June 16th	**Environ 2021 – 31st Annual Irish Environmental Researchers Colloquium**
June 17th	**Environ 2021 – 31st Annual Irish Environmental Researchers Colloquium**
June 17th	**ESAI AGM 2021** Online (held in conjunction with Environ 2021) All members welcome
June 18th	**Environ 2021 – 31st Annual Irish Environmental Researchers Colloquium**
June 30th	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
August 31th	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
September 30th	**Undergraduate Membership Offer** Free Membership for all Undergraduate Members Scheme Rolled Out
October 16th	**ESAI Environews Autumn Edition available**
October 31st	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call
October 31st	**ESAI Postgraduate Researcher of Year Award** Closing date for applications
November 3rd	**ESAI HEI nominated Undergraduate of Year 2019/2020** Announcements and presentation of certificates (by post)
December 15th	**ESAI Environews Winter Edition available**
December 31st	**ESAI Grassroots Workshop Support Scheme** Sponsored by EPA – Rolling Call

ESAI INCOME AND EXPENDITURE ACCOUNT 2021

ESAI Income and Expenditure Account	€	€
For the year ended 31 December 2021		**20,839**
Opening balance as 01/01/21		
Income	€	€
Membership	1,879	
Environ 2021 – Delegate Fee	20,511	
Environ 2021 - Sponsorship	20,000	
Environ 2020 – Delegate Fee	240	
Environ 2020 - Sponsorship	500	
Environ 2019 - Sponsorship	500	
Environ Prizes	2,250	
Rebate	2,125	
Total Income	**45,525**	
Expenditure	€	€
Environ 2020	3,025	
Environ 2021	21,502	
Environ 2022	100	
Environ 2020 – Refunds	120	
Prizes	5,317	
Website Maintenance	4,307	
Administration	8,729	
Travel	0	
Bank Charge	869	
Merchant Banking	265	
Postage/Stationary	140	
Accountancy	191	
Postgraduate of Year Prize	0	
Governance	661	
Grassroots	0	
Other	50	
Write off	2	
Total Expenditure	**43,956**	
Excess Income over Expenditure		1,569
Closing Balance @ 31/12/21		**22,408**

End of Year accounts are overseen and approved by external accountant

ESAI Council Members 2022

Chairperson	Mr Liam McCarton	chairperson@esaiweb.org
Vice Chair	Dr Niamh Power	
Honorary Secretary	Mr Philip Shine	secretary@esaiweb.org
Honorary Treasurer	Dr Niamh Power	treasurer@esaiweb.org
Communications Officer	Dr John Gallagher	communications@esaiweb.org
Editor	Ms Caroline Wynne	c.wynne@epa.ie
Conference Coordinator 2021	Dr Jean O'Dwyer	conference@esaiweb.org
Regular Members	Prof Frances Lucy – IT Sligo Dr Thomae Kakouli-Duarte – IT Carlow Prof Tasman Crowe - UCD Dr Tom Curran - UCD Dr Dorothy Stewart - EPA Ms Caroline Wynne Dr Anne Morrissey - DCU	
Membership Officer	c/o Ms Sinead Macken - Administrator	administrator@esaiweb.org

Environ 2022

Ulster University Belfast

20th – 22nd June 2022

32nd Irish Environmental Researchers Colloquium

"Unlocking Sustainability"

ORAL AND POSTER PRESENTATIONS SCHEDULE

Environ 2022 - 32nd Irish Environmental Researchers Colloquium 20 - 22 Jun 2022 *All times in BST*

Monday, 20 June

10:30am — **REGISTRATION**
Registration desk, BD Building, Main Entrance, Ground Floor

11am — **Day Trip to Giants Causeway inc. lunch & Visitors Centre Experience - Walking with Giants**
Registration desk, BD Building, Main Entrance, Ground Floor

1:30pm — **REGISTRATION**
Registration desk, BD Building, Main Entrance, Ground Floor

2pm — **Citizen Science Workshop**
Room BD-02-009 (Second Floor), BD Building

2pm — **Our Place in Space**
10km trail along Divis and the Black Mountain

6pm — **REGISTRATION**
Registration desk, BD Building, Main Entrance, Ground Floor

7pm — **Public Session Panel - Ireland Towards the Net Zero Challenge**
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

8pm — **Drinks Reception**
Room BD-01-014 (First Floor), BD Building

Tuesday, 21 June

8:30am — **REGISTRATION**
Registration desk, BD Building, Main Entrance, Ground Floor

9:15am — **Environ2022 Opening Session**
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

Opening ceremony
» Deputy VC of Ulster University, Prof Paul Seawright, Director of Research and Impact, Ulster University, Prof Tim Brundle, ENVRION2022 Convenors, Ulster University, Prof Tony Byrne and Dr Pilar Fernandez, ESAI Chairperson, Mr Liam McCarton

9:30am — **Plenary Lecture 1**
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building
Chaired by: Dr. Pilar Fernandez

Climate Change and Biodiversity in Ireland
» Prof. Jane Stout

10:15am — **Refreshments, Poster Session and Meet The Exhibitors**
Room BD-01-014 (First Floor), BD Building

11:15am — **S1-Water for the Global South**
Room BD-02-009 (Second Floor), BD Building
Chaired by: Prof. Tony Byrne

11:15am — **Solar Water Disinfection: There's a Time and Place for It?**
» Prof. Kevin G. McGuigan

11:45am — **Water and sanitation in Brazil**
» Dr. Ester Guimaraes

Continued from **Tuesday, 21 June**

12:15pm **The triad of Global Nutrition Security, Safe Water and Planetary Health: Can the 'Mobile Teaching Kitchen' initiative be a 'vehicle' for transformation?**
» Prof. Sumantra (Shumone) Ray

11:15am **S4 - Marine and Coastal**
Room BD-02-008 (Second Floor), BD Building
Chaired by: Dr. Jane Kilcoyne

11:15am **Reducing environmental impacts of marine biotoxin monitoring: a laboratory case study**
» Dr. Jane Kilcoyne

11:30am **Post-harvest stability of key biomolecules in seaweed biomass.**
» Dr. Keelan C. Lawlor, Dr. Dilip K. Rai, Prof. Dagmar B. Stengel

11:45am **Community led approaches for sustainable coastal adaptation and coastline management**
» Mr. Paul Lawlor

12pm **Microplastic abundances in Nephrops norvegicus and its surrounding sedimentary environment**
» Ms. Haleigh Joyce, Dr. João Frias, Dr. Fiona Kavanagh, Ms. Rachel Lynch, Dr. Elena Pagter, Dr. Jonathan White, Dr. Róisín Nash

12:15pm **Beach littering: Putting the user at the centre of environmental policy**
» Ms. Rachael Singleton, Dr. Susann Power, Dr. Marian McLaughlin, Prof. Una McMahon-Beattie

11:15am **S7- Environmental Policy & Communication**
Room BD-00-011A (Ground Floor), BD Building
Chaired by: Dr. Trudy McMurray

11:15am **Recycling Derived Fertilisers Market Demand in the Horticulture and Recreational Sectors in Ireland**
» Dr. Aoife Egan, Dr. Niamh Power

11:30am **Local communities and nature stewardship: Involvement, encouragement and establishment**
» Dr. Farshad Amiraslani

11:45am **Qualified support: Understanding citizens' preferences for co-investment into commercial wind farms**
» Ms. Julia le Maitre, Dr. Geraldine Ryan, Dr. Bernadette Power, Dr. Gordon Sirr

12pm **Water governance reforms in the Republic of Ireland: A historical perspective towards a sustainable water future**
» Mr. Sarpong Hammond Antwi, Dr. Suzanne Linnane, Dr. Alec Rolston, Prof. Jill Slinger

12:15pm **Unlocking blue growth: Balancing dialectic tensions of environmental protection and economic development**
» Mrs. Jessica Giannoumis, Dr. Lawrence Dooley, Dr. Valerie Cummins

12:30pm **Environmental outcomes and the Porter hypothesis: The impact of environmental regulations and compliance on company performance in Ireland**
» Ms. Maria del Pilar Cespedes Davalos, Dr. Bernadette Power, Dr. Geraldine Ryan, Dr. John Eakins, Prof. Eleanor Doyle, Dr. Ellen O'Connor

11:15am **S10 - Water Quality Monitoring**
Room BD-00-011B (Ground Floor), BD Building
Chaired by: Prof. Derek Jackson

11:15am **HIGH SHIGA TOXIN DETECTION RATIO IN E. COLI CONTAMINATED PRIVATE GROUNDWATER SOURCES IN WESTERN IRELAND**
» Dr. Liam Burke, Dr. Carlos Chique, Dr. Louise O'Connor, Ms. Alexandra Chueiri, Ms. Brigid Hooban, Ms. LOUISE REILLY, Ms. Emma Sullivan, Prof. Dearbháile Morris, Prof. Paul Hynds, Dr. Jean O'Dwyer

Continued from **Tuesday, 21 June**

11:30am **Development of CZE methods for the monitoring of pharmaceuticals in wastewater.**
» Ms. Emma O'Sullivan-Carroll, Dr. Anna Hogan, Dr. Stewart Howlett, Dr. Carmel Pyne, Dr. Paul Downing, Ms. Marguerite Lynch, Dr. Eric Moore

11:45am **A novel method of Electrochemical an Immunosensor for Detection Polychlorinated biphenyls (PCBs) for Environmental Analysis**
» Ms. Samia Alsefri, Dr. Eric Moore, Ms. Thanih Balbaied

12pm **Improving freshwater contaminant quantification by drawing upon intrinsic bioaccumulative properties**
» Ms. Irene O'Callaghan, Dr. Dara Fitzpatrick, Dr. Timothy Sullivan

12:45pm **Lunch**
Room BD-01-014 (First Floor), BD Building

1:45pm **S2-Water for the Global South**
Room BD-02-009 (Second Floor), BD Building
Chaired by: Prof. Kevin G. McGuigan

1:45pm **GCRF SAFEWATER**
» Prof. Tony Byrne

2pm **Design of household drinking water disinfection systems for rural settings of Colombia and Mexico**
» Dr. Pilar Fernandez

2:15pm **Device automation to assist with water quality monitoring for fecal contamination**
» Dr. Jeremy Hamilton, Dr. James Mclaughlin, Dr. Shashidran Raj, Dr. Alessio Morelli

2:30pm **Household slow sand filter: efficiency, configurations, limitations and perspectives**
» Prof. Lyda Patricia Sabogal Paz

2:45pm **Behaviour Analysis applied to Water, Sanitation & Hygiene (WASH) Research**
» Dr. Samuel Ginja, Dr. Stephen Gallagher, Prof. Mickey Keenan

3pm **Health Indicators and Water**
» Dr. Santosh Gaihre, Dr. Ruth Price, Prof. Helene McNulty

1:45pm **S5 - Climate in the Balance**
Room BD-02-008 (Second Floor), BD Building
Chaired by: Dr. Caterina Brandoni

1:45pm **Health and Climate Change - Communication and action through tree-planting**
» Dr. Christie Godsmark

2pm **Integrating business carbon accounting with target-aligned national emissions reduction pathways**
» Dr. Aideen O'Dochartaigh, Mr. Paul Price, Prof. Barry McMullin

2:15pm **Weather drives divergence in honeybee and bumblebee activity in Ireland**
» Mr. Arrian Karbassioon, Dr. Dara Stanley

2:30pm **Decarbonisation of Whiskey Distilleries in a Circular Economy**
» Mr. Anga Hackula, Dr. David Wall, Dr. Richard O'Shea

2:45pm **Motivated reasoning in the willingness to pay for carbon capture and storage: a contingent valuation experiment**
» Ms. Tanisha Waring, Prof. Alberto Longo, Prof. George Hutchinson

3pm **Disruptive technologies, drones, deliveries and Life Cycle Assessment**
» Ms. Juliana Steinbach, Dr. Sinead Mitchell

Continued from **Tuesday, 21 June**

1:45pm **S8 - Air Pollution**
Room BD-00-011A (Ground Floor), BD Building
Chaired by: Dr. John Gallagher

1:45pm **Agricultural Ammonia and Human Health: Impacts and Future Solutions**
» Ms. Katie Wyer, Dr. David Kelleghan, Dr. Thomas Curran

2pm **Reducing Energy Consumption in Air Filtration Systems (RECAFS)**
» Mr. Brian Considine, Prof. Aonghus McNabola, Dr. John Gallagher, Prof. Prashant Kumar

2:15pm **CONTROLLING STREET CANYON VENTILATION USING A ROOF-TOP DEFLECTOR SYSTEM**
» Mr. Madhavan Vasudevan, Prof. Aonghus McNabola, Dr. Bidroha Basu, Dr. Francesco Pilla

2:30pm **Associations between Urban Greenspace and Particulate Matter Air Pollution**
» Ms. Anna O'Regan, Ms. Rósín Byrne, Dr. Stig Hellebust, Dr. Marguerite Nyhan

2:45pm **Evaluating and Enhancing the Impact of Urban Parks on Local Air Quality Conditions**
» Ms. Mengyi Jin, Mr. Kiran Apsunde, Dr. John Gallagher, Prof. Zhongren Peng

3pm **Impacts Of Atmospheric Ammonia from Diffuse Sources**
» Ms. Katie Wyer, Dr. David Kelleghan, Dr. Thomas Curran

1:45pm **S11 - Water and Wastewater Treatment**
Room BD-00-011B (Ground Floor), BD Building
Chaired by: Prof. Piet Lens

1:45pm **Floating Treatment Wetlands to purify Primary Treated Domestic Wastewater**
» Prof. Piet Lens

2pm **Photoelectrocatalytic disinfection of water and determination of the radicals produced**
» Dr. Stuart McMichael, Prof. Tony Byrne, Dr. Pilar Fernandez

2:15pm **Pathways to private well management: A structural equation modelling approach**
» Mr. Simon Mooney, Dr. Martin Boudou, Dr. Jean O'Dwyer, Prof. Paul Hynds

2:30pm **Cost-Effective Solution to Reducing Vancomycin Concentration in Wastewater**
» Mr. Benjamin Delmond, Dr. Svetlana Tretsiakova-McNally, Dr. Dr Brian Solan, Dr. Rodney McDermott, Mr. Alexandre Audoin

2:45pm **Safe, simple, sustainable and affordable water treatment for developing regions**
» Mr. Kris O'Dowd, Prof. Suresh Pillai, Prof. Prof. Javier Marugan Aguado, Dr. Inmaculada Polo Lope, Ms. Ángela García Gil, Dr. Isabel Oller Alberola

3pm **Removal of vancomycin from the aqueous environment by granular activated carbon**
» Mr. Hamed Rasouli Sadabad, Dr. Joerg Arnscheidt, Dr. Heather Coleman, Prof. James Dooley

3:05pm **Low-cost alternative water treatment for removal of PPCPs in Lagos wastewater, Nigeria**
» Mr. Lekan Abudu, Mr. David Adeyemi, Prof. Temilola Oluseyi, Prof. Luqman Adams, Dr. Heather Coleman, Dr. Svetlana Tretsiakova-McNally, Dr. Joerg Arnscheidt

3:15pm **Refreshments, Poster Session and Meet The Exhibitors**
Room BD-01-014 (First Floor), BD Building

3:15pm **ESAI College Liaison Meeting (restricted)**
Room BD-02-009 (Second Floor), BD Building

Continued from **Tuesday, 21 June**

4:15pm **S3 - Water for the Global South**
Room BD-02-009 (Second Floor), BD Building
Chaired by: Dr. Ester Guimaraes

4:15pm **Drinking water sustainable systems at Colombia, field data and experiences**
» Dr. Margarita Hincapie, Dr. Luis Javier Montoya, Dr. Laila Galeano, Dr. Liliana Botero, Dr. Gloria Carvajal

4:30pm **Safewater Project Impact In Two Communities In Colombia**
» Mrs. Catalina Herrera, Mrs. Durys Esther Rios, Mr. Freddy Vahos, Mrs. Sandra Patricia Castro

4:45pm **SAFEWATER project: Household Water Treatment Systems in Mexico**
» Dr. Fermín Reygadas, Ms. Ane Galdos Balzategui

5pm **SAFEWATER project: Behaviour and Health Analysis in Mexico**
» Ms. Ane Galdos Balzategui, Dr. Fermín Reygadas

4:15pm **S6 - Wetland & Peatland Management**
Room BD-02-008 (Second Floor), BD Building
Chaired by: Dr. Farshad Amiraslani

4:15pm **Ireland's Saltmarsh Soil Carbon Stock: A Climate Relevant Carbon Pool**
» Ms. Shannon Burke, Dr. Elke Eichelmann, Dr. Grace Cott

4:30pm **Methane Emissions from Irish Saltmarshes**
» Ms. Lisa Jessen, Dr. Andrea Fuchs, Dr. Grace Cott

4:45pm **Below ground growth of forests on peatlands with a high pH subsoil or marl layer**
» Ms. Jill Pitcher Farrell, Mr. Nicholas Wragg, Ms. Blair Ruffing, Ms. Saoirse Tracy, Mr. Charles Harper, Mr. Thomas Cummins, Mr. Maarten Nieuwenhuis, Mr. Ken Byrne

4:15pm **S9 - Environmental Challenges**
Room BD-00-011A (Ground Floor), BD Building
Chaired by: Prof. Frances Lucy

4:15pm **Assessing Mercury-Added Product Stocks in the Built Environment**
» Dr. Yvonne Ryan, Prof. Colin Fitzpatrick

4:30pm **Spatio-temporal evolution, environmental and socio-demographic patterns of COVID-19 in Ireland**
» Dr. Martin Boudou, Dr. Coilín ÓhAiseadha, Dr. Jean O'Dwyer, Dr. Paul Hynds

4:45pm **Time for a Nappy Change: controls affecting families' nappy choices**
» Mrs. Nicola Watson, Dr. Sara Benetti, Dr. Suzanne Beech

5pm **Greenspace and COVID-19 in Ireland: A modelling study**
» Mr. Shivam Khandelwal, Dr. Martin Boudou, Dr. Coilín ÓhAiseadha, Dr. Jean O'Dwyer, Dr. Paul Hynds

4:15pm **S12 - Water Pollution and Risks**
Room BD-00-011B (Ground Floor), BD Building
Chaired by: Dr. Svetlana Tretsiakova-McNally

4:15pm **FAECAL CARRIAGE OF ANTIMICROBIAL RESISTANT ENTEROBACTERALES ASSOCIATED WITH RECREATIONAL WATER USE**
» Ms. Maeve Louise Farrell, Ms. Alexandra Chueiri, Dr. Louise O'Connor, Dr. Sinéad Duane, Dr. Liam Burke, Prof. Dearbháile Morris

4:30pm **Risk ranking of antibiotic resistance development in healthcare and agricultural settings**
» Mr. Ciaran Monahan, Dr. Suvi Harris, Prof. Dearbháile Morris, Prof. Enda Cummins

4:45pm **Source water protection and vulnerability in complex catchments**
» Mr. Kevin Atcheson, Prof. Philip Jordan, Dr. Rachel Cassidy

Continued from **Tuesday, 21 June**

5pm **METAL BIOACCUMULATION THROUGH WATER AND FEEDS IN NIGERIAN FISH**
» Mrs. CHINELO ANULIKA NZEKWE, Dr. DEBBIE CHAPMAN, Dr. Timothy Sullivan

5:15pm **Detection of mobile colistin resistance genes in the Irish environment.**
» Ms. Niamh Cahill, Ms. Brigid Hooban, Dr. Louise O'Connor, Dr. Georgios Miliotis, Dr. Deirdre Prendergast, Dr. Montserrat Gutierrez, Prof. Finola Leonard, Dr. Kaye Burgess, Prof. Martin Cormican, Prof. Dearbháile Morris

5:30pm **ESAI AGM & Postgraduate Researcher 2022 Award Winner**
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

7pm **Prosecco Reception & Live music**
Lagan Suite, Hilton Hotel Belfast

8pm **Conference Dinner - DJ & Dancing**
Lagan Suite, Hilton Hotel Belfast

Wednesday, 22 June

8:45am **REGISTRATION**
Registration desk, BD Building, Main Entrance, Ground Floor

9:15am **Plenary Lecture 2**
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building
Chaired by: Prof. Tony Byrne

Emerging Technologies Towards Net Zero
» Professor Neil J Hewitt

10:15am **S13 - Water-Energy Nexus**
Room BD-02-009 (Second Floor), BD Building
Chaired by: Dr. Pilar Fernandez

10:15am **Water-energy nexus: research trends**
» Dr. Nathan Skillen

10:30am **Adsorption of urea from human urine and subsequent hydrogen production**
» Mr. Ruben Asiain-Mira, Dr. Patricia Zamora, Dr. Victor Monsalvo, Dr. Laura Torrente-Murciano

10:45am **WO3 photoanodes for the oxidation of urea in wastewater and hydrogen production**
» Ms. Adriana Rioja Cabanillas, Dr. Pilar Fernandez, Mr. Rene Hauser, Prof. Tony Byrne

11am **Novel electro-assisted UVA-photocatalytic reactor based on rGO-TiO2 composite photoanode for wastewater treatment**
» Mr. Salem Alkharabsheh, Dr. Patricia Zamora, Dr. Victor Monsalvo, Dr. Pilar Fernandez, Prof. Tony Byrne

11:15am **Removal of emerging contaminants by UVC and UVB-LEDs driven AOPs**
» Ms. Raffaella Pizzichetti, Dr. Cristina Pablos, Dr. Ken Reynolds, Mr. Simon Stanley, Dr. Eric Moore, Prof. Prof. Javier Marugan Aguado

10:15am **S15 - Sustainable Land Use, Agriculture and Food**
Room BD-02-008 (Second Floor), BD Building
Chaired by: Prof. John Breen

10:15am **Pesticides and bees; hazard, exposure and potential solutions**
» Dr. Dara Stanley, Ms. Alison O'Reilly, Ms. Linzi Thompson, Mr. Arrian Karbassioon, Dr. Ed Straw

Continued from **Wednesday, 22 June**

10:30am **Developing a dairy energy rating for identifying innefficient energy users throughout Ireland's dairy farm population**
» Dr. Philip Shine, Dr. John Upton, Dr. Eleanor Murphy, Dr. Michael D. Murphy

10:45am **The abundance and characteristics of microplastics in Irish agricultural soils**
» Ms. Clodagh King, Dr. Siobhán Jordan, Dr. Caroline Gilleran Stephens, Dr. Joseph P. Lynch

11am **Gathering sustainable IPM advice for leatherjackets in Irish agriculture**
» Ms. Aisling Moffat, Dr. Michael Gaffney, Dr. Lorna Cole, Dr. Gail Jackson, Dr. Fiona Brennan, Dr. Louise McNamara

11:15am **Demand-driven energy and biochemical production from a two-stage anaerobic digestion reactor**
» Mr. Rajas Shinde, Prof. Jerry Murphy, Dr. Susanne Barth, Dr. David Wall

10:15am **S17- Net Zero Challenge**
Room BD-00-011A (Ground Floor), BD Building
Chaired by: Prof. Neil Hewitt

10:15am **Blended feedstock for improving downdraft gasification: A Circular Economy Example**
» Dr. Oisín de Priall, Dr. Caterina Brandoni, Prof. Neil Hewitt, Mr. Chris Johnston, Dr. George Onofrei, Prof. Ye Huang

10:30am **Marginal abatement cost curves for biogas in Ireland: Assessing on-farm anaerobic digestion through the use of an enviro-economic calculation tool.**
» Mr. Jorge Diaz Huerta, Dr. Richard O'Shea, Dr. David Wall, Prof. Jerry Murphy

10:45am **Dark fermentation of Macroalgae biomass in production of biofuels**
» Mr. James Lawrence, Prof. Piet Lens, Prof. Jerry Murphy

11am **Dedicated large-scale floating offshore wind to hydrogen**
» Mr. Omar Ibrahim, Dr. Alessandro Singlitico, Dr. Shane McDonagh, Dr. Roberts Proskovics, Dr. Cian Desmond, Prof. Jerry Murphy

10:15am **S19 - Flash Presentations**
Room BD-00-011B (Ground Floor), BD Building
Chaired by: Dr. Fermín Reygadas

10:15am **BlueBio MINERVA: Sustainable valorisation of macroalgae using a biorefinery approach**
» Dr. Fanny Lalegerie, Ms. Sofiia Tretiak, Dr. Stephen Jackson, Prof. Alan Dobson, Dr. Sarah Hotchkiss, Mrs. Rósa Jónsdóttir, Dr. Mattias Berglin, Dr. Zoë A. Popper, Prof. Dagmar B. Stengel

10:20am **Environmental variability and sustainable protocols for seaweed valorisation in BlueBio MINERVA**
» Dr. Fanny Lalegerie, Prof. Dagmar B. Stengel

10:25am **Evaluating nutrient and sediment inputs from riverbank cattle access points.**
» Ms. Alison Scott, Dr. Rachel Cassidy, Prof. Philip Jordan

10:30am **Associations between environmental knowledge, socio-demographic profiles, and the Irish diet**
» Mr. Daniel Burke, Dr. Paul Hynds, Dr. Anushree Priyadarshini

10:35am **Sustainable Kitchens**
» Mr. Cathal Pendred, Ms. Samantha Fahy

10:40am **SURICATES: Sediment Management with application to the La Rance Estuary, France**
» Ms. Iqra Rehman, Dr. Joe Harrington, Mr. Branislav Batel, Ms. Valérie Foussard

Continued from **Wednesday, 22 June**

10:45am **In-situ electrochemical determination of 2,5-diformylfuran from the photocatalytic oxidation of 5-hydroxymethylfurfural.**
» Mr. Pádraig McDonagh, Dr. Nathan Skillen, Prof. Peter Robertson, Dr. Denis Mc Crudden

10:50am **Costing the Public Health Impact of Climate Change in Ireland**
» Mr. Giacomo Di Capua, Dr. Paul Hynds, Dr. Anushree Priyadarshini

10:55am **Wild trout as a spreader of Cryptosporidium parvum zoonotic subtypes**
» Dr. Seila Couso-Pérez, Dr. Elvira Ares-Mazás, Dr. Hipólito Gómez-Couso

11:15am **Refreshment, Poster Session and Meet the Exhibitors**
Room BD-01-014 (First Floor), BD Building

12:15pm **S14 - Water-Energy Nexus**
Room BD-02-009 (Second Floor), BD Building
Chaired by: Prof. Tony Byrne

12:15pm **Phosphate capture by atomic layer deposition-based materials**
» Ms. Marina Avena Maia, Mr. Rene Hauser, Dr. Laura Torrente-Murciano

12:30pm **Bacterial community composition in a pilot-scale wastewater treatment plant**
» Ms. Shabila Perveen, Dr. Cristina Pablos, Dr. Ken Reynolds, Mr. Simon Stanley, Prof. Prof. Javier Marugan Aguado

12:45pm **Synergistic effect of 3 wavelengths for inactivation of E. coli**
» Mr. Adithya Pai Uppinakudru, Mr. Miguel Martin Somer, Dr. Ken Reynolds, Mr. Simon Stanley, Prof. Prof. Javier Marugan Aguado, Dr. Cristina Pablos

1pm **Photoelectrocatalytic removal of E. Coli, MS2, and methanol using nanostructured WO3/BiVO4**
» Mr. Conor Reddick, Dr. Carlos Sotelo Vázquez, Dr. Ken Reynolds, Mr. Simon Stanley, Dr. Cristina Pablos, Prof. Prof. Javier Marugan Aguado

12:15pm **S16 - Sustainable Land Use, Agriculture and Food**
Room BD-02-008 (Second Floor), BD Building
Chaired by: Dr. Dara Stanley

12:15pm **Potential of multi-species mixture in reducing enteric methane emissions in vitro**
» Mr. Ali Sultan Khan, Ms. Dominika J. Krol, Mr. John A. Finn, Mr. Alexandre B. De Menezes, Ms. Emily Roskam, Mr. Stuart Kirwan, Ms. Sinead M. Waters

12:30pm **Can multispecies grasslands simultaneously improve herbage productivity and micronutrient uptake?**
» Ms. Omotola Odetayo, Ms. Jane Shackleton, Dr. Cornelia Grace, Dr. Jean Kennedy, Dr. Ron De Goede, Prof. Ellis Hoffland

12:45pm **Biorefinery from Rhododendron residue for the production of antioxidants, hydrogels and nanocellulose**
» Ms. Tielidy Lima, Dr. Gabriel Goetten de Lima, Dr. Michael Nugent

1pm **Waste recovered compost: a sustainable source of fertilizer in Bangladesh**
» Dr. Paul Williams, Mr. MD RAJU AHMAD, Dr. Jason Chin, Dr. S M Ashekuzzaman, Dr. Mahmud Hossain Sumon

12:15pm **S18 - Biodiversity, Ecosystems and Ecotoxicology**
Room BD-00-011A (Ground Floor), BD Building
Chaired by: Dr. Thomaé Kakouli-Duarte

12:15pm **Impact of recycling derived fertilisers application on nematode communities in Irish grassland**
» Dr. Thomaé Kakouli-Duarte, Ms. Anna Karpinska

Continued from **Wednesday, 22 June**

12:30pm **Microbial Source Tracking of Antimicrobial Resistance in Bathing Waters in Northern Ireland.**
» Ms. cathy brooks, Ms. Elaine Mitchell, Ms. Sinéad O'Donovan, Mr. James Brown, Mrs. Kelly-Anne Carnaghan, Mr. Eoin Bleakney, Ms. Kelly Westley, Mrs. Elke Johns, Mr. Jeorg Arnscheidt

12:45pm **Mapping vegetation communities on Irish raised bogs using PlanetScope imagery and Google Earth Engine**
» Mr. Wahaj Habib, Mrs. Ruchita Ingle, Dr. Matthew Saunders, Dr. John Connolly

1pm **The Role of Urban Trees in the Improvement of Urban Biodiversity**
» Ms. Caoimhe Marron, Dr. Eoin Lettice, Dr. Barbara Doyle Prestwich

1:05pm **Development of Novel Molecular Indicators of Emerging Contaminants in Freshwater and Marine Environments**
» Ms. Enya Cody, Dr. Andrew Reynolds, Prof. Gordon Chambers, Prof. Orla Howe, Dr. Michelle Giltrap

1:10pm **The impact of indomethacin and ibuprofen on daphniids**
» Ms. Hannah Moynihan, Ms. Anna Michalaki, Dr. Konstantinos Grintzalis

12:15pm **S20 - Flash Presentations**
Room BD-00-011B (Ground Floor), BD Building
Chaired by: Prof. Lyda Patricia Sabogal Paz

12:15pm **Investigation of a novel algal-based biostimulant against RLS on barley**
» Ms. Wendy DELPONT, Dr. Zoë A. Popper

12:20pm **Cross-Laminated Timber: A sustainable solution for building construction**
» Mr. Muhammad Yasir, Mr. Andrew Macilwraith, Mr. Kieran Ruane

12:25pm **Exploring the use of plant growth regulators on hemp.**
» Ms. Grace Pender, Dr. Susanne Schilling, Dr. Rainer Melzer

12:30pm **Assessing Agricultural Biocide Usage Patterns in Ireland**
» Ms. Meabh Dowler, Mr. Daniel Burke, Dr. Jean O'Dwyer, Dr. Paul Hynds

12:35pm **Irish Faba Beans as a sustainable food source**
» Ms. Laura Mc Daid, Dr. Denis McCrudden, Dr. Sheila Alves

12:40pm **Temporal microplastic contamination of cockles from Dundalk Bay, Republic of Ireland**
» Mr. Stephen Kneel, Dr. Suzanne Linnane, Dr. Caroline Gilleran Stephens, Dr. Alec Rolston

1:15pm **Lunch**
Room BD-01-014 (First Floor), BD Building

2pm **Prize Giving & Environ 2022 Closing Ceremony**
Conor Lecture Theatre (Room BA-01-009, First Floor), Birley Building

3:30pm **POSTERS (only) list**

Bioplastics: An evaluation of sustainability
» Ms. Cherrelle Johnson, Dr. Sinead Mitchell

Recycle the Bicycle? Environmental Opportunities & Concerns from the E-Bike Revolution
» Dr. Yvonne Ryan, Prof. Colin Fitzpatrick, Prof. Catherine Woods, Dr. James A. Green

Converting waste heat into electricity using cellulose membranes
» Dr. Ievgen Nedrygailov, Dr. Kamil Rahme, Dr. Subhajit Biswas, Ms. Anjali Ashokan, Ms. Rupa Ranjani, Prof. Justin D. Holmes

Continued from **Wednesday, 22 June**

Sampling, identification and characterization of microplastics released from daily used plastic products
» Ms. Luming Yang, Dr. Dunzhu Li, Dr. Yunhong Shi, Dr. Jing Jing Wang, Dr. Liwen Xiao, Prof. John Boland

Analysis of air quality and relationship with adverse mental health disorders in Ireland.
» Ms. Kristina Leontjevaite, Dr. Aoife Donnelly, Dr. Tadhg MacIntyre

Encouraging Pro-Environmental Behaviour in Laboratories – A Plastics Challenge
» Mr. Adam Boland, Mr. Adam Murphy, Ms. Samantha Fahy, Dr. Brian Freeland, Dr. Susan Kelleher, Dr. Keith Rochfort, Dr. Jennifer Gaughran

Preliminary Study on the Medicinal Properties of Irish Monofloral Honeys
» Ms. Emma Browne, Dr. Siobhán Kavanagh, Dr. Sinead Devery

ContinuFor: Multifunctionality of Transformation to Continuous Cover Forestry.
» Ms. Laura Harris, Dr. John Devaney, Prof. Áine Ní Dhubháin, Dr. Ian Short

Reverse genetic screen using comparative genomics
» Mr. David F. G. Flores, Prof. Neil J. Rowan, Dr. Mark Daly, Dr. Ross Evans, Dr. Michael P. Mullen

Dealing with plastic packaging contaminated with residual amounts of food
» Dr. Ashlene Vennard, Mr. Paul Cairns, Dr. Svetlana Tretsiakova-McNally, Mr. Ian Harvey, Dr. John Harrison, Dr. Charlie Farrell

Prediction of radiant intensity using analytical and numerical simulation techniques
» Mr. Adithya Pai Uppinakudru, Ms. Cintia Casado Merino, Dr. Ken Reynolds, Mr. Simon Stanley, Prof. Prof. Javier Marugan Aguado, Dr. Cristina Pablos

Biohydrogen Generation from Wastewater using Microbial Electrolysis Cells – A Study of Cost-Effective and Recycled Anode Materials
» Mr. A K M Khabirul ISLAM, Dr. Patrick Dunlop, Prof. Neil Hewitt, Prof. Ye Huang, Dr. Nigel Ternan, Dr. Swati Jindal, Prof. Ke Zhang, Dr. Caterina Brandoni

INACTIVATION OF Aeromonas hydrophila USING HOUSEFOLD WATER TREATMENT
» Dr. Margarita Hincapie, Dr. Luis Javier Montoya, Dr. Liliana Botero, Dr. Laila Galeano, Dr. Gloria Carvajal

Socio-technical model for water provision in slums and migratory movements
» Dr. Ester Guimaraes

3D-printed air-cathodes for microbial fuel cells
» Mr. Yifan Sun, Ms. Zeena Wang, Dr. Dunzhu Li, Dr. Yunhong Shi, Ms. Luming Yang, Dr. Liwen Xiao

National Wastewater Surveillance as an early warning system for SARS-CoV-2
» Ms. Niamh Holohan, Ms. Alannah Byrne, Ms. Sanne Fennema, Ms. Natasha Sarwar, Ms. Sailusha Kuntamukkula, Mr. Wim Meijer

Use of waste shell as a low-cost adsorbent for phosphate removal in wastewater
» Ms. Brakemi Egbedi, Dr. Shiau Pin Tan (Graece), Dr. Mike Kinsella, Dr. Helen Hughes

Using Rainfall as a Parameter to Develop a Live Bathing Water Quality Prediction System
» Ms. Megan Whitty

Capability of granular activated carbon to remove Cryptosporidium oocysts from drinking water
» Dr. Seila Couso-Pérez, Dr. María Jesús Abeledo-Lameiro, Ms. Ana Isabel Vidal-Varela, Dr. Hipólito Gómez-Couso

Continued from **Wednesday, 22 June**

Investigating Ireland's Blue Carbon Potential Through a Scientific, Socio-economic and Legislative Approach (BlueC)

» Dr. Grace Cott, Dr. Pedro Beca-Carretero, Dr. Rachel Cave, Prof. Mark Johnson, Prof. Stephen Hynes, Dr. Anne Marie O'Hagan, Prof. Tasman Crowe, Prof. Dagmar B. Stengel

Toxicity bioassays in water clarified by the natural coagulant Opuntia cochenillifera

» Dr. Bárbara Freitas, Dr. Ulisses Costa Terin, Dr. Natália de Melo Nasser Fava, Prof. Lyda Patricia Sabogal Paz

Unmanned aerial vehicles for mapping seaweed: RGB and multispectral sensors

» Mr. Damir Akhmetshin, Dr. Owen Naughton, Dr. Leon Cavanagh, Dr. Dean Callaghan

Environ 2022

Ulster University Belfast

20th – 22nd June 2022

32nd Irish Environmental Researchers Colloquium

"Unlocking Sustainability"

ORAL AND POSTER PRESENTATIONS

Table of Contents

Solar Water Disinfection: There's a Time and Place for It?

S1-Water for the Global South - Oral

Prof. Kevin G. McGuigan [1]

1. *Royal College of Surgeons in Ireland*

Short Bio

Prof Kevin McGuigan is the director of the RCSI Solar Disinfection Research Group and Professor of Medical Physics in the Dept. of Physiology & Medical Physics where he teaches on the Medicine, Pharmacy and Physiotherapy programs. His research focusses on developing appropriate technology interventions against waterborne disease for use in low-to-medium-income-countries and resource-poor environments. His research specializes in running field studies to evaluate these technologies and has conducted field studies in India, Ethiopia, Malawi, Uganda, Kenya, Zimbabwe, S. Africa and Cambodia. Kevin is the recipient of the 2019 UNESCO-Equatorial Guinea International Prize for Research in the Life Sciences which "*rewards the projects and activities of an individual which have led to improving the quality of human life*." He is a Fellow of the Institute of Physics (FInstP) and the Royal Society of Chemistry (FRSC), has published over 80 peer-reviewed articles.

Water and sanitation in Brazil

S1-Water for the Global South - Oral

Dr. Ester Guimaraes [1]

1. *SABESP WATER AND SANITATION COMPANY ESP*

Short Bio:

PhD in Environmental Engineering Sciences from the University of São Paulo, MBA from the OHIO College of Business with the School of Economics of FGV-SP and IBE Business Institute (2010), specialization in Sanitary Engineering from the School of Public Health, University of São Paulo (1993), graduation in Electrical Engineer Fundação Armando Hairstyle Alvares (1985). Engineer at SABESP - Basic Sanitation Company of the State of São Paulo - since 1988, like Advisor Regulatory Affairs in tariffs and regulatory studies in São Paulo pro-poor programs since 2006. Regulation Courses from PURC - University of Florida, Pro-Reg and UNESCO-IHE Institute for Water Education. I am researcher at the Center for Research Support Climate Change - NapMC / TILT - Interdisciplinary Climate Investigation Center at the University of São Paulo. He is currently director project of Association of University Professionals of SABESP, member of the Technical Chamber of Rates and Regulation of the Brazilian Association of Sanitary and Environmental Engineering - National, member of the Technical Chamber of Basin Plan Committee PCJ, member of the Technical Chamber of Basin Plan Committee Alto Tietê, the Environmental Audit IEMA / EMAS Institute of Environmental Management and Assessment in UK for The European Union's Eco Management and Audit Scheme (2007).

The triad of Global Nutrition Security, Safe Water and Planetary Health: Can the 'Mobile Teaching Kitchen' initiative be a 'vehicle' for transformation?

S1-Water for the Global South - Oral

Prof. Sumantra (Shumone) Ray [1]

1. *University of Cambridge*

Short Bio:

Professor Sumantra Ray RNutr.

NNEdPro Founding Chair and Executive Director.

University affiliations: University of Cambridge | Ulster University | Imperial College London | University of Wollongong.

Sumantra (Shumone) Ray is a Licensed Medical Doctor as well as a Registered Nutritionist (Public Health), with special interests in Cardiovascular Disease Prevention and Nutrition Education in Health Systems.He is cross-appointed in Cambridge as a Director of Research at the University of Cambridge and Co-Lead for the Food, Nutrition and Education Work Package for the TIGR2ESS Programme in India (2017-21) led from Cambridge and supported by UK Research and Innovation's Global Challenges Research Fund (GCRF). Shumone is a Bye-Fellow of Fitzwilliam College at the University of Cambridge, and, additionally, holds a fractional personal chair appointment as Professor of Global Nutrition, Health and Disease at Ulster University where he is also an Advisory Board Member to the high-impact GCRF Latin American SAFEWATER programme (2017-22). In addition he has a number of honorary/visiting professorial appointments more widely, including Imperial College London in the UK, and the University of Wollongong in Australia.

Reducing environmental impacts of marine biotoxin monitoring: a laboratory case study

S4 - Marine and Coastal - Oral

Dr. Jane Kilcoyne [1]

1. *Marine Institute, Rinville, Oranmore Galway*

Dr. Jane Kilcoyne is an analytical chemist at the Marine Institute in Galway. She works in the Marine Environment and Food Safety Section, specialising in the monitoring and research of marine biotoxins, produced by phytoplankton that can accumulate in shellfish, and are harmful to human health.
Jane is an advocate for climate and biodiversity activism, sustainability, and greening laboratories. She is co-chair of the Get Greener team at the Marine Institute and is a member of the Irish Green Labs network. Her recent work highlights how laboratories can reduce environmental impacts by adopting more sustainable procedures and behaviours.

Abstract:
Laboratories globally contribute significantly to consumption of resources, greenhouse gas emissions, and generation of waste. Shellfish destined for human consumption are required to be tested for the presence of regulated marine biotoxins, that can be harmful to human health. Whilst running the national monitoring program for the detection of biotoxins in shellfish, efforts were made to increase resource efficiencies by reducing waste and energy consumption leading to reduced environmental and financial costs. Methods were verified to allow transitions to more sustainable and environmentally-friendly consumables, replacing plastics with paperboard and glass alternatives, leading to a reduction in the consumption of single-use plastics by 69%. A shift to polystyrene recycling and composting non-toxic shellfish waste led to an overall reduction in non-chemical waste of >95%. Adoption of green analytical chemistry principles to procurement and preparation of chemical solutions led to reduction in hazardous chemical waste by ~23%. A further reduction in printing (~81%) was achieved by transitioning to digital document control. Strategies to reduce energy consumption through ‘switch off’ campaigns and improved fume hood and cold storage equipment management were also implemented. Fume hood and cold storage equipment energy consumption was reduced by 30%. The strategies implemented could be adopted by other laboratories.

Post-harvest stability of key biomolecules in seaweed biomass.

S4 - Marine and Coastal - Oral

Dr. Keelan C. Lawlor [1], ***Dr. Dilip K. Rai*** [2], ***Prof. Dagmar B. Stengel*** [1]

1. *Botany and Plant Science, School of Natural Sciences, and Ryan Institute, National University of Ireland Galway, University Road, Galway, Ireland, H91 TK33.*, ***2.*** *Food Biosciences, Teagasc Food Research Centre, Ashtown, Dublin 15, Ireland.*

Seaweeds (marine macroalgae) are valuable sources of polyunsaturated fatty acids, carotenoids, phenolics and other antioxidants for a range of commercial applications. However, many of these biomolecules are sensitive to degradation. The high moisture content of seaweed derived from cultivated or natural sources means that significant time can elapse between harvest and dewatering/drying, potentially reducing quantities in, and changing composition of, high-value compounds. This study aimed to assess the stability of selected biomolecules and antioxidant capacity under outdoor storage conditions across two seasons (summer and winter), emulating industrial pre-processing conditions in four macroalgae (*Ascophyllum nodosum, Laminaria digitata*, *Chondrus crispus* and *Ulva* sp.).

All species (except *A. nodosum*) exhibited significant reductions in total fatty acids (TFA), particularly in omega-3, over time. Across all species, TFA comprised of 1.52-3.89% of biomass dry weight (DW) in summer, and 1.83-3.11% of DW in winter. Highest initial levels of omega-3 were observed in *C. crispus* in summer and *Ulva* sp. in winter. Biomass of *C. crispus* exhibited the greatest reduction in omega-3, and *A. nodosum* the least. Highest initial total pigment content was observed in *Ulva* sp. in winter (8.03 $mg.g^{-1}$ DW), which then was reduced from 2.35 to 0.87 $mg.g^{-1}$ DW in summer. Significant losses occurred in all species by week-2 and week-4 time points in summer. In winter, no significant change occurred in *A. nodosum* or *Ulva* sp., and phenolics in *A. nodosum* increased briefly post-harvest. Initial antioxidant capacity was highest in *A. nodosum* (46.24-60.93mg $TE.g^{-1}$ DWE). The remaining species exhibited modest activities (3.69-13.55mg $TE.g^{-1}$ DWE). For all species, antioxidant activity was highest in winter.

Our results highlight the importance of prompt dewatering of biomass to minimize loss of sensitive biomolecules. Overall, compound degradation was lowest in *A. nodosum* in winter, suggesting that low-light and low-temperatures were optimal for maintaining biomass composition.

Community led approaches for sustainable coastal adaptation and coastline management

S4 - Marine and Coastal - Oral

Mr. Paul Lawlor [1]

1. *Ulster University*

With our coastlines continually being altered by challenging climate change effects (that range from sea level rise, coastal erosion and more frequent flooding), the role of coastal communities in devising sustainable adaptation solutions and managing our coastline is becoming increasingly important. Through a review of the current climate adaptation policy framework in Ireland and by looking at a series of case studies (3) from Irish coastal areas, this paper examines the contribution that community groups and the voluntary sector can make to monitoring and recording coastal change in their areas and their capacity to devise and implement adaptation solutions along the coastline. The research has revealed that although examples of community led actions are relatively limited, community groups and the voluntary sector have demonstrated a capacity to undertake a wide variety of tasks that are essential to carrying out effective adaptation solutions. The findings also indicate that with additional support and suitable governance arrangements, coastal communities can play a positive and progressive role in sustainable coastal adaptation and coastline management in the years ahead.

Microplastic abundances in Nephrops norvegicus and its surrounding sedimentary environment

S4 - Marine and Coastal - Oral

Ms. Haleigh Joyce [1], Dr. João Frias [1], Dr. Fiona Kavanagh [1], Ms. Rachel Lynch [1], Dr. Elena Pagter [1], Dr. Jonathan White [2], Dr. Róisín Nash [1]

1. *Atlantic Technological University, Galway,* ***2.*** *Marine Institute, Rinville, Oranmore Galway*

The presence of microplastics, a contaminant of emerging concern, has attracted increasing research attention to commercially relevant seafood species such as *Nephrops norvegicus*. This decapod crustacean has a wide spatial and depth distribution, a non-selective feeding behaviour, and interacts with benthic sediment, which are all desirable characteristics for a bioindicator species.

This research investigated the abundance of microplastics in both *N. norvegicus* and in benthic sediments across the six primary fishing grounds in the North-East Atlantic. It assessed the relationship between MP abundance in *N. norvegicus*, their biological parameters, and their surrounding environment. It also examined their potential use as a monitoring tool for MP contamination.

Detection and quantification protocols of microplastics in *N. norvegicus* followed the methodology recommended by Hara *et al.*, (2020). Alkaline digestion of the digestive tract was carried out using a 10% potassium hydroxide (KOH) and extraction of microplastics from sediment was carried out using a high-density separation solution (sodium tungstate Na_2WO_4).

The microplastic abundances, size, shape, and polymer type data recorded in *N. norvegicus* mirrored those found in the surrounding environment samples. The level of microplastic concentrations in *N. norvegicus* (n = 600) in this study was relatively low, 2.20 ± 2.47 items per individual, when compared to other regions in Europe. The authors propose *Nephrops norvegicus* in combination with sediment as a potential monitoring tool for microplastic contamination. Based on the results of this study, data on MP ingestion could be used to assess trends in the amount and composition of litter ingested by marine animals towards fulfilling requirements of descriptor 10 of the Marine Strategy Framework Directive.

Hara, J., Frias, J., Nash, R., 2020. Quantification of microplastic ingestion by the decapod crustacean Nephrops norvegicus from Irish waters. *Marine pollution bulletin*, *152*, 110905.

Beach littering: Putting the user at the centre of environmental policy

S4 - Marine and Coastal - Oral

Ms. Rachael Singleton [1], ***Dr. Susann Power*** [1], ***Dr. Marian McLaughlin*** [1], ***Prof. Una McMahon-Beattie*** [1]

1. *Ulster University*

The beach is a space, “anomalously located between land and sea, nature and culture” (Urry, 2002, p.36). 625 pieces of litter are found for every 100m of Northern Irish beach (KNIB, 2019). Beach users contribute to the degradation of the beaches they love. This research posits that this, like many environmental challenges, is a human behavioural challenge.

Combining psychology and the environment, this approach introduces an original, blended methodology underpinned by theory, namely COM-B (Michie et al. 2011) and User-Centred Design (see Font et al. 2018). It aims to understand what influences beach littering behaviour and to identify what will reduce it. The research objectives are: to identify what, for beach users, is the value of the beach; to understand what influences beach littering behaviour; and to identify themes to inform future decision-making regarding beach management. This research recognises a unique opportunity for embedding behavioural science into beach management.

Focusing on two study beaches, Tyrella and Ballywalter, it comprises interviews with 15 beach management professionals and 14 recreational visitors; and beach observation on 10 occasions throughout the 2021 bathing season. The findings presented are threefold: the value of the beach; the target behaviour; and behavioural themes needed to drive it. The study comprises a rigorous approach to providing new ways for public sector agencies to experiment with consumer-relevant, sustainable communication and behaviour change, without having user awareness of sustainability as a prerequisite.

Font, X., English, R., & Gkritzali, A., 2018. Mainstreaming sustainable tourism with user-centred design, *Journal of Sustainable Tourism*, 26 (10), 1651-1667.

KNIB, 2019. Marine Litter Report 2018. Belfast: Keep Northern Ireland Beautiful.

Michie, S., van Stralen, and West. R., 2011. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6 (42).

Urry, J., 2002. *The Tourist Gaze*. 2nd edition. London: Sage.

Recycling Derived Fertilisers Market Demand in the Horticulture and Recreational Sectors in Ireland

S7- Environmental Policy & Communication - Oral

Dr. Aoife Egan [1], ***Dr. Niamh Power*** [1]

1. *Department of Civil, Structural & Environmental Engineering, Munster Technological University, Bishopstown, Cork, Ireland T12 P928*

Recycling derived fertilisers are recycled products such as compost and digestate that come from several different sustainable sources. These products have significant potential for replacing mineral fertilisers and there have been many campaigns in the agriculture sector to promote and encourage their use by farmers. Sustainably sourced alternatives to mineral fertiliser are important, as the global supply of rock phosphate is at risk and nitrogen fertiliser production is energy-intensive and is reliant on natural gas in the manufacturing process. Although the agricultural sector is the dominant market for these products, alternative markets including the horticulture and recreational sectors have excellent potential for RDF uptake. Horticulture, including nursery stock, ornamental plants, fruit and vegetables represented 1.2% of the overall agricultural output in 2002 in Ireland. Also, 150,000 hectares of land in Ireland were assigned for horticulture use in 2016. In addition, 37,100 hectares of land were assigned to the arts, entertainment and recreation sector, including sports fields and parkland in Ireland in 2018.

This research aims to investigate the market demand within the Irish target sectors by exploring agricultural statistics and databases to assess the nutrient demand, fertiliser use and sales rates. In addition, fertiliser price and land use were also explored. Results previously obtained from the agriculture sector indicate that the demand for nutrients from recycling is evident in Ireland, even in regions where animal manure is largely used as a nutrient source. Through this research, it is envisaged that there is an equal demand for sustainable mineral fertiliser alternatives in these new sectors. The outcome of this research is to create a niche area in the horticulture and recreation sectors for the use of recycling derived fertiliser products, thus contributing to the circular economy and closing the nutrient cycle loop. This research is currently ongoing.

Local communities and nature stewardship: Involvement, encouragement and establishment

S7- Environmental Policy & Communication - Oral

Dr. Farshad Amiraslani [1]

1. *U*

Over the past two decades, an increasing trend of the importance and strategies for local people to manage the environment has emerged. There is no single prescription as a guideline, but all research findings stress those strategies to engage local communities by creating long-term incentives, including job opportunities. Such approaches could conserve the environment while guaranteeing long-term support from local communities.
Considering the importance of agriculture and forests in Northern Ireland, efforts are needed to protect both livelihood and nature. This research paper conceptualises global ideas and concepts surrounding this growing research portfolio and introduces possible avenues for local application.
There must be collaborative efforts to establish a linkage among all stakeholders and beneficiaries invited from various levels while preparing a comprehensive guideline for this area. A possible well-connected network of local beneficiaries could be effective. A supportive financial and training package for the first years of establishment is necessary.

Qualified support: Understanding citizens' preferences for co-investment into commercial wind farms

S7- Environmental Policy & Communication - Oral

Ms. Julia le Maitre [1], ***Dr. Geraldine Ryan*** [1], ***Dr. Bernadette Power*** [1], ***Dr. Gordon Sirr*** [1]

1. *University College Cork*

Background

A projected €176 billion of €380 billion required by the European Union to reach renewable electricity share targets could be met by citizen investment into wind farms (Pons-Seres de Brauwer & Cohen, 2020). Nonetheless, a large group of 'qualified supporters' contributes to the social gap between the supportive collective intentions of society and personal willingness to accept the spatial impacts of renewable energy infrastructure in one's 'backyard' or invest in sustainable initiatives (Bell et al., 2013).

Methodology & Aims

Within this context, we present novel evidence of 8072 choices made by a representative sample of 1009 Irish respondents in a dual-response choice experiment.

We aim to interrogate which conditions are most likely to enhance participation for undecided 'swing' stakeholders whose support is qualified.

Findings

We characterise three latent classes, 'enthusiasts', 'non-investors' and 'swing supporters' of co-investment schemes. Traditional financial attributes (risk, return, financial investment partner) had the greatest relative importance, however locational impacts and voting rights on wind farm decision making were perceived differently by each segment. Further, *ex ante* attitudes towards wind farms and climate change, previous financial experience, age and tenure within the community, as well 'softer' context such as a Sustainable Energy Community in the area and knowledge barriers determine willingness to co-invest.

Conclusions and Implications

Support for citizen financial participation in wind farms might be encouraged through knowledge- and capacity-building through grassroots networks, minimising risks, and conferring voting rights to potential co-investors.

References

Bell, D., Gray, T., Haggett, C., & Swaffield, J. (2013). Re-visiting the 'social gap': public opinion and relations of power in the local politics of wind energy. *Environmental Politics, 22*(1), 115-135.

Pons-Seres de Brauwer, C., & Cohen, J. J. (2020). Analysing the potential of citizen-financed community renewable energy to drive Europe's low-carbon energy transition. *Renewable and Sustainable Energy Reviews, 133*, 110300. https://doi.org/10.1016/j.rser.2020.110300

Water governance reforms in the Republic of Ireland: A historical perspective towards a sustainable water future

S7- Environmental Policy & Communication - Oral

Mr. Sarpong Hammond Antwi [1], ***Dr. Suzanne Linnane*** [1], ***Dr. Alec Rolston*** [2], ***Prof. Jill Slinger*** [3]

1. *Dundalk Institute of Technology,* ***2.*** *Goyder Institute for Water Research,* ***3.*** *Delft*

In water-rich Ireland water resources are considered a critical natural asset. This study provides a historical perspective on the key factors driving reforms in the water sector in the Republic of Ireland where long-term shifts in demographic characteristics, agricultural activities and debates over water charges have influenced water resources availability, its supply, management practices and water governance. Through a literature review and three key validation interviews influenced by the rounds theory this study draws on threads from the past by first describing how water governance in the early 1970s was based on reactive regulations focused on pollution control and monitoring. With the advent of the Water Framework Directive, the crux of policy and management practices changed with 81% of present policies relying on the Integrated Water Resource Management principles captured in this European policy. Looking to the future the study examines how the effects of climate change on water resources may necessitate moving away from the present largely reactive response towards policies and strategies aimed at ensuring water availability and supply. The complexity of factors driving water governance and the required future management reforms mean that improved efforts are required from all actors in the sector to build resilience. The paper suggests that future policies should not emphasise only scientific evidence but be cross-sectoral in nature, striving for a balance between socio-economic factors and emphasising the interrelationships between water, climate change, agriculture, biodiversity and the perceptions and behaviours of the public regarding water resources.

Unlocking blue growth: Balancing dialectic tensions of environmental protection and economic development

S7- Environmental Policy & Communication - Oral

Mrs. Jessica Giannoumis [1], ***Dr. Lawrence Dooley*** [2], ***Dr. Valerie Cummins*** [3]

1. *University College Cork and Marine and Renewable Energy Centre Ireland,* ***2.*** *University College Cork,* ***3.*** *Simply Blue Energy*

Blue growth is a policy initiative that was implemented by the EU in 2007 (Commission of the European Communities, 2007) and is seen as a potential solution to balance the forces between environmental protection and economic development to sustainably develop marine resources. However, coastal managers struggle in implementing blue growth as no concise definition exists and consequently, little to no guidance is provided on how to proceed in its implementation. In this research, blue growth is defined as the sustainable development of marine resources, generating livelihoods, and securing wellbeing, from innovation in emerging marine sectors. With this definition in mind, coastal managers may have a better understanding of what blue growth is. This research seeks to deepen the understanding of how coastal managers can manage stakeholder engagement to achieve blue growth development. This research has identified three pairs of dialectic tensions at the core of managing blue growth: 1. Government interventions and laissez-affaire approach to manage marine resources, 2. Hard sustainability and soft sustainability approaches to marine management, and 3. State-of-the-art and legacy technologies which influence how coastal managers manage regional marine resources. To balance these dialectic tensions, coastal managers manage regional stakeholders, i.e., the triple helix, i.e., government, academia, and industry to nurture blue growth. The involvement of the stakeholders and thus the role of the coastal managers will depend on sector and technology maturity. Coastal managers operate on a sliding scale between these dialectic tensions. Hence, the role of coastal managers will change over time. The managers will perform the following four activities in an iterative process: 1. Informing and consulting, 2. Aligning objectives, 3. Collaboration, 4. Monitoring. By doing this continuously, coastal managers can achieve sustainable development of coastal regions and unlock their full blue growth potential.

Environmental outcomes and the Porter hypothesis: The impact of environmental regulations and compliance on company performance in Ireland

S7- Environmental Policy & Communication - Oral

Ms. Maria del Pilar Cespedes Davalos [1], ***Dr. Bernadette Power*** [1], ***Dr. Geraldine Ryan*** [1], ***Dr. John Eakins*** [1], ***Prof. Eleanor Doyle*** [1], ***Dr. Ellen O'Connor*** [1]

1. *University College Cork*

Porter and van der Linde (1995) argue that companies can improve their business and environmental performance in response to more flexible regulations, this is known as Porter's hypothesis. The aim of this paper is to test whether a firm's compliance with environmental regulations improves its business and environmental performance. Few studies use productivity measures or include the relationship between productivity and each companies' environmental performance in the same study (Xie et al., 2017; Yuan et al., 2017; Yuan & Xiang, 2018). Building on existing work testing Porter's hypothesis in the European Union (van Leeuwen & Mohnen, 2017) and Ireland (Power & O'Connor, 2020), along with environmental performance measures developed by Horváthová (2012), this paper brings compliance, business and environmental performance together and estimates these relationships using Irish facility-level and firm-level time-series data (2007 – 2019) and a two-step panel regression model (see Crepon-Duguet-Mairessec (CDM) (1998)).

Preliminary results from the first step of our panel, explaining firm compliance, we find that lagged values of court fines and enforcement are determinants of environmental compliance. These first-step predictions are used to estimate (1) productivity and (2) environmental performance. In a second-stage regression examining firm competitiveness, measured via labour productivity, we find that, in line with previous research, compliance and lagged values of court fines have a negative effect on productivity, while environmental performance has a positive effect. In the second-stage regression examining environmental performance, we find that whilst compliance does not influence environmental performance, lagged values of court fines have a negative effect. The positive effect of environmental performance on competitiveness implies that a win-win situation between industrial development and nature protection is possible. These finds have policy implications as the coercive and strict design of environmental regulations does not have expected impacts on competitiveness and the reduction of environmental harm.

HIGH SHIGA TOXIN DETECTION RATIO IN E. COLI CONTAMINATED PRIVATE GROUNDWATER SOURCES IN WESTERN IRELAND

S10 - Water Quality Monitoring - Oral

Dr. Liam Burke [1], ***Dr. Carlos Chique*** [2], ***Dr. Louise O'Connor*** [3], ***Ms. Alexandra Chueiri*** [3], ***Ms. Brigid Hooban*** [3], ***Ms. LOUISE REILLY*** [4], ***Ms. Emma Sullivan*** [4], ***Prof. Dearbháile Morris*** [1], ***Prof. Paul Hynds*** [5], ***Dr. Jean O'Dwyer*** [6]

1. *1) Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland, Galway. - Galway (Ireland), 2) Centre for One Health, Ryan Institute, National University of Ireland, Galway. - Galway (Ireland).,* ***2.*** *1) School of Biological, Earth and Environmental Science (BEES), University College Cork, Cork, Ireland. 2) Environmental Research Institute, University College Cork, Cork, Ireland.,* ***3.*** *1) Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland, Galway. 2) Centre for One Health, Ryan Institute, National University of Ireland, Galway.,* ***4.*** *Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland Galway, Galway, Ireland,* ***5.*** *Technological University Dublin,* ***6.*** *University College Cork*

Background: Unregulated private groundwater sources are widely used for drinking water in Ireland and are thought to represent an important transmission route for waterborne Shiga-toxin producing *Escherichia coli* (STEC).

Aim: Characterise STEC presence in private wells and investigate associated risk factors.

Methodoogy: Groundwater wells (n=52) were sampled during September/October 2019 (n=21) and 2021 (n=31). Samples (30 L) were filtered, filters enriched, and multiplex real-time PCR performed on DNA extracts for *eae*, *stx1*, *stx2* and six clinically important serogroup markers. Coliforms and *E. coli* were assessed using the Colilert-18 system (IDEXX). Potential risk factor variables were geospatially linked to source-specific geographical coordinates and assessed for bivariate association(s) with STEC-associated gene presence.

Findings: *Stx* genes were detected in 9/21 wells (42.9%) in 2019 and 1/31 wells (3.2%) in 2021 (10/52, 19.2% overall). There was a similar rate of detection for *eae* during both years (42-43%). Overall 15.4% of wells were positive for both *stx1/stx2* and *eae*. One or more clinically relevant serogroups were identified in 90% of STEC (*stx1/2*) positive samples, with O145 (n=6), O157 (n=5) and O103 (n=4) the most prevalent. STEC was detected in 8/20 *E. coli*positive samples, equating to a sample-specific STEC detection ratio (relative to generic *E. coli*) of 40%. STEC presence was associated with decreasing well depth (p=.024) and increasing local 30-day mean antecedent rainfall (p=.034). Serogroup O104 was associated with higher sheep density (p=0.44), whereas detection of *eae* (p=.025) and STEC + *eae* (p=.023) were associated with higher septic tank density.

Conclusions: Relative to global figures, this study identified a very high source-specific STEC detection rate (Chique et al, 2021) of 40% in *E. coli* contaminated groundwater sources in Ireland. Data from more widespread sampling will inform policy development for public health protection.

References:

Chique, C., *et al.* Water Research 188 (2021). https://doi.org/10.1016/j.watres.2020.116496

Development of CZE methods for the monitoring of pharmaceuticals in wastewater.

S10 - Water Quality Monitoring - Oral

Ms. Emma O'Sullivan-Carroll [1], ***Dr. Anna Hogan*** [2], ***Dr. Stewart Howlett*** [3], ***Dr. Carmel Pyne*** [3], ***Dr. Paul Downing*** [3], ***Ms. Marguerite Lynch*** [3], ***Dr. Eric Moore*** [2]

1. *University College Cork / Hovione Ltd, Cork,* ***2.*** *University College Cork,* ***3.*** *Hovione Ltd, Cork*

Environmental monitoring of pharmaceuticals in wastewater is becoming increasingly important for the health and wellbeing of the environment and the organisms that live in it. There are many different pathways in which pharmaceuticals can enter the environment but one of the major pathways is through manufacturing waste. Ensuring that the pharmaceutical concentration is a safe level in the effluents before discharge can provide a safe alternative while research is being conducted on how to fully remove the active pharmaceutical ingredients (APIs) from environmental waters. Capillary electrophoresis (CE) has been gaining attention over the last few years as a greener alternative to High Performance Liquid Chromatography (HPLC). HPLC is the more superior technique when it comes to sensitivity, but it requires the use of organic solvents in its mobile phase which can have devasting effects on the ecosystem. CE on the other hand generates less chemical waste as it requires little to no organic solvents, a smaller sample volume and faster analysis making it the more environmentally friendly technique. This research is a collaboration between Hovione Ltd, Cork, a pharmaceutical contract development and manufacturing company and University College Cork to develop a real time method to detect Hovione's (APIs) in wastewater. Capillary zone electrophoresis (CZE) methods were developed for two of Hovione's APIs: NB and ZB.

A novel method of Electrochemical an Immunosensor for Detection Polychlorinated biphenyls (PCBs) for Environmental Analysis

S10 - Water Quality Monitoring - Oral

Ms. Samia Alsefri [1], ***Dr. Eric Moore*** [1], ***Ms. Thanih Balbaied*** [1]

1. *University College Cork*

Polychlorinated biphenyls (PCBs) are a type of man-made chemical that is extremely toxic to people. The development of a device for detecting PCBs in the environment is critical due to the broad distribution of PCBs in the environment, as well as their toxicity, which can cause serious diseases in living beings such as cancer. Gas chromatography with mass spectrometric detection methods have proven to be reliable detection technologies, but they are expensive and time-consuming. The screening of large numbers of samples has been limited. This lab research effort evaluates ELISA as a laboratory instrument for detecting PCB in environmental samples. In addition, an electrochemical immunosensor for detecting Aroclor 1254 was developed. To create an electrochemical immunosensor for the detection of Aroclor 1254, polyclonal primary anti-PCB antibodies were immobilized onto a gold screen-printed electrode. The carboxylic acid terminal was activated by cross-linking (EDC) and (NHS) on the electrode surface after it was treated with 11-mercaptoundecanoic acid (11-MUA). SAM development on the gold electrode was studied using CV, EIS, LSV, AFM, scanning electron microscopy (SEM), and contact angle measurement. A 0.09 ng/mL1 limit of detection and a linear range of 0.101–220 ng/mL1 were obtained using a competitive assay. The PCBs on the immunosensor were successfully encapsulated by the self-assembled monolayers (SAM). When compared to methods such as the ELISA visual technique, electrochemical detection provided superior resolution. The innovative electrochemical immunosensor technique proposed here can provide rapid sample screening in a portable, disposable manner, which can help to reduce PCB pollution [1]. PCBs detection in water will be established with high specificity and sensitivity using immunoassay techniques in a lab-on-chip application.

Reference

Alsefri, S.; Balbaied, T.; Moore, E. Electrochemical Development of an Immunosensor for Detection Polychlorinated biphenyls (PCBs) for Environmental Analysis. *Chemosensors* **2021**, *9*, doi:10.3390/chemosensors9110307.

Improving freshwater contaminant quantification by drawing upon intrinsic bioaccumulative properties

S10 - Water Quality Monitoring - Oral

Ms. Irene O'Callaghan [1], ***Dr. Dara Fitzpatrick*** [1], ***Dr. Timothy Sullivan*** [1]

1. *University College Cork*

Background

Aquatic biomonitoring techniques allow for the assessment of qualitative changes in environmental conditions, but most biomonitoring techniques are not suited to quantitative measurement of aquatic pollutants. Direct analytical quantification of environmental concentrations is often expensive and complex, especially where higher sensitivity is required, and does not selectively quantify the bioavailable fraction of contaminants.

Aim

The aim of this work was to determine the ecological risk of various metal and metalloid contaminants in aquatic environments. The objective was to explore whether the natural tendency of benthic biota to amplify ecologically-relevant fractions of environmental contaminants through bioaccumulation could be leveraged to assist subsequent chemical analysis.

Methodology

Simultaneous field samples of surface water, sediment and macroinvertebrates (namely *Asellus aquaticus* and *Gammarus sp.*) were collected at five sites in County Cork. Samples were digested and analysed by inductively-coupled plasma – mass spectroscopy (ICP-MS). Data were processed in Microsoft Excel and R.

Findings

Results show that the elemental concentrations measured in macroinvertebrate samples can exceed those of the water samples by several orders of magnitude. Comparison of macroinvertebrate and sediment samples demonstrate that the macroinvertebrate concentrations also exceed sediment concentrations for elements with a thiophilic index in excess of S=0.6. This correlation between accumulation potential and thiophilicity has recently been demonstrated across a wide range of taxa and conditions in O'Callaghan *et al.* (2022).

Conclusions/Implications

The analysis of macroinvertebrate samples was shown to exhibit increased sensitivity compared to the direct analysis of water samples. Sensitivity is further increased for analytes that are more bioavailable, and, thus, are seen to pose a greater ecological risk. The methodology described herein has the potential to reduce sample analysis cost or increase analytical sensitivity for environmental applications.

References

O'Callaghan, I., Fitzpatrick, D., Sullivan, T., 2022. Thiophilicity is a determinant of bioaccumulation in benthic fauna. Environmental Pollution 294, 118641.

GCRF SAFEWATER

S2-Water for the Global South - Oral

Prof. Tony Byrne [1]

1. *Ulster University*

Around 2 billion people globally use a source of drinking water that is faecally contaminated and thus likely to lead to diarrheal illness: nearly 1,000 children die each day due to water and sanitation-related diarrhoeal diseases. Safe drinking-water is required for all usual domestic purposes, including drinking, food preparation and personal hygiene. Diseases related to the consumption of contaminated drinking-water place a major burden on human health. Millions of people still lack access to an improved drinking water source, and these are mostly the poor and marginalized. Many people are forced to rely on sources that are microbiologically unsafe, leading to a higher risk of contracting waterborne diseases, including typhoid, hepatitis A and E, polio and cholera. The SAFEWATER project was aimed at the design and implementation of household based water treatment systems to provide safe, accessible, sufficient, acceptable and affordable potable water for rural communities in Colombia and Mexico. Around 250 systems have been installed in households in rural communities of Colombia and Mexico and these system performance has been evaluated for over one year. Behaviour analysis and health indicators have also been assessed within the communities. The achievements of the SAFEWATER project will be highlighted and outcomes and impact will be discussed. This is a large transdisciplinary project with researchers from Ulster University, University of Sao Paulo Brazil, University of Medellin Colombia, CTA Colombia and Cantaro Azul Mexcio. The SAFEWATER project was funded by the Global Challenges Research Fund of UKRI (Grant Reference EP/P032427/1).

Design of household drinking water disinfection systems for rural settings of Colombia and Mexico

S2-Water for the Global South - Oral

Dr. Pilar Fernandez [1]

1. *Ulster University*

Low-cost technologies for safe drinking water have significant potential to improve the health of communities who rely on unsafe water. The objective of SAFEWATER is to develop sustainable technologies to supply and monitor drinking water in rural areas of Mexico and Colombia, as well as to assess its impact in the regions where the interventions take place. A co-production approach was needed due to the complexity tested nature of water knowledge.

The main objective of the SAFEWATER GCRF-project is to develop and implement low-cost technologies to supply and monitor drinking water in rural areas of Mexico and Colombia, as well as to assess its impact in the regions where the interventions take place. This research was based on a multi-disciplinary team where engineers and natural scientists from three universities and two local NGOs, to co-create drinking water solutions, co-generate, and build knowledge and culture around water in rural settings.

The water treatment systems were designed to provide the daily needs of drinking water for a family living in a rural setting of Colombia and Mexico. Our team surveyed the communities to understand their needs, demands; the chemical and microbiological quality of the local water sources were monitored to identify the main pathogens and physicochemical pollutants. We explored the best and most competitive available water technologies to design a system that removed efficiently the suspended solids, turbidity and bacteria following the protocol established by the World Health Organisation (WHO) for Point-Of-Use (POU) technologies in 2014. Our results showed that the disinfection was effective for all the microorganisms evaluated, providing with a highly protective level (WHO, 2014). These systems provided enough drinking water in households of several rural communities daily. However, some risks were faced and solved during the field trials, e.g. bacterial recontamination, electrical risks, etc.

Device automation to assist with water quality monitoring for fecal contamination

S2-Water for the Global South - Oral

Dr. Jeremy Hamilton [1], ***Dr. James Mclaughlin*** [2], ***Dr. Shashidran Raj*** [2], ***Dr. Alessio Morelli*** [2]

1. *University of Ulster,* ***2.*** *Ulster University*

Monitoring of water for fecal indicator organisms such as *E. coli* and Coliforms, represents a standard water quality procedure. Acceptable levels of these organism vary depending on the use context of the water. With strict absence requirements required for water destined for human consumption. Whereas environmental surface waters represent allow presence of these organism but within guided ranges.

Measurement of *E. coli* and Coliforms can be performed in different ways. Including selective culture, biochemical assays and molecular methods (RNA/DNA). The methodology used is often dictated by the data usage, with regulations often specifying method for drinking water assessment.

The methodologies used for regulated drinking water assessment are all culture based and performed in a lab setting. In the context of the safewater project transport of samples from rural communities across long distances for lab analysis was undesirable.

In this regard differing methodologies of *E.coli* and Coliform detection were assessed for ease of adaption to low resource settings. With the aim of on-site assessment of water quality and data forwarding overcoming transport limitations. Chromogenic culture methods were selected as the most adaptable methodology. Subsequently IoT devices to assess water quality via spectroscopic measurement of chromogenic media were designed and field tested. The range of challenges, successes and failures of technologies in the task of remote water quality assessment will be discussed.

Household slow sand filter: efficiency, configurations, limitations and perspectives

S2-Water for the Global South - Oral

Prof. Lyda Patricia Sabogal Paz [1]

1. *University of São Paulo*

Background: household slow sand filter (HSSF) has been used as a domestic treatment of drinking water in rural communities around the world due to its low-cost and efficiency. HSSF's performance in the removal of physicochemical and microbiological parameters has been studied and promising results have been published in recent years (Freitas et al, 2022).

Aim: this work shows the HSSF technology involving efficiency, available configurations, limitations and perspectives.

Methodology: an extensive literature review was carried out to collect the main documents related to the topic.

Findings: when analysing the documents consulted, it was found that the HSSF is a technology that allows improving the drinking water quality; however, it has limitations that must be observed when installed in rural areas.

Conclusions & implications: more research aimed at facilitating the HSSF operation and maintenance, as well as constant monitoring by the institutions (e.g. NGOs and governments) are essential for end-user acceptance and guaranteeing access to drinking water to meet Sustainable Development Goal 6.

Acknowledgment: Global Challenges Research Fund UK Research and Innovation (EP/P032427/1); The Royal Society (ICA\R1\201373); and National Council for Scientific and Technological Development (CNPq 308070/2021-6).

References:

Freitas, B.L S., Terin, U.C., Fava, N.M.N., Maciel, P.M.F., Garcia, L.A.T., Medeiros, R.C., M. Oliveira, P. Fernandez-Ibañez, J.A. Byrne, Sabogal-Paz, L.P. (2022). A critical overview of household slow sand filters for water treatment. Water research, 208, 117870.

Behaviour Analysis applied to Water, Sanitation & Hygiene (WASH) Research

S2-Water for the Global South - Oral

Dr. Samuel Ginja [1], ***Dr. Stephen Gallagher*** [1], ***Prof. Mickey Keenan*** [1]

1. *Ulster University*

Inadequate water, sanitation, and hygiene (WASH) remains a major determinant of global disease burden, especially among young children. Changing WASH-related practices, or behaviours, is widely recognised as essential for reducing diarrhoeal disease. A science of behaviour is needed to guide those efforts. Behaviour Analysis has existed for over 80 years and has been applied in a range of contexts and issues, including to increase healthy behaviours. In this presentation, a background to behaviour analysis will be provided, as well as an overview of the main methods and how they can be applied in WASH research. Issues and procedures discussed will include a focus on observable behaviour, measurement techniques, task analysis, and single case design. A second point of discussion will be on theoretical and conceptual models used in the field to explain behaviour and guide interventions. We will provide an analysis of WASH behaviours in terms of contingencies of reinforcement, which can be used a framework for research, practice and policy making. A third element of our presentation will be on the state of the art of WASH behaviour change interventions. Data on effectiveness will be presented, key challenges and research gaps will be explored and discussed. Examples of potentially effective strategies will be discussed, with an emphasis on using positive reinforcement to increase safe practices. A sound background knowledge of behavioural science is hoped to stimulate interest among WASH researchers, practitioners, and policy makers, and to help find more effective ways to engender and maintain behaviour change.

Health Indicators and Water

S2-Water for the Global South - Oral

Dr. Santosh Gaihre [1], ***Dr. Ruth Price*** [2], ***Prof. Helene McNulty*** [2]

1. *Nutrition Innovation Centre for Food and Health (NICHE), Ulster University, Northern Ireland; School of Medicine, Medical Sciences and Nutrition, University of Aberdeen, Scotland,* ***2.*** *Nutrition Innovation Centre for Food and Health (NICHE), Ulster University, Northern Ireland*

Abstract: Diseases related to the consumption of contaminated drinking water place a major burden on human health and therefore, ensuring access to safe drinking water is integral to achieving the United Nations Sustainable Development Goals (SDG), including Goal 3-good health and well-being and Goal 6-clean water and sanitation for all [1]. However, around two billion people globally, mainly the rural communities in low and middle-income countries (LMIC) still rely on water that is faecally contaminated and thus likely to lead to diarrheal illness [2]. The latest finding from the WHO/UNICEF Joint Monitoring Programme shows that, every year 297,000 children under the age of 5 years die due to diarrhoeal diseases linked to inadequate water, sanitation and hygiene (WASH) and people in LMIC bear the greatest disease burden [3]. Apart from poor dietary intakes, evidence shows that repeated infection from contaminated drinking water causing nutrient malabsorption, is a major contributor to malnutrition in children, in turn leading to impaired growth and poor health outcomes. Therefore, in the SAFEWATER field trials, we explored the impact of SAFEWATER system on child growth and related health outcomes in rural communities in Mexico and Colombia.

This presentation outlines the key health indicators associated with WASH, including important findings and lessons learned in the SAFEWATER field trials.

References:

1. United Nations. THE 17 GOALS | Sustainable Development. https://sdgs.un.org/goals

2. Prüss-Ustün A, Wolf J, Bartram J, Clasen T, Cumming O, Freeman MC, *et al.* Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. Int J Hyg Environ Health. 2019 Jun 1;222(5):765–77.

3. UNICEF and WHO. Progress on household drinking water, sanitation and hygiene 2000-2017. Special focus on inequalities. New York: United Nations Children's Fund (UNICEF) and World Health Organization, 2019.

Health and Climate Change - Communication and action through tree-planting

S5 - Climate in the Balance - Oral

Dr. Christie Godsmark [1]

1. *University College Cork*

Background: Climate change is one of the greatest challenges of our time, affecting our environment, our society, and our health. Climate change can impact our physical and mental health directly and indirectly. Planting trees can provide a dual mitigation and adaptation response to the climate crisis for example through carbon sequestration as well as positive impacts to our health. Therefore, trees and green spaces can deliver co-benefits for the climate, environment, health and wellbeing. Furthermore, tree-planting is a climate action that allows for public involvement, which can empower people to engage in an act of personal climate action.
Aim: The CATCH (Communication and Action through Tree-planting for Climate-Health) project at University College Cork aimed to communicate climate change impacts to human health and the concept of co-benefits focusing on trees and green spaces; whilst providing an opportunity for personal climate action – tree-planting.
Activities: The CATCH project consisted of three main activities: 1) an online event; 2) an animation; 3) tree-planting. An online event was held where the intersect between climate change, human health, trees and green spaces was communicated. Next, an animation was produced further communicating the impacts of climate change on human health to a lay audience along with the mention of climate and health co-benefits and the importance of trees. Finally, several participants from the online event were provided with a native Irish tree for planting.
Conclusion: The CATCH project provided an opportunity for an improved awareness of climate change, health and co-benefits and may have provided a spark for personal climate action through tree-planting. Several reflections after the project have since emerged which may help others to take into consideration for similar projects including: to strive for inclusivity and equity; using health as a 'hook'; knowledge sharing and clear communication of why climate action is important.

Integrating business carbon accounting with target-aligned national emissions reduction pathways

S5 - Climate in the Balance - Oral

Dr. Aideen O'Dochartaigh [1], ***Mr. Paul Price*** [2], ***Prof. Barry McMullin*** [3]

1. *DCU Business School,* ***2.*** *Dublin City University,* ***3.*** *School of Electronic Engineering, Dublin City University*

Carbon accounting and budgeting methodologies are becoming increasingly sophisticated, but there is little evidence of approaches which can connect business carbon accounting to national and global GHG reduction pathways. At company level, many companies set, measure and monitor GHG reduction targets through carbon accounting and management approaches including Science-Based Targets and the GHG Protocol. However, these approaches have been critiqued in relation to both the integrity of the methodology and their utility in achieving emissions reductions. Furthermore, the focus in research and practice is largely on entity-level accounting and reporting, with few studies exploring if and how entity-level metrics can connect to broader sectoral, national and global indicators. This paper explores approaches to integrating business carbon accounting with target-aligned national and global policy pathways and methodologies. The study utilizes as an illustrative case a European country, Ireland, where a new national carbon budgeting policy framework, including legally binding sectoral targets, is being introduced in 2022. Existing approaches to company carbon accounting are evaluated in terms of their utility and limitations for connecting business impacts with national climate policy targets, and for limiting cumulative carbon budgets in line with those targets. Illustrative scenarios are then developed to assess how business carbon accounting could be integrated with target-aligned national policy pathways and global accounting and reporting frameworks such as UNFCCC methodology. Scenarios include an assessment of corporate and national emissions responsibility assigned on the basis of annual revenue, which suggests that corporate responsibility for global warming is far higher than estimated using current methodologies. Preliminary findings indicate that existing company carbon accounting does not apply principles consistent with the Paris Agreement goals. Company accounting frameworks are subject to significant limitations regarding methodology and utility, and existing methodologies are not sufficiently granular to support integrated carbon accounting across entities, sectors and nation states.

Weather drives divergence in honeybee and bumblebee activity in Ireland

S5 - Climate in the Balance - Oral

Mr. Arrian Karbassioon [1], ***Dr. Dara Stanley*** [1]

1. *University College Dublin*

Insect pollination by both managed and wild bees is a highly valued ecosystem service that ensures reproduction among plants and the production of high-quality crops. Flower visitation by bees is known to be influenced by the weather, and as the global climate continues to change the flying frequency and foraging objectives of bees may change as well. In order to maximize the benefits of pollination in a changing world we must first understand how current weather conditions influence the activity of both wild and managed bee species. This is of particular interest in a country such as Ireland where inclement weather conditions are nominally sub-optimal for bee foraging.

We observed honeybee (*Apis mellifera*; largely managed) and buff-tailed bumblebee (*Bombus terrestris;* largely wild) colonies across a variety of weather conditions in a paired design within several apple orchards to determine how weather variables (temperature, relative humidity, solar radiation, wind) influence the flight activity of each species. We found the two species are expected to become more active in warmer, drier conditions, and reduce their flights as humidity increases. The rate of individuals foraging for pollen in both species increases with temperature but is restrained by humidity. Honeybees appear more sensitive to changes in solar radiation; on the whole honeybees are more sensitive to changes in a wider range of weather variables than bumblebees, which appear more resilient.

Our results indicate that the presence of bumblebees may compensate for decreases in honeybee activity in certain weather conditions, which may be particularly important for crops that flower in the spring when weather conditions are more variable. Results are additionally contextualized within the framework of current management practices and climate change projections.

Decarbonisation of Whiskey Distilleries in a Circular Economy

S5 - Climate in the Balance - Oral

Mr. Anga Hackula [1]***, Dr. David Wall*** [2]***, Dr. Richard O'Shea*** [1]

1. *University College Cork,* ***2.*** *MaREI Centre, Environmental Research Institute, University College Cork, Ireland*

Large industry in Ireland must decarbonise their processes. As part of their corporate social responsibility, industry must reduce greenhouse gas emissions and utilise renewable energy. Ireland has an established and prominent whiskey industry; going forward it is imperative that circular economy strategies are implemented whereby any by-products generated are viewed as a resource. Anaerobic digestion is a technology that can potentially realise a circular economy approach for distillers by offering a means of valorising the whiskey by-products generated onsite.

A novel two-phase anaerobic digestion system termed *Leach-bed reactor with Expanded Granular Sludge Bed (LBR-EGSB)* was designed and commissioned to generate both biogas and volatile fatty acids (VFAs) from existing whiskey by-products ie. draff, thin stillage and thick stillage. VFAs have a range of high-value applications as platform chemicals and can be used in the production of bio-plastics. Biogas can be used to generate renewable electricity or be upgraded to biomethane, a substitute to natural gas, for the purposes of industrial heat or used as an advanced transport fuel. Continuous experimental trials were undertaken to evaluate the performance of the LBR-EGSB with whiskey by-products. The primary VFAs produced were butyric acid (±49%) and acetic acid (±26%). The biogas produced was found to be rich in methane content (±75%).

Implementation of the LBR-EGSB has the potential to reduce the distillers' dependence on natural gas or decarbonise their vehicle fleet. Further research is required to establish the optimal configuration for the LBR-EGSB that is both sustainable, reducing greenhouse gas emissions onsite, and provides the maximum economic return to the distillery. Nonetheless, the LBR-EGSB provides an opportunity to valorise distillery by-products using a circular approach and close the loop on the energy-food-materials nexus.

Motivated reasoning in the willingness to pay for carbon capture and storage: a contingent valuation experiment

S5 - Climate in the Balance - Oral

Ms. Tanisha Waring [1], ***Prof. Alberto Longo*** [2], ***Prof. George Hutchinson*** [1]

1. *Queen's University Belfast,* ***2.*** *Queens University Belfast*

Almost all climate projections indicate that limiting average global temperature increase by 2°C, let alone 1.5°C, can only be achieved through large-scale carbon capture interventions. However, it is widely recognized that the implementation of technologies such as carbon capture and storage (CCS) is often dependent on public acceptance. Previous studies have found evidence suggesting that an individual's perceptions surrounding climate policy is influenced by political beliefs; yet, these have rarely been explored in stated preference studies, such as contingent valuation (CV). We employ message framing in an economic valuation of CCS to understand how it influences individuals' willingness to pay (WTP). We administer an online contingent valuation survey to 1033 individuals in the United Kingdom, employing split sampling to investigate the effect of different message framings on the WTP decisions made by political partisans. Findings indicate that the mean WTP of the sample is approximately £96 as a one-off household tax. We observe evidence of motivated reasoning, albeit not in a political context. While an environmental message frame encourages left wing partisans to pay more for CCS as expected, there is little other evidence of political confirmation bias in the sample. Rather, concerns about climate change and energy security are shared across the political spectrum and have a stronger influence on WTP for CCS than political orientation. We observe that right wing individuals presented with an environmental message frame still tend to be in favour of the technology despite this information not being aligned with traditional right wing political beliefs. Similarly, concerns about energy security are just as much an issue for left wing partisans as for their right wing counterparts. We conclude that to increase social acceptance of CCS, information strategies should appeal to audience values and characteristics for more effective communication.

Disruptive technologies, drones, deliveries and Life Cycle Assessment

S5 - Climate in the Balance - Oral

Ms. Juliana Steinbach [1], ***Dr. Sinead Mitchell*** [2]

1. *National University of Ireland Galway,* ***2.*** *National University of Ireland, Galway*

Disruptive Technologies represent a challenge to environmental assessments as little information concerning products and/or services is available to researchers due to commercial sensitivities (Neuberger, 2007). Drone delivery innovation has the potential to help break the fossil fuel supremacy that dominates the transportation sector (Yowtak et al., 2020). However, It is not yet clear if an electric powered system is enough to guarantee that the disruptive technology will not fall under 'business-as-usual'. Mi-Drone (www.marei.ie/project/mi-drone) is an Enterprise Ireland Disruptive Technologies Innovation Funded (DTIF) project aspiring to develop the technology to scale up drone manufacturing. The project is aligned with a more sustainable delivery as a service to the fast-food, pharmacy and the grocery industry. A literature review on the state of the art of comparative life cycle assessments (LCA) was conducted to create a foundation to assess the environmental impacts of drones and concurrent delivery vehicles. The review has revealed that varied scenarios of business models led to contrasting outcomes regarding LCA. Moreover, the functional unit constituents have steered different scenarios throughout the goal and scope phase that later impacted the input data on the inventory phase. This work aims to expand the current discourse of sustainability that has been shaping drone delivery and provide a critical analysis about disruptive technology environmental assessments.

Neuberger B. An Exploration of Commercial Unmanned Aerial Vehicles (UAVs) An Exploration of Commercial Unmanned Aerial Vehicles (UAVs) Through Life Cycle Assessments Through Life Cycle Assessments. 2017

Yowtak K, Imiola J, Andrews M, Cardillo K, Skerlos S. Comparative life cycle assessment of unmanned aerial vehicles, internal combustion engine vehicles and battery electric vehicles for grocery delivery. In: Procedia CIRP. Elsevier B.V.; 2020. p. 244–50.

Agricultural Ammonia and Human Health: Impacts and Future Solutions

S8 - Air Pollution - Oral

Ms. Katie Wyer [1], ***Dr. David Kelleghan*** [2], ***Dr. Thomas Curran*** [1]

1. *University College Dublin,* ***2.*** *Environmental Protection Agency*

Globally, agriculture is responsible for 81% of ammonia (NH_3) emissions. Although there are numerous policies in place regarding NH_3 as an environmental pollutant in various countries, there are none which focus on the contribution NH_3 has to the formation of fine particulate matter ($PM_{2.5}$). NH_3 emissions from agriculture are responsible for 30% and 50% of all $PM_{2.5}$ in the US and Europe respectively. Exposure to $PM_{2.5}$ results in approximately 3.3 million premature deaths annually and can contribute significantly to the onset of health issues such as Chronic Obstructive Pulmonary Disease (COPD) and the onset of asthma in young children. Several studies have suggested the most cost efficient and effective form of $PM_{2.5}$ mitigation is to reduce emissions of NH_3 from agriculture, which would reduce negative health impacts to the general population and prevent economic losses from premature deaths and illnesses. Skjøth & Geels (2013) project an emission increase of 40% with current global warming scenarios. Global NH_3 emissions are increasing irrespective of these climate scenarios, causing greater impacts to the environment and human health. With these emissions projected to increase further due to climate change, there is an urgent need to reduce emissions to avoid further damage to these receptors. This analysis examined scientific literature related to the sources of NH_3 from agriculture, the contribution of agricultural NH_3 emissions to the formation of $PM_{2.5}$, the socio-economic costs of exposure to these pollutants, and how climate change will impact the future of these pollutants.

Skjøth, C. A., & Geels, C. (2013). The effect of climate and climate change on ammonia emissions in Europe. *Atmos. Chem. Phys.*, *13*(1), 117–128. https://doi.org/10.5194/acp-13-117-2013

Keywords: Agriculture, Ammonia, Human Health, PM2.5, Emissions

Reducing Energy Consumption in Air Filtration Systems (RECAFS)

S8 - Air Pollution - Oral

Mr. Brian Considine [1], ***Prof. Aonghus McNabola*** [1], ***Dr. John Gallagher*** [1], ***Prof. Prashant Kumar*** [2]

1. *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin,* ***2.*** *University of Surrey, Global Centre for Clean Air Research (GCARE)*

Natural and anthropogenic sources of particulate matter (PM) have a detrimental impact on energy consumption and indoor air quality (IAQ) in buildings. The transfer of PM from the ambient environment to a mechanically ventilated building using an air handling unit (AHU) is poorly understood. This research was focused on developing sustainable PM control technology known as aspiration efficiency reducers (AERs) in order to reduce the ambient PM concentration entering an AHU and minimise filter loading. This will reduce energy consumption, increase filter lifespan and improve IAQ. Commercial rainhood attachments for AHUs such as a lourve design were also evaluated to provide a baseline comparison. Results showed that AERs could reduce filter loading for PM_{10} concentrations by 5-35%, corresponding to 3.2-9.3% energy savings [1].

Furthermore the project was also concerned with expanding our understanding of how $PM_{2.5}$ emissions from local traffic pollution sources impacts filter loading. Considering the AHU rooftop location and orientation relative to the wind, and the PM source could lead to further optimisation of a ventilation systems performance. This study found increasing the distance from the local source reduces an AHUs filter loading when facing into the wind. Rotating the inlet away from the prevailing wind results in reduced accumulation of PM and is largely independent of the rooftop location at this orientation.

Finally field tests have been performed on the AERs designed and compared with a control AHU using a commercial rainhood. The pressure drop across both an ePM1 70% bag filter and a coarse 60% efficiency panel filter was monitored in addition to the system pressure and compared.

[1] Considine, B., McNabola, A., Kumar, P., and Gallagher, J., 2022, “A Numerical Analysis of Particulate Matter Control Technology Integrated with HVAC System Inlet Design and Implications on Energy Consumption,” Building and Environment, **211**, p. 108726.

CONTROLLING STREET CANYON VENTILATION USING A ROOF-TOP DEFLECTOR SYSTEM

S8 - Air Pollution - Oral

Mr. Madhavan Vasudevan [1], ***Prof. Aonghus McNabola*** [2], ***Dr. Bidroha Basu*** [3], ***Dr. Francesco Pilla*** [4]

1. *Trinity College Dublin,* ***2.*** *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin,* ***3.*** *Munster technological University,* ***4.*** *University College Dublin*

The street canyons offer an unfavorable micro-environment for the dispersion and dilution of pollutants emitted from traffic sources at street level. The rate of exit of pollutants from street canyons can be enhanced by means of passive control interventions. Unlike other passive interventions that facilitate the re-direction of the flows within the street canyons, the roof-top deflector system aims to promote greater mixing between the above roof-level ambient air and the generally more contaminated street canyon air, to result in lower residence times within the canyon. In this study, a roof-top deflector system is numerically assessed and the impact of the system on pollution removal is estimated through both turbulent dispersion and carriage of pollutants along the mean flow. Along with the two components facilitating the exit of the pollutants from the street canyon, the degree of stagnancy of the flow in the street canyon is defined.

The positioning of the deflector system, the resulting upward exit of flow across the roof- level plane of the street canyon, stagnancy of the flow, corresponding flow field, and the concentration of the pollutants in the overall street canyon, along windward, leeward walls, and at the street levels, are all correlated. It was shown that the amount of air exiting the roof-level plane overshadowed the significance of the rate of recirculation (degree of stagnancy) with the street canyon. However, the recirculation rate helps to understand the varying concentration levels along the selected study regions despite similar amounts of air exiting the roof- level plane. Overall the results demonstrate the roof-level deflector systems have the potential to reduce concentrations within street canyons by up to 59%, and as such warrant further investigation in alternative urban geometries and in the field.

Associations between Urban Greenspace and Particulate Matter Air Pollution

S8 - Air Pollution - Oral

Ms. Anna O'Regan [1], ***Ms. Rósín Byrne*** [2], ***Dr. Stig Hellebust*** [2], ***Dr. Marguerite Nyhan*** [3]

1. *Discipline of Civil, Structural & Environmental Engineering, University College Cork; MaREI, the SFI Research Centre for Energy, Climate & Marine; Environmental Research Institute,* ***2.*** *School of Chemistry, University College Cork; Environmental Research Institute,* ***3.*** *Discipline of Civil, Structural & Environmental Engineering, University College Cork; MaREI, the SFI Research Centre for Energy, Climate & Marine; Environmental Research Institute; Harvard T.H. Chan School of Public Health*

In recent years there has been a surge in the number of people residing in urban areas. Such urban growth has led to many environmental issues, including poor air quality. With urbanisation set to continue, there is an urgent need to mitigate air pollution and reduce the associated health implications. There is increasing evidence of the potential health benefits of urban greenspace, which can potentially balance air pollution-related health risks in urban areas. This research set out to understand the potential of nature-based solutions in mitigating urban air pollution and the associations between urban greenspace and air pollution.

This innovative research examined the associations between urban greenspace and air pollution metrics at multiple spatial scales (buffer radii of 100m – 2000m) in Cork City. Urban street-level greenspace was quantified in high spatial resolution using Google Street View images (O'Regan et al., 2021). A satellite-based index called the Normalised Difference Vegetation Index (NDVI) was also calculated. Particulate matter (PM) air pollution of varying size fractions (PM2.5, PM10, PM1) was measured using Cork City Council's PurpleAir sensor network (www.corkairquality.ie). It was observed that higher levels of urban greenspace were associated with decreases in PM air pollution.

As the population of cities continues to grow, the development of greenspace will become more and more contested. Government officials and local authorities must recognise the importance of incorporating greenspace into future developments. This study shows that investing in greenspace development will improve air quality in cities. This will in turn lead to improved population health, wellbeing and facilitate a greater quality of life for the population of Ireland.

O'Regan, A.C., Hunter, R.F. & Nyhan, M.M. (2021). "Biophilic Cities": Quantifying the Impact of Google Street View-Derived Greenspace Exposures on Socioeconomic Factors and Self-Reported Health. Environmental Science and Technology, 55(13), 9063-9073. doi:10.1021/acs.est.1c01326

Evaluating and Enhancing the Impact of Urban Parks on Local Air Quality Conditions

S8 - Air Pollution - Oral

Ms. Mengyi Jin [1], ***Mr. Kiran Apsunde*** [2], ***Dr. John Gallagher*** [2], ***Prof. Zhongren Peng*** [3]

1. *Shanghai Jiao Tong University,* ***2.*** *Trinity College Dublin,* ***3.*** *University of Florida*

Urban parks have long had social value for citizens in cities, whilst also presenting environmental benefits through mitigating air and noise pollution, reducing the urban heat island effect, and supporting biodiversity. However, these fragmented green spaces are often surrounded by heavily trafficked streets and high-rise buildings, increasing the exposure risk from traffic-related air pollution (TRAP). This case study focuses on a city park in Dublin city to evaluate the impact of urban form and nature-based solutions – in the form of dense vegetation and lawn areas - on local air quality from TRAP sources. A monitoring and modelling software ENVI-met, is adopted to examine interactions between this urban park and surrounding buildings on local air quality. The spatiotemporal distribution of TRAP – specifically particulate matter (PM), nitrogen dioxide (NO_2), ozone (O_3), and black carbon (BC) – was measured through fixed and mobile monitoring campaigns in and around an urban park. Calibrated simulations using the microclimate modelling software ENVI-met assessed the role of the existing nature-based solutions in the park. Further simulations considered changes in the configuration of the urban morphology and nature-based solutions in the park to improve air quality for park users and local inhabitants. The findings of this study can provide valuable guidance for urban planning and the design of urban parks to evaluate the value of nature-based solutions for local air quality.

Impacts Of Atmospheric Ammonia from Diffuse Sources

S8 - Air Pollution - Poster with 5 min Presentation

Ms. Katie Wyer [1], ***Dr. David Kelleghan*** [2], ***Dr. Thomas Curran*** [1]

1. *University College Dublin,* ***2.*** *Environmental Protection Agency*

The Triple A project (Abating Ammonia in Agriculture) is funded by the Department of Agriculture, Food, and the Marine (DAFM) and led by Teagasc. This project aims to reduce ammonia (NH_3) emissions from agriculture with a focus on methods used for the land application of slurry and manure, which accounts for approximately 30% its of national emissions. Ireland has exceeded their National Emission Ceiling (NEC) Directive limits for NH_3 since 2016, and with requirements for a further 1% reduction for 2020 and 5% for 2030 (both relative to 2005 emission levels) it is vital that national emissions of NH_3 are reduced.

While it is imperative that total national emissions are decreased, it is also vital that reductions in the concentration, deposition, and subsequent impacts (on both the environment and human health) are achieved. This is necessary not just for compliance with the NEC Directive, but also the Habitats Directive. One goal of the Triple A project is to develop national models which will represent the contribution of passive or diffuse sources, such as cattle farming and land spreading of fertiliser. Understanding the management of sources is essential to reducing negative ecological impacts. It has been shown that contributions from passive sources alone contribute to the identification of ecological indicators for ammonia pollution. The creation of these models will aid in this understanding and will assist in the identification of problem areas in Ireland that are at risk from NH_3 emissions and subsequent concentrations. In addition to environmental impacts, when released to the atmosphere, NH_3 can react with other chemicals and contribute significantly to the generation of fine particulate matter ($PM_{2.5}$), which impacts human health. Reducing NH_3 emissions from these areas of concern can also aid in enhancing air quality and reducing human health impacts from NH_3 emissions resulting from agriculture.

Floating Treatment Wetlands to purify Primary Treated Domestic Wastewater

S11 - Water and Wastewater Treatment - Oral

Prof. Piet Lens [1]

1. *National University Galway*

Floating treatment wetlands (FTWs) are a cost-effective treatment option for the phytoremediation of wastewater. This study examined the performance of emergent macrophytes and free-floating hydrophytes for municipal wastewater treatment, alongside determining the active pollutant removal sites in FTWs. Primary effluent from a municipal wastewater treatment plants was treated using emergent macrophytes and free-floating hydrophytes. Physico-chemical parameters and total microbial activity were studied over the trial period. The emergent macrophytes *Iris pseudacorus* and *Phragmites australis* showed high removal efficiency for total dissolved nitrogen (TDN) and total phosphorus (TP), with mean removal rates of 74 and 71 %, respectively. Furthermore, the removal efficiencies for the parameters such as BOD, NH_4^+-N, PO_4^{3-}
were >50%, while other parameters like COD and TOC were >30%. For free-floating hydrophytes, in the NH_4^+-N removal efficiency was >70%, while all other parameters were < 63%. Furthering this, NO_3-N were produced in high amounts during the treatment process in both FTWs. Fluorescein di-acetate (FDA) tests, ATP assays, nitrification and denitrification tests showed that active pollutant removal in FTWs takes place in the root zone. The roots had a mean nitrification rate of 2.75 µg/ml h^{-1}, denitrification rate of 0.132 µg/ml h^{-1}, FDA produced of 9.2 µg/ml and ATP concentration of 2.3 µg/ml FDA. These parameters in water and gravel were lower across the trial period.

Photoelectrocatalytic disinfection of water and determination of the radicals produced

S11 - Water and Wastewater Treatment - Oral

Dr. Stuart McMichael [1], ***Prof. Tony Byrne*** [1], ***Dr. Pilar Fernandez*** [2]

1. *University of Ulster,* ***2.*** *Ulster University*

For photoelectrocatalytic (PEC) water treatment and disinfection a considerable amount of research has focused on improving the photoanode efficiency; however, the generation of reactive oxygen species (ROS) at the cathode is desirable for disinfection. In this work, a TiO_2 nanotube (TiNT) array was used as the photoanode and different cathode materials were investigated (platinum, carbon felt, carbon paper and carbon paper modified with Pt nanoparticles (PtNP)) based on the onset potential for the oxygen reduction reaction (ORR), current density and peroxide generation. For the PtNP the onset potential for the ORR was shifted more positive than for platinum and higher current density was observed; however, with Pt or PtNP carbon no significant production of H_2O_2 was observed. The non-modified carbon paper had the highest Faradaic efficiency for the generation of H_2O_2 (15.5%). The highest rate of *E. coli* inactivation was achieved with the non-modified carbon electrode (2.51 log reduction) compared to Pt (0.79 log reduction) in a small scale reactor. This demonstrates the importance of cathode material selection to ensure that ROS generation is maximised. The TiNT photoanode was shown to generate hydroxyl radicals and superoxide radical anion by the reduction of O_2 by conduction band electrons. A customised thin cell PEC reactor with a TiNT photoanode and carbon cathode achieved a 5.0 log reduction of *E.coli* in 20 min using real surface water under 45.6 Wm^{-2} UV.

Pathways to private well management: A structural equation modelling approach

S11 - Water and Wastewater Treatment - Oral

Mr. Simon Mooney [1], ***Dr. Martin Boudou*** [1], ***Dr. Jean O'Dwyer*** [2], ***Prof. Paul Hynds*** [1]

1. *Technological University Dublin,* ***2.*** *University College Cork*

Background: Drinking water contamination disproportionately impacts rural communities due to ageing populations, geographic isolation and susceptibility to extreme weather events (EWEs). As rural regions are characterised by high private (unregulated) groundwater reliance and prevalent contaminant sources, routine and event-based private well management is vital to reducing consumption of microbially contaminated water. In the Republic of Ireland, up to 80% of annual cases of Verotoxigenic *E.coli* (VTEC) enteritis are associated with private well exposure – with a temporal link identified between increased EWE occurrence and acute gastrointestinal infection (AGI) outbreaks.

Aim: Evidence-based risk communication is required to educate Irish well owners and promote appropriate supply management behaviours. To date, however, pathways and relationships between behavioural predictors remain unknown while latent constructs such as risk perception, climate change concern and perceived self-efficacy have yet to be sufficiently explored. In response, a national behavioural survey of 560 Irish private well owners was conducted.

Methodology: Structural equation modelling was employed to identify predictors and underlying relationships determining adoption of three (key) binary outcomes: information seeking, post□EWE actions and supply testing.

Findings: Upon development of optimal models, perceived self-efficacy and climate change concern emerged as significant direct and/or indirect influences on all three behaviour types. Perceived self-efficacy had an inverse influence on EWE risk perception in all three models but positively influenced supply awareness (where present). Presence of a vulnerable (infant and/or elderly) householder was notably found to negatively influence adoption of post-EWE actions ($\beta = -0.131$, $p = 0.016$).

Conclusion & implications: Residential and age-related factors constitute key demographic variables influencing private well management and are strongly mediated by cognitive variables. Study findings will inform future risk communication interventions seeking to minimise exposure to private contaminated groundwater and reduce the rural health burden of waterborne infection in the face of increasingly frequent EWEs.

Cost-Effective Solution to Reducing Vancomycin Concentration in Wastewater

S11 - Water and Wastewater Treatment - Oral

Mr. Benjamin Delmond [1], ***Dr. Svetlana Tretsiakova-McNally*** [2], ***Dr. Dr Brian Solan*** [2], ***Dr. Rodney McDermott*** [2], ***Mr. Alexandre Audoin*** [2]

1. *Trinity College Dublin,* ***2.*** *Ulster University*

One of the significant challenges in modern society is to devise environmentally benign routes to address the emerging post-treatment contaminants, for example antibiotics, in our natural and manmade watercourses. It is well-recognised that antibiotic resistance is often originated within wastewater treatment plants (Pazada *et al.*, 2019). Traditionally, activated carbon is used at wastewater treatment plants as an efficient adsorbent of antibiotic molecules or their metabolites suspended or dissolved in wastewaters. However, this material has high production and reactivation costs, coupled with a significant carbon footprint.

Our ongoing research proposes a more sustainable and cost-effective solution to the problem in the form of chemically modified ligno-cellulosic waste - sawdust. This unwanted material was applied as the adsorbent to the model systems containing 50-200 ppm of vancomycin dissolved in distilled water. It was found that such adsorbents are highly effective for reducing the concentration of vancomycin in contaminated waters. Indeed, the levels of antibiotic removal reached 65% when sawdust from mixed tree species was used, and 57% in the case of ash tree sawdust. Analysis of the adsorption isotherms indicated a monolayer adsorption of vancomycin onto the sawdust particles. This was characterised by a homogeneous adsorption surface with identical adsorption sites.

These preliminary findings indicate the feasibility of converting the sawdust waste into a novel means for wastewater treatment capable of dealing with antimicrobial pollutants. The simplicity of the method offers many developing economies sustainable means of managing this escalating problem.

Pazda, M., Kumirska, J., Stepnowski, P., Mulkiewicz, E., 2019. Antibiotic resistance genes identified in wastewater treatment plant systems – A review. *Science of The Total Environment*, 697, p.134023.

Safe, simple, sustainable and affordable water treatment for developing regions

S11 - Water and Wastewater Treatment - Oral

Mr. Kris O'Dowd [1], ***Prof. Suresh Pillai*** [1], ***Prof. Prof. Javier Marugan Aguado*** [2], ***Dr. Inmaculada Polo Lope*** [3], ***Ms. Ángela García Gil*** [4], ***Dr. Isabel Oller Alberola*** [3]

1. *Atlantic Technical University Sligo,* ***2.*** *Department of Chemical and Environmental Technology, ESCET, Universidad Rey Juan Carlos, C/Tulipán s/n, 28933 Móstoles, Madrid, Spain,* ***3.*** *CIEMAT PSA,* ***4.*** *King Juan Carlos University*

It is estimated that by 2025 over 50% of the global population will have inadequate access to clean drinking water sources [1], as a result, the development of sustainable water treatments will be required in years to come. The WHO has recognized the use of Solar Disinfection (SODIS) as an effective method for the treatment of water in developing countries [2], this simple method uses a transparent plastic container that is filled with water and placed in sunlight for 24 to 48 hours for treatment to obtain safe drinking water. As part of the H2020 project, PANI-WATER the use of a Transparent Jerry Can (TJC) made from polypropylene is proposed that can be used as both a storage container and a treatment reactor. The efficacy of the TJC at causing microbiological inactivity *via* its elimination of selected microorganisms, the structural integrity of the plastic for long term use *via* advanced weathering techniques and if the treated water is safe for human consumption using MTT assays on human cells over a period of 9 months. The development of other sustainable methods of water treatment is a key point of the PANI-WATER project with the use of photocatalytic processes, advanced oxidation processes such as the photo-Fenton process and 2-D materials for wastewater treatment [3].

1. Ballesteros, M., et al., *Worldwide Research Trends on Solar-Driven Water Disinfection.* International Journal of Environmental Research and Public Health, 2021. **18**(17): p. 16.

2. World Health, O., *Evaluating household water treatment options: health-based targets and microbiological performance specifications*. 2011, World Health Organization: Geneva.

3. O'Dowd, K. and S.C. Pillai, *Photo-Fenton disinfection at near neutral pH: Process, parameter optimization and recent advances.* Journal of Environmental Chemical Engineering, 2020. **8**(5): p. 104063.

Removal of vancomycin from the aqueous environment by granular activated carbon

S11 - Water and Wastewater Treatment - Poster with 5 min Presentation

Mr. Hamed Rasouli Sadabad [1], ***Dr. Joerg Arnscheidt*** [1], ***Dr. Heather Coleman*** [2], ***Prof. James Dooley*** [3]

1. *School of Geography and Environmental Science, Ulster University,* ***2.*** *School of Pharmacy and Pharmaceutical Sciences, Ulster University,* ***3.*** *School of Biomedical Sciences, Ulster University*

Background: Bacterial resistance against the antibiotic Vancomycin has been listed as “a cause of concern” by the World Health Organisation (WHO, 2022) due to evidence for its increasing occurrence in the aqueous environment. Thirty to seventy percent of consumed antibiotics (including vancomycin) are excreted by humans and animals and thus a large share of these therapeutically applied compounds enters the wastewater (Hiller et. al., 2019). Conventional treatment plants are not effective in removing antibiotics. Therefore, these compounds are widely present in aquatic environments, where they are frequently detected in low concentration ranges (Huang et. al., 2019).

Aim: To investigate adsorption of vancomycin on granular activated carbon for its removal from the aqueous environment.

Methodology: The experimental study has been carried out with bench-scale batch tests to investigate the adsorption process and the impact of contact time, pH and adsorbent dose on its removal efficiency for vancomycin.

Findings: The main results of this study are as follows.

- Activated carbon is capable of removing vancomycin from the aqueous environment with a maximum removal efficiency of up to 65 % within 48 hours.
- The process is relatively dependent on the pH values of the solution.
- Adsorption of vancomycin onto activated carbon follows the Freundlich isotherm and pseudo-second order kinetics.
- It is suggested that the removal of vancomycin from water is likely to occur via bulk transfer, intra-particle diffusion and bond formation between vancomycin and activated carbon.

References:

European Centre for Disease Prevention and Control & World Health Organization. Regional Office for Europe (2022).

Hiller, C. X., et. al. 2019. Antibiotic microbial resistance (AMR) removal efficiencies by conventional and advanced wastewater treatment processes: A review. Science of The Total Environment (685) 596-608.

Low-cost alternative water treatment for removal of PPCPs in Lagos wastewater, Nigeria

S11 - Water and Wastewater Treatment - Poster with 5 min Presentation

Mr. Lekan Abudu [1], ***Mr. David Adeyemi*** [1], ***Prof. Temilola Oluseyi*** [2], ***Prof. Luqman Adams*** [2], ***Dr. Heather Coleman*** [3], ***Dr. Svetlana Tretsiakova-McNally*** [4], ***Dr. Joerg Arnscheidt*** [5]

1. *Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Lagos,* ***2.*** *Department of Chemistry, Faculty of Science, University of Lagos,* ***3.*** *School of Pharmacy and Pharmaceutical Sciences, Ulster University,* ***4.*** *Ulster University,* ***5.*** *School of Geography and Environmental Science, Ulster University*

This study reports the fate of pharmaceuticals and personal care products (PPCPs), and potentials of use of activated carbon for the removal of PPCPs in the wastewater. The presence of these contaminants in the environment has posed a lot of threats to human health and the environment. The major sources of pharmaceuticals in water bodies are wastewater treatment plants (WWTPs) effluents, untreated sewage and runoff from agricultural farms. Lagos, a highly populated city in Nigeria is faced with the challenges of PPCPs in the waterbodies and only a limited studies have been carried out on the removal of these pollutants in the waterbodies. Antibiotics are one of the most prevalent classes of pharmaceuticals found in Lagos water bodies (Ebele *et al.*, 2017) and their presence has resulted in significant human burdens, hence the resistance of several microorganisms to commonly prescribed antibiotics. Several water treatment methods for removal of pollutants from water include advanced oxidation processes, nano filtration and reverse osmosis, but most of them are expensive, and sometimes generate toxic by-products. Adsorption is an alternative method for wastewater treatment and is widely accepted due to its ease of operation, relatively low cost and maintenance. This has led to the development of numerous adsorbents for environmental remediation, such as activated carbon, nanocomposites, clays, and polymeric porous materials (Abo El Naga *et al.*, 2019). With its high surface area, large pores, great adsorption capacity, hydrophobicity, remarkable recycling ability, operational stability, ease of regeneration procedures, and eco-friendliness, activated carbon is one of the most widely used adsorbents for water remediation. This study aims at activating low-cost agricultural wastes for the removal of selected commonly consumed PPCPs found in the Lagos water bodies resulting from WWTPs, drainages and canals in the city as they are channeled into the Lagos lagoon

Drinking water sustainable systems at Colombia, field data and experiences

S3 - Water for the Global South - Oral

Dr. Margarita Hincapie [1], ***Dr. Luis Javier Montoya*** [1], ***Dr. Laila Galeano*** [1], ***Dr. Liliana Botero*** [1], ***Dr. Gloria Carvajal*** [1]

1. *University of Medellin*

Background: To supply sustainable drinking water is necessary a transdisciplinary approach. A scientific staff for conception and proposal of new sustainable technologies, an engineering staff for design, social equipment to the appropriation of technology, health staff to identify the benefits of the communities, and educational staff to implement changes in behaviors and train to the use of technologies. Appropriation and appreciation of technologies by people is a fundamental factor to guarantee the sustainability of the drinking water systems.
Aim: To show the main results obtained in the implementation in the field of 54 drinking water system, their performance, the strategies of implementation, and the main challenges observed to develop a sustainable and safe system.
Methodology: 54 household systems were evaluated for 12 months, doing measures of turbidity, conductivity, pH, Temperature, E. coli, and coliforms, in raw water, treated water in a storage tank, in the kitchen, and in the bathroom.
Findings: These measures show the efficiency of the treatment. This work reveals different challenges with communities and the necessity of implementation of strategies to contribute to the water quality and health of the community to maintain, clean, and use the water treatment system.
Conclusions & Implications: The proven technology supplies safe water at a relatively low cost in rural communities of Colombia. The measures parameters show the effectiveness of water treatment but reveal the necessity of a periodical cleaning and maintenance of the system. Also, some risks of contamination of water were identified at taps in the kitchen and bathrooms. There are a lot of challenges related to drinking water treatment in rural areas in developing countries such as Colombia, a key factor to having a successful drinking water treatment system is the participation of local communities in the management of the systems.

Safewater Project Impact In Two Communities In Colombia

S3 - Water for the Global South - Oral

Mrs. Catalina Herrera [1], ***Mrs. Durys Esther Rios*** [1], ***Mr. Freddy Vahos*** [1], ***Mrs. Sandra Patricia Castro*** [1]

1. *Science and Technology Center of Antioquia CTA (Centro de Ciencia y Tecnología de Antioquia)*

The SAFEWATER (SW) project was developed in Colombia in two rural communities. A total of 54 systems were installed, two of them in rural schools in each community and the other 52 systems in homes. An integral part of the project was to evaluate its impact on health through anthropometric measurements of height, weight and anemia in children, as well as to evaluate the social appropriation of technology through the identification of behavioral changes in relation to water uses habits and in the use and maintenance of the system. Other ethnographic methods were also used to complement this evaluation, such as interviews and testimonies that have been recorded on videos.

We collect a baseline data in the two intervention communities (IC) and in one control community (CC), for a total of 75 children (38 in the IC), 52 households who were followed up on changes in behavior in the IC and 30 in the CC.

WASH-type strategies were developed to engage communities: a community water committees were formed in each CC and government stakeholders have been involved to support the project once the project ends.

There is evidence of difference in health impact between the CC that doesn´t consume safewater and the IC. In relation to behavioral changes, we identified barriers at the beginning of the project resistance to change the traditional practice (boiling water), economics fears (increase in energy consumption and its payment). At the end, we identified good acceptance by users, economic benefits (decrease in gas consumption to boil water), increase in quality of life (less time invested to boil the water).

SAFEWATER project: Household Water Treatment Systems in Mexico

S3 - Water for the Global South - Oral

Dr. Fermín Reygadas [1], ***Ms. Ane Galdos Balzategui*** [1]

1. *Cantaro Azul*

In low and middle-income countries, there are still great inequalities in water supply between regions and between rural and urban areas. Household water treatment and safe storage (HWTS) provides a solution and for many contexts remain the only medium-term alternative. Many different HWTS technologies exist, they are widely used and there is evidence of their positive impacts. However, most of the HWTS systems are designed to treat around 20 liters per day. Therefore, their use is reduced to drinking water and few other domestic uses. Since not all the water in the household is treated, exposure and consumption of unsafe water remains a common practice that limits the effectiveness of most HWTS technologies.

Our presentation describes the implementation and evaluation of a novel point-of-entry (POE) technology in 190 households in 4 rural communities in Mexico. The system consists of a raw water tank, a pre-treatment stage of filtration followed by disinfection with UVC light, and a second tank for storing 250 liters of treated water. It includes the distribution of water through pipes and taps to key points within the household where water is used directly, avoiding the need for additional storage at those points. In short, it is a household solution that provides safe, running tap water.

We conducted a 12-months, randomized trial to (1) evaluate the field efficacy of this HWTS system in improving water quality and (2) to assess the risk of post-treatment contamination. Escherichia coli was used as an indicator of fecal contamination and is was quantified using Aquagenx CBT EC MPN. Our presentation addresses the community management and operation of the system along with lessons learned in the process and recommendations for future implementation.

SAFEWATER project: Behaviour and Health Analysis in Mexico

S3 - Water for the Global South - Oral

Ms. Ane Galdos Balzategui [1], ***Dr. Fermín Reygadas*** [1]

1. *Cantaro Azul*

The lack of safe water remains one of the main challenges for global health. The problem is multifactorial and requires creative, sustainable solutions that involve different stakeholders. The SAFEWATER project designed and installed a novel household water treatment and safe storage (HWTS) system. This paper reports the results, challenges and lessons learned from the impact evaluation of an intervention in rural, indigenous context of southern Mexico.

We conducted a randomized stepped wedge trial (RSWT) where 190 households (located in 4 communities) received the intervention, between February 2021 and May 2022. At baseline, all households started in the control arm and, in a random sequence, “crossed over” to the intervention arm during one of seven “steps” after baseline. We measured primary outcomes (water contamination, water related behaviors and diarrhea) during eight household visits. Data was collected using survey questionnaires and observation. Escherichia coli (*E.coli*) was quantified using Aquagenx CBT EC MPN in water from those points in the households where informants identified having drank more recently.

We have just completed the field trial and a partial analysis has led to encouraging results. The intervention increased the percentage of households where the water consumed is free from *E.coli* (from 15 to 68%) and 78% of households in the intervention arm reported that the last point from which they consumed water was directly from the system tap, without additional storage of post-treatment water.

SAFEWATER’s intervention to date has shown positive results in terms of increasing access to treated and safely stored water and changes in some water-related behaviors (e.g. exclusive consumption of treated water). The results of this study will contribute substantially to the literature on HWTS, highlighting the need to adapt solutions to the context and ensure their sustainability.

Ireland's Saltmarsh Soil Carbon Stock: A Climate Relevant Carbon Pool

S6 - Wetland & Peatland Management - Oral

Ms. Shannon Burke [1], ***Dr. Elke Eichelmann*** [1], ***Dr. Grace Cott*** [1]

1. *School of Biology and Environmental Science, University College Dublin*

Blue carbon ecosystems store as much as 50% of the carbon found in ocean sediments though they cover less than 0.5% of the seabed. Ireland's most prominent blue carbon ecosystem, saltmarshes, cover at least 10,000ha, however little blue carbon research in Ireland has been conducted to date. Determining the carbon stock of saltmarshes in Ireland will further contribute to our understanding of the carbon storage potential of these ecosystems. Here, we provide the soil organic carbon stocks of Irish saltmarshes, up to a depth of 1m.

Samples were collected from 21 saltmarshes found across Ireland between September 2019 and September 2021. These sites cover 950ha and represent the five saltmarsh (estuary, bay, fringe, sandflat, and lagoon) and sediment types (clay, silt, mud, sand, and peat) present in Ireland.

Soil cores were collected from these sites using a gouge auger or Russian peat auger with 6cm diameters to measure the soil carbon pools. Soil organic carbon was determined using the Loss on Ignition method outlined in the Coastal Blue Carbon manual (Howard *et al.*, 2014).

The estimated total soil organic carbon (SOC) stock of these saltmarshes was determined to be 132148.7 ± 10875.1 Mg C_{org} with a SOC density of 139.3±11.5 Mg C_{org} ha^{-1}. Saltmarsh and sediment type were shown to have a substantial effect on SOC density, as fringe sites (454.9±48.2 Mg C_{org} ha^{-1}) were shown to have a SOC density 10-fold that of lagoon sites (48.8 ± 7.5 Mg C_{org} ha^{-1}).

This provides, to our knowledge, the first complete account of soil carbon density (< 1m) of saltmarsh soils in Ireland. Further studies are ongoing to determine the rate of carbon burial in Irish saltmarshes.

Howard, J., Hoyt, S., Isensee, K., Telszewski, M., Pidgeon, E. (Eds.) (2014). Coastal blue carbon. Conservation International, IOC of UNESCO, IUCN, 36(1), p. 180.

Methane Emissions from Irish Saltmarshes

S6 - Wetland & Peatland Management - Oral

Ms. Lisa Jessen [1]***, Dr. Andrea Fuchs*** [2]***, Dr. Grace Cott*** [2]

1. *University College Dublin,* ***2.*** *School of Biology and Environmental Science, University College Dublin*

Wetland environments are the largest natural sources of methane (CH_4) emissions and are associated with the largest amount of uncertainty regarding the global CH_4 budget (Saunois et al. 2020). Coastal wetlands (CWs) in particular play an important role in carbon-sequestration and -storage because of their high levels of primary productivity and low rates of decomposition. Despite the availability of organic carbon, CWs emit less CH_4 than freshwater wetlands. Tidal inundation of CWs with seawater leads to anaerobic conditions (favouring methanogenesis) while simultaneously increasing salinities and the presence of sulphate resulting in sulphate-reducing bacteria out-competing methanogens (Poffenbarger et al. 2011).

Ireland has approximately 100km^2 of saltmarsh cover but there is currently no data regarding GHG emissions from saltmarshes in Ireland. Methane emissions from CWs in Ireland are hypothesized to be low because of complete tidal inundation, creating high salinity environments. The main objective of this study was to quantify the magnitude and variability of methane emissions across Irish saltmarshes in different geomorphic settings and vegetation types. Samples were taken from across Ireland from different substrate types and vegetation zones, using static gas chambers. Gas samples were analysed on a Picarro-G2201-*i* Isotopic-Analyser.

Initial results from this analysis show that CH_4 emissions from Irish saltmarshes varied between vegetative zones from -0.86 to 2.68 g CH_4 m^{-2} yr^{-1}. These emissions are on average 5-times lower than emissions found in other studies, primarily in the US (e.g Poffenbarger et al. 2011), showing that they are a minimal source of CH_4. At present, Ireland does not include coastal wetlands in its national GHG inventory, but inclusion could prove beneficial given the low emissions and potential for carbon sequestration.

Poffenbarger, H.J., et al. (2011).Salinity influence on methane emissions from tidal marshes. *Wetlands*, *31*(5),pp.831-842.

Saunois, M., et al. (2020).The global methane budget 2000–2017. *Earth system science data*, *12*(3),pp.1561-1623.

Below ground growth of forests on peatlands with a high pH subsoil or marl layer

S6 - Wetland & Peatland Management - Oral

Ms. Jill Pitcher Farrell [1], ***Mr. Nicholas Wragg*** [2], ***Ms. Blair Ruffing*** [1], ***Ms. Saoirse Tracy*** [2], ***Mr. Charles Harper*** [2], ***Mr. Thomas Cummins*** [2], ***Mr. Maarten Nieuwenhuis*** [2], ***Mr. Ken Byrne*** [1]

1. *University of Limerick (UL),* ***2.*** *University College Dublin*

High pH material and marl - a calcareous deposit can occur as a discontinuous layer or subsoil in peatlands in Ireland. Current forest policy prevents the establishment of forests on such sites, one reason for this are rooting difficulties in calcareous layers. An investigation was conducted into the performance of already established forest stands on such soils. This study included 19 forest stands and 6 tree species.

Split-tube undisturbed root cores of 40 cm length and 7 cm diameter were collected to include the boundary between the calcareous layer and the peat. Cores were subjected to three methodologies; the core break method, X-ray Computed Tomography (CT) scanning, root washing and WinRHIZO^{TM} 2D scanning and software.

X-Ray CT captures 3D images, these were analysed, and roots are visible in the calcareous and marl layers. The core break method, root washing and WinRHIZO^{TM} 2D scanning and software were also used to identify and quantify roots in each soil layer.

Soil samples were collected at each site, pH, acid-neutralising capacity (ANC), organic matter, and soil water content were analysed along with testing for carbonates indicated by effervescence on applying dilute HCl. The soil properties of the peat layers and the calcareous layers were also compared.

This is one of the first studies which applies X-ray CT to *in-situ* observations of tree roots in forests on peatland soils. X-ray CT analysis has the potential to increase our understanding of forests in Ireland, in particular root architecture and growth. Combination analysis of the various methodologies and comparison of root images and soil properties allows for a deeper understanding than the interpretation of one set of results in isolation.

Assessing Mercury-Added Product Stocks in the Built Environment

S9 - Environmental Challenges - Oral

Dr. Yvonne Ryan [1], ***Prof. Colin Fitzpatrick*** [1]

1. *University of Limerick (UL)*

Background: Mercury and its compounds are priority toxic substances. Ireland reports mercury emissions to atmosphere as a party to the UN Convention on Long Range Transboundary Air Pollution using conversion factors based on economic activity (Environmental Protection Agency, 2021a). The conversion factors are no longer relevant to current waste management practices. The Minamata Convention and preceding EU Directives on Eco-Design have reduced the mercury content of products. However, an environmental threat remains in the case of historic equipment and exempted product categories.

Aim: This paper scopes and ranks key categories of mercury-added products (MAPs) in the Irish built environment.

Methodology: Put on market, waste collected, waste characterisation and data on MAPs in scrap metal collection were analysed. The rate of mercury lost per annum based on these data was calculated. The UN Mercury Inventory Toolkit was employed to identify additional MAPs and grey data were reviewed to scope and priority rank MAPs in the Irish built environment.

Findings: Upwards of 18kg of mercury was lost to the environment due to leakage of waste electronics and mercury containing lamps from home maintenance and renovation to general and scrap metal waste streams. The quantity of MAP lighting in building stock is greatly underestimated. Professional lighting installation as part of governmental energy efficiency retrofits caused a stock increase that may not fully be reflected in the put-on-market data available to policy makers.

Conclusions & Implications: Contamination of materials prior to treatment needs consideration to realise elements of the circular economy. Exempted MAP stocks in the built environment are currently unknown. Empirical studies are required to quantify these and target safe handling.

Spatio-temporal evolution, environmental and socio-demographic patterns of COVID-19 in Ireland

S9 - Environmental Challenges - Oral

Dr. Martin Boudou [1], ***Dr. Coilín ÓhAiseadha*** [2], ***Dr. Jean O'Dwyer*** [3], ***Dr. Paul Hynds*** [4]

1. *Technological University Dublin,* ***2.*** *Health Surveillance Protection Centre,* ***3.*** *University College Cork,* ***4.*** *Environmental Health and Sustainability Institute, TU Dublin*

Since February 2020, the Republic of Ireland, alongside the rest of the world, has been severely affected by the spread of COVID-19. Factors leading from a symptomatic case to a severe outcome have been identified, however, to date the geographic evolution of the disease remain unclear. Understanding the spatio-temporal mechanics of transmission is crucial to limiting propagation of future respiratory disease outbreaks in Ireland. The current study sought to track the spatio-temporal evolution of symptomatic COVID-19 cases across the Republic of Ireland using a space-time scanning technique and development of a space-time recurrence cluster index.

Symptomatic cases of infection reported amongst the population aged <65 years were employed from 01/03/2020 to 27/11/2020 (n= 40,643) and geo-linked at the Electoral Division (ED) level (n=3,409). Space-time scanning analyses were conducted (SaTScan) to identify emerging temporal (time-specific) clusters across EDs. Analyses were performed using three-day time-steps across the entire study period (68 space-time scans). Subsequently, identified clusters were mapped and overlayed to build a "space-time cluster recurrence index".

Iterative space-time recurrence cluster index mapping permits the first, detailed animated picture of the spatio-temporal evolution of COVID-19 across the Republic of Ireland. Findings highlight the significance of urban environments including Dublin and Cork cities, particularly during early pandemic phases. Distinct spatio-temporal patterns are observed across varying environments and settlement types. For example, a more rapid response was noted in Northern and Northwestern regions during the "second wave" (September to November 2020). Results suggest the significance of specific regional socio-economic and demographic attributes (i.e., socio-behavioural environments *vis*. population density, proximity to cities or the Northern-Ireland border, number of people per room). The cluster index represents a powerful transferable tool for health authorities to undertake real-time monitoring of ongoing human health events and apply geographically adapted interventions to limit the spread of future epidemics.

Time for a Nappy Change: controls affecting families' nappy choices

S9 - Environmental Challenges - Oral

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

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

Lifecycle assessments suggest that modern cloth nappies have fewer environmental impacts than their disposable counterparts in terms of GHG, plastic and landfill (UNEP 2021). However, despite these apparent environmental benefits consumers still use predominantly disposable nappies. This paper will use theories of planned behaviour to explore the differences in perceived and actual behaviours between disposable and cloth nappy users. A self-selecting web-based survey was used to recruit participants with children up to the age of five and explore their decision-making in this regard. The findings of the survey reveal that disposable nappy users are more likely to prioritise convenience and to cite additional laundry loads as the main reasons for not using cloth nappies. This is despite tending to have the necessary infrastructure (such as disposable income, space and washing facilities) to enable them to do so. This indicates that the perceptions of home-laundered cloth nappies as inconvenient makes families more likely to opt for disposable nappies. Whilst cloth nappies were generally assumed to be more environmentally friendly and aesthetically pleasing by all parents irrespective of their choices, this was not enough to overcome the convenience and ease of use for the majority of participants. This study concludes that many disposable nappy users select disposable nappies with the assumption that they are easier and more convenient when this may not be the case. The implication of this study is that interventions which improve the convenience of cloth nappies and the perception of ease of use will encourage greater uptake of cloth nappies.

References.

UNEP. (2021) Recommendations from Life Cycle Assessments Single-use nappies and their alternatives hosted by. United Nations Environment Programme.

Greenspace and COVID-19 in Ireland: A modelling study

S9 - Environmental Challenges - Oral

Mr. Shivam Khandelwal [1], ***Dr. Martin Boudou*** [1], ***Dr. Coilín ÓhAiseadha*** [2], ***Dr. Jean O'Dwyer*** [3], ***Dr. Paul Hynds*** [4]

1. *Technological University Dublin,* ***2.*** *Health Surveillance Protection Centre,* ***3.*** *University College Cork,* ***4.*** *Environmental Health and Sustainability Institute, TU Dublin*

Relatively few epidemiological studies exist on the association between nature and health. Likewise, while multiple studies have focused on the clinical factors pre-empting a severe case of COVID-19 infection (e.g., underlying health conditions, age, etc), no Irish research has examined the effect of the natural environmental on COVID-19 incidence or severity (hospitalization, admission to ICU and mortality). Identifying areas at higher risk due to local environmental factors constitutes a knowledge gap for informing mitigation/intervention strategies prior to future similar public health events.

The current study focused on three major Irish cities: Dublin, Cork, and Galway. A Normalized Difference Vegetation Index (NDVI) dataset was constructed using the Google Earth Engine Explorer and Sentinel-2 MSI (Multispectral Instrument) open-access software (Level 1-C dataset). NDVI represents quantified vegetation (and is thus used as a proxy within urban areas for publicly accessible/observable parks, trees, vegetation, etc.), ranging from -1 (water body) to 1 (Dense vegetation). NDVI values were geographically linked to CSO Small Area (SA) units across all three main cities and associated with their respective COVID-19 incidence and severity rates from March to November 2020. A serial of statistical modelling techniques (glm) were subsequently employed to identify relationships between greenspace proportion and COVID-19. A restricted modelling approach was used to account for the confounding influence of specific socio-economic factors (i.e., gender, age groups, and deprivation level).

Findings indicate that the proportion of local greenspace is strongly associated with both COVID-19 incidence and severity - lower proportion of greenspace was negatively associated with the COVID crude incidence rate within all three cities (i.e., increased greenspace, decreased COVID-19 transmission). Conversely, SAs with a higher percentage of greenspace were associated with higher COVID-19 mortality rates in the more socioeconomically deprived areas of Dublin (OR: 2.637, AUC: 0.67) and Cork (OR: 9.21, AUC: 0.87), but not Galway.

FAECAL CARRIAGE OF ANTIMICROBIAL RESISTANT ENTEROBACTERALES ASSOCIATED WITH RECREATIONAL WATER USE

S12 - Water Pollution and Risks - Oral

Ms. Maeve Louise Farrell [1], ***Ms. Alexandra Chueiri*** [1], ***Dr. Louise O'Connor*** [1], ***Dr. Sinéad Duane*** [2], ***Dr. Liam Burke*** [3], ***Prof. Dearbháile Morris*** [3]

1. *1) Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland, Galway. 2) Centre for One Health, Ryan Institute, National University of Ireland, Galway.,* ***2.*** *1) Antimicrobial Resistance,* ***3.*** *1) Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland, Galway. - Galway (Ireland), 2) Centre for One Health, Ryan Institute, National University of Ireland, Galway. - Galway (Ireland).*

Background: There is a need to better understand the complex role of the environment in the dissemination and spread of antimicrobial resistance (AMR), with exposure to AMR in recreational waters representing potential health risks. The study aim was to investigate whether those who regularly partake in natural recreational water-based activity (water users, WU) are more likely to be colonised with AMR bacteria than those who do not use the water as frequently (non-water users, NWU) in Ireland.

Methods: Between September 2020 and October 2021, 411 faecal samples were collected from 199 WU and 212 NWU and cultured on chromogenic agars to screen for carbapenemase-producing Enterobacterales and ESBL-producing Enterobacterales (ESBL-PE). Enterobacterales were identified by MALDI-TOF and subject to antimicrobial susceptibility testing (AST) using 16 antibiotics representing 6 classes in accordance with EUCAST criteria.

Results: A total of 113 unique Enterobacterales were isolated from 92 individuals (38 WU, 54 NWU). Based on AST, 11 WU (6%) and 24 NWU (11%) harboured ESBL-PE. Furthermore, 7 (4%), 9 (5%), 6 (3%) and 6 (3%) WU harboured isolates resistant to fluoroquinolones, aminoglycosides, tetracycline, and trimethoprim, respectively. In contrast, 8 (4%), 14 (7%), 13 (6%) and 15 (7%) NWU harboured isolates resistant to the same antimicrobial classes. In terms of clinically important resistances (ESBL-PE, carbapenem and fluoroquinolone), 5 WU (3%) harboured both phenotypic ESBL-PE and fluoroquinolone resistant isolates, in comparison to 6 NWU (3%). Resistance to ertapenem was identified in 6 WU (3%) and 6 NWU (2.8%).

Conclusion: This study demonstrates the widespread occurrence of organisms with resistances of clinical importance across both groups. Further work is required to understand the consequences of exposure to recreational waters. A longitudinal study is ongoing, whereby individuals are followed over the course of a year to assess the persistence and occurrence of resistances of clinical importance.

Risk ranking of antibiotic resistance development in healthcare and agricultural settings

S12 - Water Pollution and Risks - Oral

Mr. Ciaran Monahan [1], ***Dr. Suvi Harris*** [2], ***Prof. Dearbháile Morris*** [3], ***Prof. Enda Cummins*** [4]

1. *University college dub,* ***2.*** *IMAXT Consortium, Cancer Research UK, Cambridge Institute,* ***3.*** *1) Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland, Galway. - Galway (Ireland), 2) Centre for One Health, Ryan Institute, National University of Ireland, Galway. - Galway (Ireland).,* ***4.*** *University College Dublin*

Antibiotics administered to human patients or livestock are incompletely absorbed in the gastrointestinal tract, and as such, residues of antibiotics can enter the environment. These antibiotic residues in surface waters can cause selective pressure on bacterial populations, leading to development of antibiotic resistance. Resistant bacteria present in surface waters can cause illnesses which may be difficult to treat in hospitals, increasing mortality and expending healthcare resources. Studies of surface water bodies in Ireland has identified antibiotic residue concentrations potentially high enough to exert selective pressure. This risk ranking study aims to assess the contributions of administration in healthcare and agriculture of six antibiotic classes, identifying key risk groups to prioritize in antibiotic stewardship and future research. Classes examined were penicillins, macrolides, tetracyclines, sulfonamides, fluoroquinolones, and trimethoprim. Two model frameworks were developed, modelling the potential release of antibiotic residues from human and livestock-administered antibiotics. Models simulate initial use and subsequent reduction or removal of released antibiotics *via* a series of stages, utilizing Irish usage data. For healthcare, steps include usage, dose sizes, excretion, degradation in wastewater, and removal during wastewater treatment. For livestock, stages include usage, excretion and degradation during manure storage. Release amounts are then used in combination with dilution factors to generate predicted environmental concentration values. Finally, advised safety limits for resistance development from the literature were used to generate risk quotient values for each antibiotic class in each industry. Final risk quotient values suggest human-administered macrolides and penicillins are of greatest concern, being classified as moderate risk groups. Low-risk groups for human-use were ranked in descending order as quinolones, tetracyclines, trimethoprim. Overall, human-use antibiotics were predicted to have greater risk than agricultural use. This study develops a novel risk ranking protocol directly comparing antibiotic pollution arising from healthcare and agriculture usage, and subsequent risk of antibiotic resistance development.

Source water protection and vulnerability in complex catchments

S12 - Water Pollution and Risks - Oral

Mr. Kevin Atcheson [1], ***Prof. Philip Jordan*** [1], ***Dr. Rachel Cassidy*** [2]

1. *Ulster University,* ***2.*** *Agri-Food and Biosciences Institute*

The provision of safe drinking water is challenged due to catchment land use, which can impact the quality of source waters. Consequently, increased burdens are placed upon utility companies to treat water for human consumption. Prevention led approaches to pollution reduction at catchment scale can help to reduce this burden.

This study considers protection and vulnerability of source waters in the River Derg, an Irish surface water dominated catchment (384km^2) abstracting water for approximately 30,000 people. Four workpackages were undertaken as part of the Source to Tap project (www.sourcetotap.eu). First, a hydrological investigation of pesticide pathways was undertaken with a focus on MCPA. Pathway MCPA loads were apportioned using two filtering approaches (Local Minimum Method and Load Recession Analysis). Over a seven-month application period, it was found that over 70% of the MCPA load was lost from land in quickflow pathways, and 12% in a deep base flow pathway. Both are considered in terms of impacts and mitigation. Second, catchment interventions to decrease organic soil transfer from land to water were assessed against in-stream turbidity and colour. Turbidity appeared to decrease compared to control catchment conditions, but not colour. Third, a pilot forest-to-bog restoration provided the first quantitative assessment of cell-bunding using water level fluctuations and water colour as parameters of concern. Compared to controls and other treatments, cell bunding indicated the need for longer term establishment and monitoring following restoration. Finally, an assessment of forestry practices and its impact upon raw water quality was conducted following clear-felling. The effectiveness of plot scale sediment attenuation measures following was investigated, and indicated greater protection with increased in-stream and off-line measures.

METAL BIOACCUMULATION THROUGH WATER AND FEEDS IN NIGERIAN FISH

S12 - Water Pollution and Risks - Oral

Mrs. CHINELO ANULIKA NZEKWE [1], ***Dr. DEBBIE CHAPMAN*** [2], ***Dr. Timothy Sullivan*** [2]

1. *U,* ***2.*** *University College Cork*

METAL BIOACCUMULATION THROUGH WATER AND FEEDS IN NIGERIAN FISH

CHINELO ANULIKA NZEKWE[1] DEBORAH V CHAPMAN & TIMOTHY SULLIVAN [1,2]

AFFILIATIONS: School, of Biological, Earth and Environmental Sciences, University College Cork Ireland [1], Environmental Research Institute, UCC[2]

Human exposure to metals is of global concern because it ultimately results in toxicity and diseases in humans and animals through the environment and consumption of contaminated food. It is an immediate issue for Nigeria as a developing nation with a population of about 200 million people in a world facing a global food crisis. This study aims to evaluate metal concentrations that the populace in Eastern regions of Nigeria may be exposed to through consumption of dried aquatic foods available in its major markets, fresh and dried catfish, shrimps, prawns and periwinkles. Enugu metropolis is chosen as the study area as it was the former capital of the Eastern region of Nigeria. The study design of this work is being carried out in the Enugu urban area by testing samples available in the major markets and fish farms within the metropolis. Obtained samples were wet digested and metal concentrations assessed using the inductively couple plasma optical emission spectroscopy (ICP). Questionnaires were distributed to selected areas to determine the quantity and frequency of consumption these seafoods.

This study aims to determine metal bioaccumulation in various types of aquatic products, during product processing, water profile, feed contamination and if there is a relationship between the distribution, consumption of aquatics food and the rising health issues in Enugu, Nigeria.

REFERNECES

Asdeo A, Looker S, (2011). A comparative analysis of trace metals in vegetables. Research Journal of Environmental Toxicology 5(2): 125-132.

Hu, H., 2002. Human health and heavy metals exposure. In: McCally, M. (Ed.), Life

Support: the Environment and Human Health. MIT Press, Cambridge, pp. 65–82

Detection of mobile colistin resistance genes in the Irish environment.

S12 - Water Pollution and Risks - Oral

Ms. Niamh Cahill [1], ***Ms. Brigid Hooban*** [1], ***Dr. Louise O'Connor*** [1], ***Dr. Georgios Miliotis*** [1], ***Dr. Deirdre Prendergast*** [2], ***Dr. Montserrat Gutierrez*** [2], ***Prof. Finola Leonard*** [3], ***Dr. Kaye Burgess*** [4], ***Prof. Martin Cormican*** [5], ***Prof. Dearbháile Morris*** [1]

1. *1) Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland, Galway. 2) Centre for One Health, Ryan Institute, National University of Ireland, Galway.,* ***2.*** *Department of Agriculture, Food and the Marine, Celbridge, Co. Kildare, Ireland,* ***3.*** *School of Veterinary Medicine, University College Dublin, Belfield, Dublin 4, Ireland,* ***4.*** *Teagasc Food Research Centre, Dublin, Ireland,* ***5.*** *1) Antimicrobial Resistance and Microbial Ecology Group, School of Medicine, National University of Ireland, Galway. 2) Centre for One Health, Ryan Institute, National University of Ireland, Galway. 3) Health Service Executive, Galway, Ireland.*

Antimicrobial resistance (AMR) is a major public health threat. Resistance to last line antibiotics is emerging and treatment options are becoming limited. Mobile colistin resistance (*mcr*) genes pose a significant threat to the treatment of multi-drug resistant (MDR) infections. We report the first detection of *mcr-8* and *mcr-9* in the Irish environment.

Samples from water bodies, wastewaters and integrated constructed wetlands (ICW) collected between November 2018 and October 2020 were assessed for AMR. Wastewater samples were cultured directly on selective agars including Brilliance ESBL, Brilliance CRE and mSuperCARBA to screen for ESBL and carbapenemase-producing Enterobacterales, respectively. Water and ICW samples were filtered and enriched in buffered peptone water prior to culture. Enterobacterales were identified via MALDI-TOF and subsequently underwent whole genome sequencing and analysis. All *mcr*-positive isolates were tested for susceptibility to colistin by broth microdilution and to 15 other antimicrobials via disc diffusion (EUCAST and CLSI criteria).

Eight *mcr*-positive Enterobacterales were isolated from 2 freshwater (n=2), 3 wastewater (n=5) and 1 ICW influent (n=1) samples. One isolate harboured *mcr-8* (*K.pneumoniae*, ST111), while the remaining 7 (1 *K.michiganensis* (ST260), 1 *R.ornithinolytica* (Novel ST), 2 *E.coli* (ST635, ST10), 1 *E.ludwigii* (Novel ST) and 2 *E.hormaechei* (ST278, ST133) harboured *mcr-9* genes. All isolates were MDR. While the *mcr-8* positive *K.pneumoniae* demonstrated resistance to colistin, all *mcr-9* harboring Enterobacterales remained susceptible. Genotypic analysis revealed that these isolates harboured between 10 and 63 antimicrobial resistance genes including genes associated with resistance to other last line antimicrobials e.g. carbapenemases (OXA-48, NDM-1). All *mcr* genes were located on plasmids.

These results highlight potential sources and reservoirs of *mcr* genes in the environment in Ireland. It is evident that there is a need for monitoring the environment for AMR, including *mcr*, to gain a better understanding of its role in the persistence and dissemination of these genes.

Water-energy nexus: research trends

S13 - Water-Energy Nexus - Oral

Dr. Nathan Skillen [1]

1. *Queens University Belfast*

Short Bio

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

Adsorption of urea from human urine and subsequent hydrogen production

S13 - Water-Energy Nexus - Oral

Mr. Ruben Asiain-Mira [1], ***Dr. Patricia Zamora*** [2], ***Dr. Victor Monsalvo*** [2], ***Dr. Laura Torrente-Murciano*** [3]

1. *Aqualia / University of Cambridge,* ***2.*** *Aqualia,* ***3.*** *University of Cambridge*

This work demonstrates the feasibility of a new process to enable the valorisation of human urine as an energy source.

Removal of nitrogen plays a key role in wastewater treatment, as its uncontrolled discharge would lead to eutrophication of the water bodies. Currently, nitrogen is removed at wastewater treatment plants using energy-intensive biological processes that represent around 50% of the total energy consumption (Palatsi et al., 2021). However, 80% of the nitrogen in urban wastewater comes from human urine, where nitrogen is found in the form of urea (Maurer et al., 2003). Furthermore, urea is a hydrogen-rich compound and hence a potential source of energy. Therefore, separative toilets can collect urine and extract the urea and transform it into a source of green energy.

The process designed herein is based on the use of adsorption for the extraction of urea from urine and its later recovery as hydrogen. Comparative study between the adsorption of urea from synthetic and real urine were carried out using activated carbon as adsorbent. Thermal urea desorption and decomposition into ammonia and carbon dioxide at 250°C leads to full regeneration of the carbon, showing constant adsorption capacity for 5 consecutive adsorption/desorption cycles. Finally, we coupled the desorption with an ammonia decomposition catalyst to produce hydrogen. Energy balances show that this system in a city of 160,000 inhabitants would lead to a hydrogen production of 430 kg/day, with a net electrical production of 2,500 kWh/day.

References:

Maurer, M., Schwegler, P., Larsen, T.A., 2003. Nutrients in urine: energetic aspects of removal and recovery. Water Science and Technology 48, 37–46.

Palatsi, J., Ripoll, F., Benzal, A., Pijuan, M., Romero-Güiza, M.S., 2021. Enhancement of biological nutrient removal process with advanced process control tools in full-scale wastewater treatment plant. Water Research 200, 117212.

WO3 photoanodes for the oxidation of urea in wastewater and hydrogen production

S13 - Water-Energy Nexus - Oral

Ms. Adriana Rioja Cabanillas [1], ***Dr. Pilar Fernandez*** [1], ***Mr. Rene Hauser*** [2], ***Prof. Tony Byrne*** [3]

1. *Ulster University,* ***2.*** *Delft IMP,* ***3.*** *University of Ulster*

Nutrient pollution due to intense human activities, affects the quality of the soil, air and water and have a detrimental impact on the ecosystems. Nutrient pollution in water bodies occurs due to excess of nitrogen compounds. Nitrogen excess is typically removed in wastewater treatment plants by several biological treatment steps. However, spatial and economical constrains prevent the full implementation of these processes for the required discharge limits in some plants. Moreover, wastewater has a great potential for energy recovery, which is not exploited at present. Consequently, there is a need to develop technologies that could improve the management of the nutrient cycle in a more cost efficient, sustainable and effective use of resources. In this work, we study the use of WO_3 and P25 materials for the photoelectrochemical degradation of urea coupled to the production of H_2.

The TiO_2 photoanode was formed by a mesoporous film of TiO_2 (Evonik Aeroxide P25) deposited onto doped tin oxide coated glass (FTO). The WO_3 photoanode was synthesized by a hydrothermal method where the nanoplates are grown directly in the FTO glass Yang et al. (2012) . A photoanode exposed area of 20 cm^2 was used together with platinized Ti mesh as a cathode, in a custom-made photoelectrochemical cell. The photoelectrochemical results showed that WO_3 photoanode has an improved photocurrent as well as a considerable higher urea removal when compared to P25. Urea degradation products were identified and the production of H_2 detected. This research shows the potential of using WO_3 photoanodes for the removal of nitrogen pollutants and energy recovery from wastewater as valuable alternative to conventional water treatment processes.

References:

Yang, Jiao et al. 2012. “Hydrothermal Synthesis and Photoelectrochemical Properties of Vertically Aligned Tungsten Trioxide (Hydrate) Plate-like Arrays Fabricated Directly on FTO Substrates.” *Journal of Materials Chemistry* 22(34): 17744–52.

Novel electro-assisted UVA-photocatalytic reactor based on rGO-TiO2 composite photoanode for wastewater treatment

S13 - Water-Energy Nexus - Oral

Mr. Salem Alkharabsheh [1], ***Dr. Patricia Zamora*** [2], ***Dr. Victor Monsalvo*** [2], ***Dr. Pilar Fernandez*** [3], ***Prof. Tony Byrne*** [3]

1. *Nanotechnology and Integrated BioEngineering Centre, Ulster University, Jordanstown Campus, Shore Road, Newtownabbey, Belfast, BT37 0QB, United Kingdom,* ***2.*** *FCC Aqualia, Avenida Camino de Santiago 40, Building 3, 4th floor, 25080 Madrid, Spain,* ***3.*** *Nanotechnology and Integrated BioEngineering Centre, Ulster University, Jordanstown Campus, Shore Road, Newtownabbey, Belfast, BT37 0QB, United Kingdom.*

Recently, Photoelectrocatalysis (PEC) was investigated as a novel technology for the degradation of organic pollutants in treated wastewater effluent (TWWE). Up to date, several PEC reactors designed based on TiO_2 photoanode for wastewater treatment (Meng et al. 2015). Particulate TiO_2 is commonly used as a photoanode, but it presents a low photocatalytic efficacy. The incorporation of reduced graphene oxide (rGO) with TiO_2 has been reported as a method to enhance the photocatalytic efficiency of TiO_2 due to the improvement in charge separation. This study aims to optimize the operational conditions of a novel scalable PEC reactor based on a 0.5 L sandwich configuration, which utilizes TiO_2 and rGO-TiO_2/ITO photoanodes under back-face irradiation and platinized titanium as a cathode. For this purpose, two parameters including the UVA-LED irradiance and rGO:TiO_2 weight ratio explored for the degradation of diclofenac as a model pollutant in 10 mM Na_2SO_4 as an electrolyte with 2 mS/cm conductivity similar to TWWE. (Rodríguez Chueca et al. 2015) The influence of two rGO:TiO_2 weight ratios, 1 and 5, were prepared by photocatalytic reduction; and two UVA irradiance values, 16.4 and 51.7 mW/cm^2, were investigated. The addition of 1 wt. % of rGO- TiO_2 raised the reaction rate constant compared to pristine TiO_2 (from 0.0171 to 0.0214 min^{-1}) under 16.4 mW/cm^2. Comparatively, the k for the 5 wt. % of rGO-TiO_2 (0.0208 min^{-1}) was lower than 1wt. % of rGO- TiO_2 due to the light screening effect produced at higher graphene concentrations. (Wang, Li, Chen, & Tao, 2012). In addition, increasing the irradiance 3 times (from 16.4 to 51.7 mW/cm^2) resulted in increase in K for 1 wt. % of rGO-TiO_2 (from 0.0214 to 0.0226min^{-1}), but higher energy consumption. Therefore, 1 wt.% rGO loading under 16.4 mW/cm^2 irradiance selected as the optimum condition for the PEC reactor.

Removal of emerging contaminants by UVC and UVB-LEDs driven AOPs

S13 - Water-Energy Nexus - Oral

Ms. Raffaella Pizzichetti [1], ***Dr. Cristina Pablos*** [1], ***Dr. Ken Reynolds*** [2], ***Mr. Simon Stanley*** [2], ***Dr. Eric Moore*** [3], ***Prof. Prof. Javier Marugan Aguado*** [1]

1. *Department of Chemical and Environmental Technology, ESCET, Universidad Rey Juan Carlos, C/Tulipán s/n, 28933 Móstoles, Madrid, Spain,* ***2.*** *ProPhotonix IRL LTD, 3020 Euro Business Park, Little Island, Cork, T45 X211, Ireland,* ***3.*** *Sensing and Separation Group, School of Chemistry, University College Cork, Cork, Ireland*

A big challenge of water contamination is the presence of emerging contaminants (ECs) in treated water which poses a risk to the safety of the environment and the health of human beings (Villanueva et al. 2014). UV-based light coupled with advanced oxidation processes (AOPs) is considered one of the most effective emerging technologies for environmental remediation methods (Rodriguez-Narvaez et al. 2017). This work focuses on the energy-efficient removal of emerging contaminants through high irradiation of UVC (265nm and 275nm) and UVB (285nm-310nm) light-emitting diodes (LEDs). Four contaminants, diclofenac (DCF) and ibuprofen (IBU) as common pharmaceuticals, and bisphenol A (BPA) and dibutyl phthalate (DBP) as plastic additives, were selected as a case study for the optimisation of the UV-LED systems. Their detection and quantification were conducted through high-performance liquid chromatography (HPLC) with a reverse C18 column with an optimised mobile phase of acetonitrile and 25 mM phosphate acetate buffer (pH 3) in a ratio of 80:20 v/v. Experiments were carried out on a bench-scale recirculation photoreactor where the LEDs irradiated a quartz tube of 20 mm inner diameter. The results showed that the efficacy of UV-LED systems for decontamination alone was slow, implying large energy costs for efficient removal. However, a removal dependency on the wavelength was found to depend on the absorption spectrum of the compound, where the ECs degradation can be described by a pseudo-first-order degradation rate constant (k_{obs}) as a function of time or UV fluence. The combination of UV-LED/H_2O_2 and UV-LED/Chlorine was studied and compared in terms of electrical energy consumption and environmental impacts.

Rodriguez-Narvaez, Oscar M. et al., 2017. Treatment Technologies for Emerging Contaminants in Water: A Review. Chemical Engineering Journal 323: 361–80.

Villanueva, Cristina M. et al., 2014. Assessing Exposure and Health Consequences of Chemicals in Drinking Water. Environmental Health Perspectives 122(3): 213–21.

Pesticides and bees; hazard, exposure and potential solutions

S15 - Sustainable Land Use, Agriculture and Food - Oral

Dr. Dara Stanley [1], ***Ms. Alison O'Reilly*** [1], ***Ms. Linzi Thompson*** [1], ***Mr. Arrian Karbassioon*** [1], ***Dr. Ed Straw*** [1]

1. *University College Dublin*

Pesticides are widely used in modern agriculture to produce food on large scales and at low cost. Concerns exist around impacts pesticides could have on biodiversity and associated ecosystem services, with a particular focus on bees in recent research and policy action. Here we discuss recent research investigating the hazards that pesticides used in an Irish context may pose to bees at field-realistic levels. We find that insecticides, but also fungicides and herbicides, may have implications for bee ecology and behaviour, and make recommendations for further research and incorporation into full risk assessment. We also investigate the range of mitigation measures available to reduce impacts of pesticides on bees, finding many commonly implemented measures lack full empirical support. For example, choosing times of day when pollinators are less active is recommended for application of many pesticides but is not widely supported in the literature. In addition, deciding when this is and whether it will reduce risk is complex and differs for different pollinator groups. Results are discussed in the context of both pesticide use and pollinator conservation, with the aim of integrating pollination service provision with crop protection.

Developing a dairy energy rating for identifying innefficient energy users throughout Ireland's dairy farm population

S15 - Sustainable Land Use, Agriculture and Food - Oral

Dr. Philip Shine [1], ***Dr. John Upton*** [2], ***Dr. Eleanor Murphy*** [3], ***Dr. Michael D. Murphy*** [1]

1. *Department of Process, Energy and Transport Engineering, Munster Technological University, Cork, Ireland,* ***2.*** *Animal and Grassland Research and Innovation Centre, Teagasc Moorepark Fermoy, Co. Cork, Ireland,* ***3.*** *Bord Bia, 140 Pembroke Road, Ballsbridge, Dublin 4, Ireland*

Background: The Irish government have outlined plans to reduce agricultural energy use by 20%, while sourcing at least 20% of said energy from renewable technologies by 2030. The National Artificial Intelligent Dairy Energy Application (NAIDEA) was developed to help achieve these targets.

Aim: The main objective was to integrate macro-level survey information collected through Bord Bia's Sustainable Dairy Assurance Scheme with artificial neural network (ANN) models to allow dairy stakeholders identify dairy farms consuming energy inefficiently in a compact and efficient standalone application.

Methodology: ANN models were trained and evaluated to simulate total, milk cooling, milk harvesting and water heating electricity use using monitored consumption data, milk production, stock data and infrastructural data collected between 2014 and 2021 on 70+ pasture-based dairy farms. The methodology also employed hyperparameter tuning and variable selection techniques to identify the network parameters and farm parameters that maximised prediction accuracy without overfitting. In addition, NAIDEA calculates a five-point Dairy Energy Rating (A to E) for each farm, allowing farms that are using energy efficiently or inefficiently to be identified.

Findings: NAIDEA provides government bodies with macro-level dairy energy statistics and a targeted approach to reducing energy related carbon emissions through: 1) efficiently and cost effectively quantifying the energy related emissions of milk production over time in line with changes to government policy, and 2) identifying dairy farms which are consuming energy inefficiently. Government bodies may then direct those inefficient dairy farms towards the existing suite of decision support tools such as the Agricultural Energy Optimisation Platform.

Conclusions & Implications: The existing suite of decision support tools in the dairy energy domain rely on the initiative of farmers to investigate and upgrade their energy infrastructure. NAIDEA has removed this barrier, effectively bridging the gap between Ireland's population of dairy farms and access to decision support.

The abundance and characteristics of microplastics in Irish agricultural soils

S15 - Sustainable Land Use, Agriculture and Food - Oral

Ms. Clodagh King [1], ***Dr. Siobhán Jordan*** [1], ***Dr. Caroline Gilleran Stephens*** [1], ***Dr. Joseph P. Lynch*** [1]

1. *Centre for Freshwater and Environmental Studies, Dundalk Institute of Technology, A91K584 Dundalk, Co. Louth, Ireland*

Microplastics are emerging persistent pollutants (Kumar et al., 2020) that exist and accumulate in all environmental media (Cverentárová et al., 2021) but have only been extensively studied in aquatic systems (Zhu et al., 2019). Microplastics represent potential threats to soil biodiversity and function (de Souza Machado et al., 2018) and may be entering the human food chain (Lehel and Murphy, 2021). The main aim of this study was to investigate the abundance and characteristics of microplastics in Irish agricultural soils. Soil samples (0-20 cm depth) were collected and analysed for microplastics from 24 sites, which included 18 tillage and six grassland soils, in Ireland, using density separation methods (Corradini et al., 2019) and Raman spectroscopy. Microplastics were found in soils at all sites with the average abundance 1135 ± 375 items kg^{-1}. Applications of biosolids and plastic mulches coincided with higher microplastic concentrations in tillage soils (1693 ± 710 items kg^{-1}), compared to soils without these amendments (604 ± 219 items kg^{-1}). Black and clear microplastics were mostly identified, with fibres representing over 90% of all recovered microplastics. Eight polymer-types were identified, with polyethylene (PE) and polyamide (PA) found more than other polymers. Most microplastics extracted were >1 mm in size, however, over 30% of microplastics across all soils were smaller than 1 mm. Potential sources may include farm plastics such as silage bale wrap, plastic mulch films, twine, netting and other textiles from synthetic clothing released during washing and retained in biosolids. Further research must be conducted to establish the adverse effects different classes microplastics have on soil structure and soil organisms. Environmental risk assessments are necessary to reduce transport of microplastics into the agri-soil environment.

Gathering sustainable IPM advice for leatherjackets in Irish agriculture

S15 - Sustainable Land Use, Agriculture and Food - Oral

Ms. Aisling Moffat [1], ***Dr. Michael Gaffney*** [2], ***Dr. Lorna Cole*** [3], ***Dr. Gail Jackson*** [4], ***Dr. Fiona Brennan*** [5], ***Dr. Louise McNamara*** [6]

1. *Teagasc Crop Research Centre, Oakpark, Carlow, Ireland, Teagasc Food Research Centre, Ashtown, Dublin, Ireland, Teagasc Johnstown Castle, Wexford, Ireland, Scottish Rural University College, Ayrshire, University of Edinburgh,* ***2.*** *Teagasc Food Research Centre, Ashtown, Dublin, Ireland,,* ***3.*** *Scottish Rural University College, Ayrshire,* ***4.*** *University of Edinburgh,* ***5.*** *Teagasc Johnstown Castle, Wexford, Ireland,* ***6.*** *Teagasc Crop Research Centre, Oakpark, Carlow, Ireland*

Background

Tipula larvae, or leatherjackets, are important agricultural pests as their feeding cause's significant damage in cereals and grassland (Blackshaw et al., 1999). The primary insecticide for control has been withdrawn from use within the EU due to the associated risks, to human health and the environment. Control options are extremely limited and need to be renewed from an integrated pest management (IPM) perspective.

Aim

The objective of this research is to create a modern IPM toolkit for this historic pest. Here we conducted the first national survey of Ireland, to determine the leatherjacket species of agronomic importance and the soil factors influencing larval occurrence.

Methodology

A national survey across Ireland was conducted to determine (i) the *Tipula* species of agronomic importance, and (ii) the soil factors that limit larval survival/occurrence. Larval feeding experiments were established, with six plant monocultures and a mixed-species sward, to identify optimum grassland sward compositions for highly infested fields. Soil microbiome analysis from fields across Scotland and Ireland was also carried out to investigate the microbial communities present in fields with high and low pest pressure.

Findings

More than 70% of larvae collected were identified as *Tipula paludosa*. pH, Mg and P had significant negative correlations with larval populations. The glasshouse trials showed significant yield losses within the white clover monoculture swards ($p<0.005$), while the diverse swards proved more tolerant.

Conclusions and Implications

This analysis will provide sustainable control strategies for leatherjacket larvae. Through better understanding the pest of interest, the role of soil properties and cultivar choice, we aim to provide farmers with an IPM toolkit for a pest with limited control options.

References

Blackshaw, R. and C. Coll (1999). "Economically important leatherjackets of grassland and cereals: biology, impact and control." Integrated Pest Management Reviews 4(2): 145-162.

Demand-driven energy and biochemical production from a two-stage anaerobic digestion reactor

S15 - Sustainable Land Use, Agriculture and Food - Poster with 5 min Presentation

Mr. Rajas Shinde [1], ***Prof. Jerry Murphy*** [1], ***Dr. Susanne Barth*** [2], ***Dr. David Wall*** [1]

1. *MaREI Centre, Environmental Research Institute, University College Cork, Ireland,* ***2.*** *Teagasc Crop Research Centre, Oakpark, Carlow, Ireland*

Renewable electricity sources such as wind turbines are intermittent. This poses a challenge in the future energy transition in accepting high shares of renewable electricity on the grid. At times such intermittent renewable electricity sources need to be backed up by natural gas or coal fired power plants. Therefore, dispatchable renewable energy sources are required to support increasing shares of intermittent renewable electricity. Biogas produced from anaerobic digestion (AD) is proposed as a solution that can be produced on-demand.

A two-stage AD system, comprising of a Leach Bed Reactor (LBR) and a high-rate methanogenic reactor such as the Upflow Anaerobic Sludge Blanket (UASB), allows for greater flexibility as compared to conventional single stage AD reactors. The LBR-UASB not only produces energy in the form of biogas but also allows the harvesting of intermediate products in the AD process, namely volatile fatty acids (VFAs). VFAs are precursors to several platform chemicals and present a valuable market commodity. The LBR-UASB can potentially be operated in a demand-driven manner to produce biogas at times of high electricity demand, and VFAs at other times to increase profitability. Moreover, the LBR-UASB is suitable for the digestion of more difficult to digest biomass such as grass from marginal grasslands.

In this study, experimental trials were conducted on the LBR-UASB reactor using grass silage feedstock to validate the feasibility of a demand-driven approach. Initial trials established the VFA production profile from the LBRs. Acetic acid and butyric acid were the predominant VFAs, while longer-chain VFAs such as caproic acid were obtained with longer operation times. The capacity for dispatchable (demand-driven) electricity generation was evaluated by gradually transitioning to intermittent and irregular feeding of the UASBs to produce biogas. Novel systems such as the LBR-UASB provide significant opportunities in AD-based biorefineries and can assist with Ireland's decarbonisation objectives.

Blended feedstock for improving downdraft gasification: A Circular Economy Example

S17- Net Zero Challenge - Oral

Dr. Oisín de Priall [1], ***Dr. Caterina Brandoni*** [1], ***Prof. Neil Hewitt*** [1], ***Mr. Chris Johnston*** [2], ***Dr. George Onofrei*** [3], ***Prof. Ye Huang*** [1]

1. *Ulster University,* ***2.*** *Agri-Food and Biosciences Institute,* ***3.*** *Atlantic Technological University, Galway*

Sustainable sources of energy are increasingly wanted to combat the current climate crisis and reach the goal of net zero carbon emissions by 2050 (BEIS, 2019). Increasing volumes of agricultural waste are also an issue across the island of Ireland, due to large volumes generated and concerns surrounding spreading this material for disposal. Using agriculture wastes as feedstock for downdraft gasification means energy can be extracted as a sustainable source of heat and electricity. Disposal fees and energy purchasing costs could be avoided along with promoting environmental protection through eutrophication avoidance. The novel aim of the present work was investigating blends of feedstocks to examine their influence on relevant parameters, with the overall goal of improving the gasification process. Blends of agricultural residues and wood pellets along with the bioenergy crop miscanthus for comparison were investigated in terms of their impact on energy, economy and the environment. Through a combination of experimental analysis and process simulations, a full investigation was carried out. Results from the small-scale experimental analysis were used to validate the models generated using ECLIPSE process simulation software. Primary outcomes from the feedstock blending research indicated a 12.9% improvement in producer gas lower heating value. This was due to the increased carbon content of the feedstock along with an increase in the methanation, water gas shift and Boudouard reactions. The efficiency of the combined heat and power unit increased by 2.5%, and 6.1% for electrical and thermal, respectively. The optimal blend was identified as 60/40 by weight, increasing energy content without detracting from the economics of the system.

References:

BEIS, 2019. UK becomes first major economy to pass net zero emissions law [WWW Document]. Gov.uk. URL https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law (accessed 5.25.20).

Key words: circular economy, waste management

Marginal abatement cost curves for biogas in Ireland: Assessing on-farm anaerobic digestion through the use of an enviro-economic calculation tool.

S17- Net Zero Challenge - Oral

Mr. Jorge Diaz Huerta [1], ***Dr. Richard O'Shea*** [2], ***Dr. David Wall*** [1], ***Prof. Jerry Murphy*** [1]

1. *MaREI Centre, Environmental Research Institute, University College Cork, Ireland,* ***2.*** *University College Cork*

Marginal Abatement Cost Curves (MACC) have been used as tools to assess the mitigation options available in different sectors of the economy to aid the selection of options to achieve the current emission reduction targets in Europe. In an Irish context, a MACC was developed in the *Climate Action Plan 2019* in which anaerobic digestion (AD) was assessed as a mitigation option within the agriculture sector. This option was seen as a high-cost abatement solution based on a price point of 50 €/tCO_2eq for the production of biomethane to produce renewable heat (280 €/tCO_2eq). This MACC represents a single scenario that does not encompass how variable an AD system can be based on its scale, design, technology, feedstock, and function. Furthermore, MACCs do not provide information about the methodology used or the system boundary selected for the analysis. To address this, a tool was developed to combine techno-economic assessments (TEAs) and life-cycle assessments (LCA) to compare and analyse different scenarios of on-farm AD systems in Ireland. By combining the net present values obtained from the TEA and abatement potential from the LCA a MACC can be generated to compare AD configurations. Different configurations may include the use of biogas to generate heat in a boiler, electricity, and heat in a CHP unit, and biomethane in an upgrading unit. Furthermore, the tool can potentially be used to highlight key barriers preventing the adoption of on-farm AD plants in Ireland. Once finished, the tool will incorporate sensitivity analysis highlighting the most influential variables affecting the performance of the system. Upon their identification, an uncertainty analysis through the use of Monte Carlo Simulation can be carried out to assess potential outcomes to construct a MACC that incorporates uncertainty.

Dark fermentation of Macroalgae biomass in production of biofuels

S17- Net Zero Challenge - Oral

Mr. James Lawrence [1], ***Prof. Piet Lens*** [2], ***Prof. Jerry Murphy*** [3]

1. *NUI,* ***2.*** *National University Galway,* ***3.*** *MaREI Centre, Environmental Research Institute, University College Cork, Ireland*

Availability of fossils fuels is a major problem that the transportation sector faces. Increased pollution, fossil fuel availability and other adverse effects are just some of the reasons that have prompted a need to find additional resources for fuel. One such fuel is known as biohythane which is CH4 and H2 blend. Co-production of a mixture CH4 and H2 in the form of biohythane in two stage anaerobic digestion (AD) process is gaining more interest than their individual production. Biohythane is considered a better transportation fuel than compressed natural gas due to its high range of flammability, reduced ignition temperature and lowered NOX emissions. Two-stage AD is advantageous over one-stage AD due to short hydraulic retention time (HRT), high energy recovery, high chemical oxygen demand (COD) removal, higher H2 and CH4 yields, and reduced carbon dioxide (CO2) in biogas. This study will look to improve the production of biohythane by focusing on different aspects of the AD process such as microbial diversity and the operational process parameters.
Testing was carried out in batch form focusing on three different types of macroalgae biomass. Initial work focused on the examination of the species Ulva due to it containing the cell wall carbohydrate known as Ulvan. This polysaccharide possesses unique characteristics which makes its extraction favourable due to its broad potential for utilisation within the medical industry. Work focused on examining the performance of Ulvan extracted biomass versus lyophilised biomass in production of hydrogen via dark fermentation at numerous temperatures.

This work highlighted that in fact the extracted biomass performed better in terms of biofuel production indicating its potential to be further examined and brought forward to a reactor system.

Dedicated large-scale floating offshore wind to hydrogen

S17- Net Zero Challenge - Oral

Mr. Omar Ibrahim [1], ***Dr. Alessandro Singlitico*** [2], ***Dr. Shane McDonagh*** [3], ***Dr. Roberts Proskovics*** [4], ***Dr. Cian Desmond*** [5], ***Prof. Jerry Murphy*** [1]

1. *MaREI Centre, Environmental Research Institute, University College Cork, Ireland,* ***2.*** *Technical University of Denmark,* ***3.*** *Gavin & Doherty Geosolutions Ltd.,* ***4.*** *ORE Catapult,* ***5.*** *Gavin & Doherty Geosolutions Ltd*

To achieve the Net-Zero emissions goal by 2050, a major upscale of green hydrogen needs to be achieved in the energy mix. Hydrogen as a clean energy carrier and as a precursor to hydrogen-based fuels (also known as electrofuels) will have a leading role. These electrofuels are expected to play a pivotal role in sectors where direct electrification is challenging especially in hard to abate sectors, such as steel, chemicals, fertilisers, long-haul transport, shipping, and aviation. The renewable source used in production must be both cost-effective and of a sufficient deployment capacity. Floating offshore wind (FOW) is believed to be the next wave in renewable energy with approximately 80% of the world's offshore wind resource potential in waters deeper than 60 metres, where bottom-fixed wind turbines are less feasible. The HyWind Scotland farm recorded a very high average capacity factor (CF) of 57% in 2020; such high CFs associated with FOW is a key synergy for coupling with hydrogen production.

In this work we consider dedicated large-scale floating offshore wind farms for hydrogen production with three coupling typologies; (i) centralised onshore electrolysis, (ii) decentralised offshore electrolysis, and (iii) centralised offshore electrolysis.

The decentralised offshore typology, employing a semi-submersible platform could accommodate a proton exchange membrane electrolyser on deck; this would negate the need for an additional separate structure or hydrogen export compression and enhance dynamic operational ability. It is flexible; if one electrolyser (or turbine) fails, hydrogen production can easily continue on the other turbines. It also facilities flexibility in further expansion as it is very much a modular system.

Alternatively, less complexity is associated with the centralised offshore typology, which may employ the electrolysis facility on a separate offshore platform and be associated with a farm of spar-buoy platforms in significant water depth locations.

BlueBio MINERVA: Sustainable valorisation of macroalgae using a biorefinery approach

S19 - Flash Presentations - Poster with 5 min Presentation

Dr. Fanny Lalegerie [1], ***Ms. Sofiia Tretiak*** [1], ***Dr. Stephen Jackson*** [2], ***Prof. Alan Dobson*** [2], ***Dr. Sarah Hotchkiss*** [3], ***Mrs. Rósa Jónsdóttir*** [4], ***Dr. Mattias Berglin*** [5], ***Dr. Zoë A. Popper*** [1], ***Prof. Dagmar B. Stengel*** [1]

1. *Botany and Plant Science, School of Natural Sciences, Ryan Institute for Environmental, Marine and Energy Research, National University of Ireland Galway, Galway, Ireland,* ***2.*** *School of Microbiology, University College Cork, Cork, Ireland,* ***3.*** *Cybercolloids, Carrigaline, Co. Cork, Ireland,* ***4.*** *Matís, Iceland and UNA Skincare, Iceland,* ***5.*** *RISE, Sweden*

Using a biorefinery approach and principles of waste reduction, the BlueBio Cofund project MINERVA ("*Marine Innovation using Novel Enzymes for waste Reduction and Valorisation of Algal Biomass*") aims to support sustainable exploitation of algal biomass across many sectors using new processes that generate novel high-value products with multiple bioactivities. Targeted applications include ingredients for food, feed and cosmetic industries, aquaculture with unique natural antifouling agents, and medical biomaterials.Despite the significant and growing attention nationally and across Europe, marine macroalgae remain anunderutilised resource within the European bioeconomy and algal valorisation is still in its infancy. Based on the harvest of wild biomass and cultivation of only a limited number of species, the European seaweed industry is mainly focused on low-value end-products, being largely wasteful and not optimally developed.

With partners from Ireland, Iceland, and Sweden, MINERVA contributes to European macroalgal research within the framework of a Circular Blue Bioeconomy. The project focuses on the sustainable exploitation of local and native brown macroalgae based on their abundance and historical harvesting, and investigates the potential of new local niche species. Specifically, MINERVA develops new, environmentally friendly processesimproving the purification of algal bioactive compounds, and uses omics-based approaches to generate new enzymes to treat biomass for targeted high-value applications. Preliminary results highlight the importance of environmental change on sustainable protocols, and demonstrate optimized extraction process for protein, polysaccharide and polyphenol contents with multiple uses. Bacterial isolates and clones from brown seaweeds display hydrolytic activities and algal cell-wall biodegradation potential; seaweed fibers are under evaluation for the food industry; and algal components are evaluated in anti-fouling formulation and integration into biomaterials.

Environmental variability and sustainable protocols for seaweed valorisation in BlueBio MINERVA

S19 - Flash Presentations - Poster with 5 min Presentation

Dr. Fanny Lalegerie [1], ***Prof. Dagmar B. Stengel*** [1]

1. *Botany and Plant Science, School of Natural Sciences, Ryan Institute for Environmental, Marine and Energy Research, National University of Ireland Galway, Galway, Ireland*

Sustainable biomass production and stable biomass composition are key to seaweed valorization for multiple potential applications. However, productivity and chemical composition of macroalgae are known to vary between and within species, and across di□erent spatial and temporal scales, with additional increasing concerns about future variations due to climate change. Thus, to achieve an optimal and sustainable valorisation of natural macroalgal biomass within the European blue bioeconomy, algal chemical variability must be considered and integrated into relevant biorefinery processes. As part of the BlueBio Cofund project MINERVA ('*Marine Innovation using Novel Enzymes for waste Reduction and Valorisation of Algal Biomass*'), specific research evaluates and optimizes the algal biomass to ensure a sustainable exploitation across several industrial sectors. Two key aspects are considered, *i.e.* the selection of biomass by focusing on local and native species; and the effect of environmental changes on algal physiology and the composition of key components for specific high-value applications. Methodological comparisons are carried out to identify, and then apply, most relevant protocols for the assessment of natural variability, in particular of high value compounds such as polyphenols. To achieve this, total phenolic content (TPC) is determined using different methods and standards representing commonly employed methods across industry and academia. This will allow cross-referencing with different methods published in the literature. To capture the impact of likely differences in methodologies applied to different species at different seasons, a systematic screening of >30 Irish macroalgal species has been undertaken. To evaluate likely effects of climate change on productivity and bioactivity in the commercial intertidal brown alga *Ascophylllum nodosum* (Phaeophyceae, Ochrophyta), responses to temperature were evaluated by Pulse-Amplitude Modulated (PAM) chlorophyll fluorescence, CO_2-absorption and O_2-evolution, and related to seasonal responses of associated antioxidant capacities.

Evaluating nutrient and sediment inputs from riverbank cattle access points.

S19 - Flash Presentations - Poster with 5 min Presentation

Ms. Alison Scott [1], ***Dr. Rachel Cassidy*** [2], ***Prof. Philip Jordan*** [3]

1. *School of Geography and Environmental Science, Ulster University and Agri-Food and Biosciences Institute, New Forge Lane, Belfast,* ***2.*** *Agri-Food and Biosciences Institute, New Forge Lane, Belfast,* ***3.*** *School of Geography and Environmental Science, Ulster University*

Critical source areas (CSAs) in agricultural catchments contribute to nutrient and sediment loadings, negatively impacting the chemical and biological health of surface waters. Diffuse CSAs are defined as areas with both a high runoff risk and high soil phosphorus (P) concentrations and point CSAs include areas where cattle have unrestricted access to rivers, leading to elevated inputs of nutrients and sediment through direct defecation and poached bank faces. Soil compaction at these sites has also been found to exacerbate surface runoff pathways. Exclusion measures such as riparian fencing are common features in current agri-environment schemes (AESs). However, there is a lack of empirical data regarding the impact of unrestricted cattle access to declining water quality through nutrient and sediment inputs.

This work aims to quantify bank change at unmitigated cattle access points and provide the evidence required to develop future AES. Seven active and four recovering cattle access points were identified within two intensive grassland catchments in NI. Annual erosion rates were estimated at riverbank scale using repeated terrestrial laser scanning surveys (TLS) at the beginning and end of the grazing season (May and November 2021) and after the high river flows of the following winter period (March 2022). Drone photogrammetry surveys were also used to estimate cumulative erosion volumes at each site. Adjacent deep soil coring provided the proportion of total P available for export and riverbank bulk density sampling provided an estimate of mass total P and sediment loss.

Research findings will be discussed within the context of AES with water quality objectives and riparian management in grazed grasslands.

Associations between environmental knowledge, socio-demographic profiles, and the Irish diet

S19 - Flash Presentations - Poster with 5 min Presentation

Mr. Daniel Burke [1], ***Dr. Paul Hynds*** [1], ***Dr. Anushree Priyadarshini*** [1]

1. *Environmental Health and Sustainability Institute, TU Dublin*

Climate change and food security represent two of humanity's greatest challenges, with dietary habits contributing to both. The type and volume of food consumed have varying levels of environmental impact, with high-meat diets typically associated with higher greenhouse gas (GHG) emissions than plant-based diets. Ireland's per capita GHG emissions are the highest in the EU, with 35% from the agri-food sector; changing dietary habits may be an effective approach to GHG mitigation, however, human behaviour needs to be understood.
The current study aimed to explore the associations between socio-demographics and environmental knowledge in Ireland by answering the following research question: *Is environmental knowledge associated with socio-demographic and dietary factors?*
A cross-sectional online questionnaire was developed and conducted across Ireland to collate respondents' demographics, health status, food consumption patterns, and environmental knowledge (agricultural water usage and livestock GHG emissions). Statistical analysis was subsequently undertaken.
Overall, 968 participants (556 female, 412 male) completed the questionnaire. Lower individual BMI was significantly associated ($p<0.05$) with increasingly accurate water knowledge, while correctly predicting personal BMI was significantly associated with water and GHG knowledge. The presence of children in the household also exhibited significant associations with environmental knowledge; GHG awareness was increasingly precise in households comprising children, while water knowledge was more accurate in households without children. Higher levels of educational attainment correlated with elevated levels of water knowledge but not GHG knowledge. Less frequent or no meat consumption had significant associations with environmental awareness; self-reported flexitarians, vegetarians, and vegans exhibited higher GHG knowledge. Surprisingly, there were no significant associations with gender, age, or urbanicity. Environmental awareness can be improved by focusing on household composition and health through consumer-oriented communication.

Sustainable Kitchens

S19 - Flash Presentations - Poster with 5 min Presentation

Mr. Cathal Pendred [1], ***Ms. Samantha Fahy*** [1]

1. *Dublin City University*

All kitchens use large quantities of energy, water and food in the course of generating meals, however poor practices also lead to significant waste generation in the over-consumption of energy and water and over 1 million tonnes of food waste each year according to the EPA[1] making Ireland one of the worst for food waste in the EU[2]. The Sustainable Kitchens project at DCU is investigating this energy - water - waste - food waste nexus in commercial kitchens. The baseline data of environmental impacts are quantified through an environmental audit of the key high impact activities: Energy, Procurement (food & misc.), Water, and Food Waste.

By assessing the impact of each intervention (typically physical and behavioural change actions and/or communication/ engagement activities), reductions in environmental impacts can be quantified and compared. To provide an overarching perspective and comparison of the impacts all quantified data is converted into a carbon equivalent value (CO2e) i.e. energy usage measured in kilowatt hrs can be converted to CO2e using the appropriate emissions factor as can food waste or water usage with CO2e as common currency. The effectiveness of interventions are determined and best practice 'sustainable operating procedures' guidelines compiled.

The Sustainable Kitchens project investigates what best practices should be implemented in the sector as the transition is made towards a carbon neutral society. With various willing stakeholders (including two commercial kitchens, two catering companies and two separate organisations), a comparative analysis will be used to determine environmental best practices that should lead this project to delivering recommendations on how this industry can adapt to do its part in reducing Ireland's GHG emissions.

Acknowledgement: Project supported by European Consortium for Innovative Universities (ECIU)

[1] https://www.epa.ie/our-services/monitoring–assessment/circular-economy/food-waste/

[2] https://council.ie/ireland-has-one-of-the-worst-records-for-food-waste-in-the-eu/

SURICATES: Sediment Management with application to the La Rance Estuary, France

S19 - Flash Presentations - Poster with 5 min Presentation

Ms. Iqra Rehman [1], ***Dr. Joe Harrington*** [1], ***Mr. Branislav Batel*** [1], ***Ms. Valérie Foussard*** [2]

1. *Munster technological University,* ***2.*** *EPTB Rance Fremur*

ABSTRACT: Sediments are an integral part of aquatic systems, the building block for natural habitats and an inherent component of many ecosystem services. The EU Interreg-funded SURICATES project aims to increase sediment reuse for erosion and flood protection by providing port and waterway managers with a new large-scale solution for sediment reuse in North West Europe with application to a number of pilot sites. The management of dredged sediment is a major challenge globally for ports and waterways and the overall aim is to ensure that material is used, treated, or disposed in an environmentally sound manner. Beneficial uses of sediment may be categorized as Engineering uses, Environmental enhancement, and/or Agricultural and Product uses.
A key pilot site for the SURICATES project is the La Rance Estuary, France site where one of the largest tidal power plants was commissioned in 1967. The installation of this infrastructure has led to significant siltation at the mouth of the estuary. The SURICATES Project will focus on the potential beneficial use of these sediments at the nearby La Hisse land site which extends over approximately eight hectares with seven storage lagoons in which sediments are treated (drained and dehydrated) before being sent to an appropriate sediment recycling channel. Dredging operations are currently planned at a number of siltation locations along the La Rance Estuary (as part of an experimental management plan to propose and implement sediment management experiments) with the opportunity for the SURICATES project to use this pilot site as an example of sediment beneficial use application in the context of increased circular economic activity. The activity will be supported by the local sediment manager EPTB, and the Brittany Region who are responsible for the sediment management activity at the La Rance and La Hisse sites.

In-situ electrochemical determination of 2,5-diformylfuran from the photocatalytic oxidation of 5-hydroxymethylfurfural.

S19 - Flash Presentations - Poster with 5 min Presentation

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

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

The photocatalytic conversion of biomass resources into value-added chemicals is a continuously developing research area, which can provide a solution to ongoing environmental and energy supply concerns. 5-Hydroxymethylfurfural (HMF) is an important biomass derived platform chemical, and its selective photocatalytic oxidation to high value chemicals such as 2,5-diformylfuran (DFF) is an ongoing challenge. Therefore, as the need for improved methods to convert HMF into value added chemicals increases, so too does the requirement for complementary rapid in-situ monitoring methods to ensure the efficiency of these processes. In this study, for the first time, a facile in-situ electroanalytical method for monitoring the production of DFF from the photocatalytic oxidation of HMF was demonstrated. This novel method was employed for rapid, selective and accurate monitoring of the production of DFF in a real time photocatalytic reaction. The resulting product yields were confirmed through strong correlation with simultaneous HPLC analysis. Moreover, the newly reported method was capable of real time monitoring with increased data quantity over the same timeframe. This novel electroanalytical method provides a more detailed understanding of the DFF production process which could support the development of photocatalytic technology for biomass valorisation.

Costing the Public Health Impact of Climate Change in Ireland

S19 - Flash Presentations - Poster with 5 min Presentation

Mr. Giacomo Di Capua [1], ***Dr. Paul Hynds*** [1], ***Dr. Anushree Priyadarshini*** [1]

1. *Environmental Health and Sustainability Institute, TU Dublin*

Background. Recent studies suggest that increasing global average temperatures will result in losses of ≈€64.6B of Irish GDP by 2050, a significant proportion thereof being directly/indirectly attributable to healthcare. Climate change will negatively affect human health via exposure to temporal stressors including fluctuating air quality, mental stress, and enteric pathogens. Resulting clinical conditions will equate to significant healthcare costs being borne by the Irish taxpayer. However, to date, these costs remain unknown.

Aim. The ***C****limate change and the* ***R****epublic of* ***I****reland:* ***S****ocietal health* ***I****mpacts and* ***S****olutions* (CRISIS) project will provide estimates of the economic burden of climate change on public health in the ROI for two "sentinel" climate-related health outcomes, namely asthma and cryptosporidiosis, subsequently forecasting future costs as a function of climate-related health and population projections.

Methodology. Direct costs will be computed using time-driven activity-based costing on the sequence of processes and resource usage ("care pathways") associated with the treatment of asthma and cryptosporidiosis, identified through Process Mapping and semi-structured clinical interviews. For indirect costs, a hybrid set of macroeconomic and microeconomic measures of burden of disease will be developed via meta-analysis. Population and climate change-related health projections will be employed to forecast the future likely economic burden of climate-associated asthma and cryptosporidiosis via micro-simulation.

Findings. Findings will include estimates of current and likely future costs of climate-associated asthma and cryptosporidiosis on public health in the ROI as a function of climate change scenarios, and identify economic vulnerabilities associated with specific demographic and/or geographic sub-populations.

Conclusions & Implications. CRISIS will translate cross-sectoral health impacts into monetary "bottom lines" for (a) elucidating health-related costs associated with specific climate change scenarios, (b) increasing the evidence-base for budgetary allocation based on simulated health vulnerabilities, and (c) developing a baseline for future research on indirect costs of climate-associated health outcomes via hybrid costing.

Wild trout as a spreader of Cryptosporidium parvum zoonotic subtypes

S19 - Flash Presentations - Poster with 5 min Presentation

Dr. Seila Couso-Pérez [1], ***Dr. Elvira Ares-Mazás*** [2], ***Dr. Hipólito Gómez-Couso*** [2]

1. *School of Engineering, Ulster University, Shore Road, Newtownabbey, BT37 0PB, United Kingdom,* ***2.*** *Laboratory of Parasitology, Department of Microbiology and Parasitology, Faculty of Pharmacy, University of Santiago de Compostela, 15782 Santiago de Compostela, A Coruña, Spain*

Cryptosporidium is a ubiquitous protozoan parasite that infects the gastrointestinal epithelium of several vertebrate hosts, including humans, causing a diarrhoeal disease, cryptosporidiosis. The infection can be acquired directly, through contact with infected hosts, and indirectly, through the ingestion of water and food contaminated with oocysts (infective form).

The aim of this study was to detect and characterize molecularly *Cryptosporidium* in wild trout (*Salmo trutta*). A total of 613 wild trout were captured in 44 Galician rivers (NW Spain) and classified according to their estimated age. The gastrointestinal tracts were differentiated in pyloric caeca and intestine, which were homogenized and concentrated in PBS 0.04 M pH 7.2/diethyl ether (2:1).

Cryptosporidium oocysts were observed by immunofluorescence microscopy in 103 of 613 specimens (16.8%). The highest prevalence rate was detected in specimens <2 years (23.1%). *Cryptosporidium* oocysts were mainly observed in pyloric caeca (69.9%), showing statistically significant differences between the anatomical locations (P<0.01). By amplification and sequencing of the SSU-rDNA gene, *Cryptosporidium parvum* was identified in 47 fish, including 5 specimens in which clusters of 4–20 oocysts were observed in the pyloric caeca. By GP60 gene analysis, zoonotic subtypes IIaA15G2R1 and IIaA18G3R1 were found in 1 and 9 trout, respectively. This finding may indicate a true infection by *C. parvum*, as the homogenization process would break the epithelial cells, releasing oocysts, free or in clusters.

This study confirms the presence of these *C. parvum* subtypes in Galician rivers, proving the wide dispersion of this parasite in aquatic freshwater environments. The identification of *C. parvum* zoonotic subtypes in brown trout may indicate a risk to public health as trout may be a potential source of infection to humans.

This study was funded by the Autonomous Government of Galicia (ED431C 2021/26). SC-P is granted by the Margarita Salas Mobility Fellowship Programme

Phosphate capture by atomic layer deposition-based materials

S14 - Water-Energy Nexus - Oral

Ms. Marina Avena Maia [1], ***Mr. Rene Hauser*** [2], ***Dr. Laura Torrente-Murciano*** [1]

1. *University of Cambridge,* ***2.*** *Delft IMP*

This work investigated the development of materials with a ZnO uniform core-shell structure through atomic layer deposition (ALD), to be applied as adsorbent materials for phosphate uptake. Phosphate, which is one of the primary precursors in fertilizers, is a finite resource in current scarcity. Phosphate is mainly obtained by the mining of phosphorous rocks, and this nutrient was declared as one of the 30 critical resources in the European Union (Henckens, 2021). In wastewater treatment plants, urine-containing streams are the largest source of phosphate, which offers a sustainable phosphate source alternative to its mining (Egle *et al.*, 2015). This marks a crucial time point were phosphate capture and recovery processes for its reuse are needed in order to guarantee food security worldwide. Adsorption is a promising avenue for phosphate recovery due to its accumulation ability. After the adsorption cycle, the phosphate can be released back into the solution in the desorption step.

In this work, the deposition of a ZnO layer on TiO_2 was performed through ALD. ZnO was deposited using diethylzinc as the precursor and water as the oxidizer. Through ALD, an adsorbent material with a uniform layer and abundant adsorption sites can be synthesized, which can ensure an efficient adsorption process. Each ALD cycle consisted of four sequential exposures of the TiO_2 to: diethylzinc vapor, purge with N_2, deionized H_2O vapor, purge with N_2. TEM images exhibited that the ZnO layer was formed around the TiO_2. Regarding the adsorption studies, the ZnO@TiO_2 material showed that it is a promising candidate for phosphate capture, with an adsorption capacity of 60 mg/g.

References:

Henckens, T. (2021). Governance of The World's Mineral Resources: Beyond the Foreseeable Future. Elsevier.

Egle, L., et al. (2015). Overview and description of technologies for recovering phosphorus from municipal wastewater. Resources, Conservation and Recycling, 105, 325-346.

Bacterial community composition in a pilot-scale wastewater treatment plant

S14 - Water-Energy Nexus - Oral

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

1. *Universidad Rey Juan Carlos Madrid/ ProPhotonix IRL LTD, 3020 Euro Business Park, Little Island, Cork, T45 X211, Ireland,* ***2.*** *Department of Chemical and Environmental Technology, ESCET, Universidad Rey Juan Carlos, C/Tulipán s/n, 28933 Móstoles, Madrid, Spain,* ***3.*** *ProPhotonix IRL LTD, 3020 Euro Business Park, Little Island, Cork, T45 X211, Ireland*

Wastewater treatment plants (WWTPs) contain a diverse bacterial community composed of environmental and enteric species. This study aimed at characterising the bacterial communities, as well as measuring selected ARB/ ARGs in samples collected from WWTP (influent, secondary effluent, tertiary effluent) and in MP biofilms deployed in the WWTP samples for a period of 3 days. 16srDNA amplicon sequencing was used to analyse the bacterial community composition. Standard plate counting method and real-time polymerase chain reaction (qPCR) were used to quantify the ARB and ARGs, respectively. In the samples collected on day 0, Proteobacteria was the dominant phylum in the influent (32 %) and secondary effluent (44 %) while Patescibacteria dominated in the final effluent (22 %). On day 3, the bacterial community was composed of Proteobacteria in the MP biofilms (79 – 82 %) and surrounding water (56 – 66 %) in all samples. The highest species alpha-diversity was observed on day 0 (Shannon 4.99 – 4.18). MP biofilm had lower species diversity (Shannon 1.57 – 2.72) as compared to the surrounding water (Shannon 3 – 4.16). ARB quantified on day 1 and 3 were highest in the influent and lowest in the final effluent, both in the MP biofilm and surrounding waters. The relative abundances of sul1, vanA and intl1 (Class 1 integron-integrase gene) were highest in the secondary effluent on day 0 while lower in the influent and final effluent. The relative abundance of vanA appeared higher in secondary effluent only, while sul1 and intl1 had higher relative abundance both in the MP biofilm and surrounding waters. This indicated a redistribution of ARGs on day 3. Change in bacterial community composition and diversity was observed across WWTP. Low species diversity in MP might indicate towards attachment of selective species on MP surface.

Synergistic effect of 3 wavelengths for inactivation of E. coli

S14 - Water-Energy Nexus - Oral

Mr. Adithya Pai Uppinakudru [1], ***Mr. Miguel Martin Somer*** [2], ***Dr. Ken Reynolds*** [3], ***Mr. Simon Stanley*** [3], ***Prof. Prof. Javier Marugan Aguado*** [2], ***Dr. Cristina Pablos*** [2]

1. *Universidad Rey Juan Carlos Madrid/ ProPhotonix IRL LTD, 3020 Euro Business Park, Little Island, Cork, T45 X211, Ireland,* **2.** *Department of Chemical and Environmental Technology, ESCET, Universidad Rey Juan Carlos, C/Tulipán s/n, 28933 Móstoles, Madrid, Spain,* **3.** *ProPhotonix IRL LTD, 3020 Euro Business Park, Little Island, Cork, T45 X211, Ireland*

The evolution of ultraviolet light in the past decade has led to the production of high-power light emitting diodes emitting light in the ultraviolet range. While excimer and mercury lamps have the capability to exhibit lower wavelengths of UV light, they are bulky and need more power compared to UV LEDs[1]. Multiple studies have been conducted on the disinfection capability of UV-C LEDs. One of them is the potential synergistic combination of 2 or more wavelengths. Synergistic inactivation of microorganisms has been proved by many authors, while others have concluded that synergy cannot be achieved due to the second law of photochemistry[2]. A review of all the research conducted on synergy point out that different experimental conditions and type of LEDs have had a key impact on the results[3]. The study attempts to approach the concept of disinfection and synergy from the perspective of light operation. It optimises the kind and type of wavelengths used in the system and studies the effect of 3 wavelengths (265nm, 275nm and 310nm) on the inactivation of E. coli K12. The study further compares the kinetic constants obtained with E. coli absorption capability and uses this data to asses the potential synergistic combination of wavelengths by varying light parameters in the set-up.

References

- Lawal, O., Cosman, J. & Pagan, J. UV-C LED Devices and Systems: Current and Future State. IUVA News 20, 22–28 (2018).
- Thompson, T., Eliason, G. & Pasquantonio, J. Synergy Between 275 nm and 365 nm UV LEDs for Inactivation of RNase A. 5766. 2. Gao, Z. C. et al.
- Pichel, N., Vivar, M. & Fuentes, M. The problem of drinking water access: A review of disinfection technologies with an emphasis on solar treatment methods. Chemosphere 218, 1014–1030 (2019).

Photoelectrocatalytic removal of E. Coli, MS2, and methanol using nanostructured WO3/BiVO4

S14 - Water-Energy Nexus - Oral

Mr. Conor Reddick [1], ***Dr. Carlos Sotelo Vázquez*** [1], ***Dr. Ken Reynolds*** [2], ***Mr. Simon Stanley*** [2], ***Dr. Cristina Pablos*** [1], ***Prof. Prof. Javier Marugan Aguado*** [1]

1. *Department of Chemical and Environmental Technology, ESCET, Universidad Rey Juan Carlos, C/Tulipán s/n, 28933 Móstoles, Madrid, Spain,* ***2.*** *ProPhotonix IRL LTD, 3020 Euro Business Park, Little Island, Cork, T45 X211, Ireland*

This work assesses the disinfection rates of $WO_3/BiVO_4$ photocatalysts (flat $BiVO_4$, flat WO_3, flat $WO_3/BiVO_4$, nanostructured WO_3, and nanostructured $WO_3/BiVO_4$) for *E. coli*, MS2, and methanol in a photoelectrocatalytic cell illuminated by a 365nm LED light. WO_3 is a promising photocatalyst for disinfection due to its efficient generation of ROS, chemical stability, and electron transport properties, however WO_3 suffers from fast electron-hole recombination [1]. Incorporating $BiVO_4$ as a heterojunction with WO_3 utilizes near-visible photons, and spatially separates electron-hole carriers [2].

Tests were conducted in electrocatalytic, photocatalytic and photoelectrocatalytic conditions. A three-electrode cell containing a photoanode, an Ag/AgCl reference electrode and a platinum mesh counter electrode was used. Tests were conducted at 0.5 V vs Ag/AgCl. Methanol oxidation to formaldehyde was measured by colorimetry, whilst *E. coli* and MS2 disinfection were quantified by plating on LB and Tryptone-Yeast-Glucose agars respectively.

For all pollutants under photoelectrocatalytic conditions, the nanostructured materials exhibited higher disinfection rate than their flat equivalents. However, the ratio of reaction rates between flat and nanostructured materials varied. Nanostructured materials exhibited roughly 6x higher rate constant than their flat equivalents for methanol, 2.5-3x higher for MS2. Initial *E. coli* results indicate this ratio drops further.

The findings suggest disinfection rates are influenced by the pollutant particle size relative to the nanostructured material, as methanol can penetrate the photocatalytic surface, MS2 can partially penetrate it, and E. *coli* can only access the outermost sites. Heterojunction materials improved rates for *E. coli* and MS2 but hindered reaction rates for methanol, possibly due to the rapid hole scavenging of methanol inhibiting recombination in WO_3.

[1] Liu, Xien, 2012. Nanostructure-based WO3 photoanodes for photoelectrochemical water splitting. Physical Chemistry.

[2] Sotelo-Vazquez, Carlos, 2017. Evidence and Effect of Photogenerated Charge Transfer for Enhanced Photocatalysis in WO3/TiO2 Heterojunction Films: A Computational and Experimental Study. Advanced Functional Materials.

Potential of multi-species mixture in reducing enteric methane emissions in vitro

S16 - Sustainable Land Use, Agriculture and Food - Oral

Mr. Ali Sultan Khan [1], ***Ms. Dominika J. Krol*** [1], ***Mr. John A. Finn*** [1], ***Mr. Alexandre B. De Menezes*** [2], ***Ms. Emily Roskam*** [3], ***Mr. Stuart Kirwan*** [3], ***Ms. Sinead M. Waters*** [3]

1. *Teagasc Johnstown Castle, Wexford, Ireland,* ***2.*** *National University of Ireland, Galway,* ***3.*** *Animal Bioscience Research Centre, Teagasc Grange, Dunsany, Meath*

Multi-species swards (MSS) can overcome the challenges of reducing nitrogen fertilizer usage while simultaneously increasing the grassland yield . However, the impact of MSS on enteric methane emissions remains unclear.

Here, we explored the effect of perennial ryegrass, timothy, red clover, white clover, chicory, plantain and their equi-proportional mix receiving 150 kg N ha^{-1} yr^{-1} and perennial ryegrass receiving 300 kg N ha^{-1} yr^{-1} on ruminal methane emissions and fermentation parameters *in vitro* using the rumen simulation technique (RUSITEC) system.

A total of 32 vessels (8 vessels/system) containing rumen inoculum acquired from four rumen-fistulated Aberdeen Angus cross steers fed on a grass silage (*ad libitum*) and 3 kg concentrate diet, and vessels were fed with respective plant species at rate of 20g/day for 14-days of diet adaptation followed by 7-days of gas volume, methane, and pH recording. Data for gas volume, methane, and pH was analysed using Tukey-Kramer‘s test in SPSS-25. $P \leq 0.05$ was considered significant and tendencies when $0.05 < P < 0.10$.

Ribwort plantain, chicory and white clover fermentation revealed higher pH and lower methane production than other grass species, where six-species mixture showed intermediate pH, total gas, and methane production than other plant species ($P < 0.05$).

Based on this *in vitro* experiment, our results suggest that plant diversity in forage has the potential to reduce enteric methane via different methane production profiles among different vegetation types.

This project was funded by Teagasc Walsh Scholarship fund reference number 2019002.

Can multispecies grasslands simultaneously improve herbage productivity and micronutrient uptake?

S16 - Sustainable Land Use, Agriculture and Food - Oral

Ms. Omotola Odetayo [1], ***Ms. Jane Shackleton*** [2], ***Dr. Cornelia Grace*** [2], ***Dr. Jean Kennedy*** [2], ***Dr. Ron De Goede*** [3], ***Prof. Ellis Hoffland*** [3]

1. *1. Wageningen University and Research 2. Devenish Research Development and Innovation,* ***2.*** *Devenish Research Development and Innovation,* ***3.*** *Wageningen University and Research*

Background: The use of multispecies grasslands has shown to be one of the prominent practices of promoting agricultural sustainability because of less reliance on external nitrogen input (Finn et al, 2013). However, in livestock-based grassland systems, there's little evidence regarding the role of multispecies in mobilizing micronutrients important for livestock health - such as Zinc. Zinc (Zn) plays a key role in regulating the metabolic activities in animals and enhances plant growth. The consumption of forages with low Zn concentration ultimately leads to Zn deficiency in livestock.

Aim: To investigate whether multispecies grasslands can increase both Zn uptake and herbage yield.

Methods: A greenhouse experiment was conducted, using soil collected from the mineral layer of a fallow grassland in Dowth, Co. Meath, Ireland. Two grass species (*Lolium perenne, Phleum pratense*), two legumes (*Trifolium repense, Trifolium pratense*) and two forbs (*Cichorium intybus, Plantago lanceolata*) were grown as monocultures, 2-species mixtures and 6-species mixtures in four replicates. At harvest, the mixtures were separated into individual species and all the plant samples were dried at 70^0C to determine their dry matter yield. The samples were digested with nitric acid in a microwave and the Zn concentration was determined on ICP-OES.

Results: The capacity of all the monoculture species to mobilize Zn varied significantly ($p<0.05$). In the 2-species mixtures, there was a significant difference ($p<0.05$) among all the treatments. Although, we found a significant effect of multispecies mixtures on yield ($p<0.05$), there was no effect on herbage Zn uptake.

Conclusions: To simultaneously achieve increased yield and Zn uptake in herbage, other productive grassland species should be investigated for their zinc-mobilizing potential.

Reference

Finn et al. (2013). Ecosystem function enhanced by combining four functional types of plant species in intensively managed grassland mixtures. *Journal of applied ecology.*

Biorefinery from Rhododendron residue for the production of antioxidants, hydrogels and nanocellulose

S16 - Sustainable Land Use, Agriculture and Food - Oral

Ms. Tielidy Lima [1], ***Dr. Gabriel Goetten de Lima*** [2], ***Dr. Michael Nugent*** [1]

1. *Technological University of the Shannon: Midlands Midwest,* ***2.*** *Programa de Pós-Graduação em Engenharia e Ciência dos Materiais – PIPE, Universidade Federal do Parana*

Rododendron ponticum is an invasive non-native shrub which has spread across Ireland. It was introduced in the 18th Century from Asia as an ornamental plant. However rhododendron spreads rapidly and is described as one of the biggest threats to peatlands in the west of Ireland and the government has spent almost half a million euro on clearing this species from Connemara National Park. The aim of the research is to utilise Rhododendron for the development of new products and find alternative applications. Chemicals developed from Rhododendron plants have great potential for adding value to the biomass production chains. Rhododendron pulp was used as a raw material in order to produce micro- fibrillated cellulose (MFC) by twin screw extrusion (TSE). Rhododendron pulp was passed through an extruder 5,10,15 and 20 times to evaluate the effect of defibrillating cellulose by an extrusion process. Films were produced and were characterised using DSC and FTIR to investigate the difference in each step in the extruder. The DSC curve of film extruded 5 times has shown melting point in 438°C and ΔHf on 247.4 J/g. For the film extruded 20 times on the extruder the values were respectively 425.96°C for the melting point and the ΔHf on 492.2 J/g. Additionally Rhododendron leaves showed many potentially useful antioxidant compounds. The antioxidant values against the DPPH (2,2-diphenyl-1-picryl-hydrazyl) radical was 15.1 µM/g. The phenolic analysis was 30 mg/g. This data shows a high antioxidant potential. These extracts, were compounded using Polyvinyl Alcohol (PVA) and a dissolution test was performed to determine the release of these antioxidant compounds. We are studying the possibility of using these compounds and determining their feasibility in biomedical applications.

Waste recovered compost: a sustainable source of fertilizer in Bangladesh

S16 - Sustainable Land Use, Agriculture and Food - Oral

Dr. Paul Williams [1], Mr. MD RAJU AHMAD [1], Dr. Jason Chin [1], Dr. S M Ashekuzzaman [2], Dr. Mahmud Hossain Sumon [3]

1. *Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, Belfast BT9 5BY, UK,* ***2.*** *Department of Civil, Structural & Environmental Engineering, Munster Technological University, Bishopstown, Cork, Ireland T12 P928,* ***3.*** *Department of Soil Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

Background: Bangladesh government subsidizes chemical fertilizer imports in the order of $3,473.3 million (2021–22), which is four times higher than the fiscal years 2020–21, BIB, (2022), to support farmers and protect crop production amid what is a very challenging global supply chain crisis. Farmers produce some compost, but it is not sufficient in scale. Hence, commercial composting has the potential to help mitigate the fertilizer shortage. However, the government has only approved 32 composting plants, Cofie et al., (2014). Therefore, the supply of commercial compost is not meeting the country's demand. Thus, a survey was conducted to better understand the operation and capacities of commercial composters.

Aim: To explore the life cycle of feedstock/compost, composting technologies, and the sector's capacity to accelerate the availability of compost.

Methodology: The survey respondents were representatives of commercial composting plant owners (n=31) covering 17 districts.

Findings: Among the 31 composting plants, 19 plants use feedstock from their community. However, two plants use municipal solid waste. Technical influences: 17 used open-air composting technology, and two used windrow technology. The restricted oxygen supply influences the composting process and compost in windrow composting technology, Zhou (2017). The survey data revealed that registration and licensing for production and marketing are time-consuming and difficult.

Conclusions & Implications: There are a limited number of authorized plants, yet the feedstocks and technologies used are diverse. The sector is still undeveloped but is rapidly expanding, with hundreds of registration applications in process.

References:

BIB, 2022. Business Insider Bangladesh (BIB), Dhaka, Bangladesh.

Cofie, O., Rao, K. C., Fernando, S., & Paul, J., 2014. Composting Experience in Developing Countries: Drivers and Constraints for Composting Development in Ghana, India, Bangladesh, and Sri Lanka.

Zhou, J.M., 2017. Effect of turning frequency on co-composting pig manure and fungus residue. J. Air Waste Manag. Assoc. 67, 313–321.

Impact of recycling derived fertilisers application on nematode communities in Irish grassland

S18 - Biodiversity, Ecosystems and Ecotoxicology - Oral

Dr. Thomaé Kakouli-Duarte [1], ***Ms. Anna Karpinska*** [1]

1. *Institute of Technology Carlow*

The three main nutrients routinely applied for food security are by farmers via artificial mineral fertilisers are phosphorous (P), nitrogen(N) and potassium (K). The global demand for recycled phosphorus is increasing due to the growing human population. Nutrient recovery technologies are employed to produce recycling derived fertilisers (RDF) from three large waste streams, sewage sludge, food waste and manure, in the form of ash or struvite, that can replace conventional mineral fertilisers in farms. However, it is essential that RDF undergo an ecological risk assessment prior to their application.

Nematodes are the most abundant and widespread soil animals, sensitive to pollutants and environmental disturbance and ideal as biological indicators of environmental change. This project is an investigation on the ecological impact of RDF by studying their effects on the terrestrial nematode communities in field trials located in Ireland, as part of the INTERREG_NWE Project called ReNu2Farm (www.nweurope.eu/renu2farm). Nematode DNA was extracted from soil samples, the 18S rRNA gene was sequenced, and further bioinformatic analysis were employed to reveal any significant differences between the treatments. Nematode abundance expressed in molecular operational taxonomical units (MOTUs) was examined using Nematode INdicator Joint Analysis (NINJA) to exclude any adverse effects of RDF on soil nematode species compared to those in control plots.

A two-year Irish field trial revealed no major difference between the struvites and the controls. Neither struvite fertiliser reduced the number of observed nematode species or adversely affected nematode communities, thus helped maintaining soil nematode biodiversity. Canonical correspondence analysis (CCA) revealed that P appeared to be a significant driving factor in shaping the nematode communities in the sewage ash treatment. Poultry ash should only be applied in balanced nutrient conditions, as surplus negatively affected nematode taxa sensitive to environmental disturbance. Overall, RDFs were identified as a sustainable alternative to mineral fertilisers.

Microbial Source Tracking of Antimicrobial Resistance in Bathing Waters in Northern Ireland.

S18 - Biodiversity, Ecosystems and Ecotoxicology - Oral

Ms. cathy brooks [1], ***Ms. Elaine Mitchell*** [1], ***Ms. Sinéad O'Donovan*** [1], ***Mr. James Brown*** [1], ***Mrs. Kelly-Anne Carnaghan*** [1], ***Mr. Eoin Bleakney*** [1], ***Ms. Kelly Westley*** [1], ***Mrs. Elke Johns*** [1], ***Mr. Jeorg Arnscheidt*** [2]

1. *AFBI,* ***2.*** *School of Geography and Environmental Science, Ulster University*

Bathing water quality in Northern Ireland is classified by the concentrations of faecal indicator bacteria (FIB) *E. coli* and Intestinal *Enterococci* under the EU Bathing Water Directive 2006/7/EC and 19 of the 26 designated bathing locations were classified as 'Excellent' in 2021. Faecal contamination of surface waters has the potential to spread not only pathogenic organisms but also antimicrobial resistant organisms. Antibiotic resistance patterns of enteric bacteria can be useful in identifying the source of faecal pollution, but these methods can be time consuming and labour intensive. The main objective of this study was to assess the utility of DNA extracts, taken from filtered water samples for microbial source tracking (MST), for the detection of antimicrobial resistance genes (ARG). Marine and freshwater samples were taken weekly from six designated bathing locations that failed to achieve the 'Excellent' classification in 2021. Samples were examined for concentrations of faecal indicator bacteria and the human and ruminant sources of faecal pollution were quantified using MST. These DNA extracts were also assessed for the presence of three beta lactam antimicrobial resistance genes, OXA-48, KPC and NDM-1. Significant correlations were observed between FIB and MST results and bla-OXA-48 ARG was found in freshwater samples at all six locations studied and was present in a greater proportion of samples with a significant human faecal bacterial load than locations with low levels of FIB or a dominant ruminant faecal load. These results demonstrate the potential dissemination of antimicrobial resistant bacteria at bathing locations in Northern Ireland. This simple method may prove to be a useful screening tool for monitoring the source of contamination of surface waters impacted by antimicrobial resistant bacteria.

Mapping vegetation communities on Irish raised bogs using PlanetScope imagery and Google Earth Engine

S18 - Biodiversity, Ecosystems and Ecotoxicology - Oral

Mr. Wahaj Habib [1], ***Mrs. Ruchita Ingle*** [1], ***Dr. Matthew Saunders*** [1], ***Dr. John Connolly*** [1]

1. *Trinity College Dublin*

In Ireland, peatlands cover about 20 % of the total land area and store approximately 1085 Mega tonnes (Mt) of carbon. Peatlands have been severely impacted (~ 90 %) by human intervention, predominantly by drainage and subsequent conversion to forestry, agriculture, and extraction. Vegetation communities, artificial drains and open water bodies play a crucial role in C/GHG dynamics, and their detailed mapping is essential for precise estimation of C/GHG fluxes. These maps could also prove helpful in developing a better understanding and long-term monitoring of terrestrial C/GHG dynamics of these ecosystems.

High-resolution (3m) multispectral imagery acquired by PlanetScope between October 2019 and December 2020, was used to map vegetation communities across a drainage gradient on three raised bogs in the Midlands of Ireland. These sites represent an industrial peat extraction site, a near-natural site, and a site under rehabilitation. Cloud free imagery was collected for all the three sites and seasonal mosaics were calculated using a mean filter to derive a single image for each season and each site. The SMILE (Statistical Machine Intelligence and Learning Engine) Random Forest algorithm, a machine learning-based image classification technique was used in Google Earth Engine (GEE) platform. Data acquired through detailed field surveys (from various sources for each site) depicting vegetation communities across the study sites were used to derive the training and validation sample data for the image classification. The classification results revealed an average of 90% accuracy for all the maps. The results from this study illustrate the potential of these data and methods for long term monitoring of raised bogs. Additionally, this will also aid in the understanding of C/GHG dynamics by upscaling the fluxes from in-situ estimates to local and national scales.

The Role of Urban Trees in the Improvement of Urban Biodiversity

S18 - Biodiversity, Ecosystems and Ecotoxicology - Poster with 5 min Presentation

Ms. Caoimhe Marron [1], ***Dr. Eoin Lettice*** [2], ***Dr. Barbara Doyle Prestwich*** [2]

1. *School of Biological, Earth and Environmental Science, University College Cork,* ***2.*** *Environmental Research Institute, University College Cork*

The Role of Urban Trees in the Improvement of Urban Biodiversity

Authors: Caoimhe Marron[1], Barbara Doyle Prestwich[2], Eoin Lettice[2]

Affiliations: ***1****. School of Biological, Earth & Environmental Sciences, University College Cork.* ***2****. Environmental Research Institute, University College Cork*

The role that trees can play in our urban areas has come under renewed focus as we grapple with the twin crises of climate change and biodiversity loss. Trees can help to mitigate the effects of climate change as well as helping cities to adapt to the changing weather patterns predicted over the coming decades. This project builds on other successful 'urban tree' projects ongoing in the research group including the South Parish Tree Survey; the UCC Open Arboretum Project; and the 'Tree Explorers' project. In particular, it will focus on the role of trees in protecting and enhancing biodiversity in the urban environment. The project assesses biodiversity across several groups including insect, lichen, epiphyte and bird biodiversity. These are being quantified using a range of ecological field techniques including sticky traps, quadrats and observation data. In addition, environmental factors that may influence the distribution of these groups will be assessed, including light intensity and temperature. Dataloggers and meteorological data are being used to gather this information. Additionally, hemispherical photography allows the calculation of the sky view factor; This can subsequently be used in conjunction with the corresponding microclimate data. These canopy images are run through a gap light analyser software to determine the amount of light which penetrates the tree canopy. As an outcome to this project, we will seek to engage with city councils (including Cork City Council) to disseminate our findings regarding urban biodiversity. This will advise the council as to which trees and locations are best suited for the improvement of biodiversity in cities.

Development of Novel Molecular Indicators of Emerging Contaminants in Freshwater and Marine Environments

S18 - Biodiversity, Ecosystems and Ecotoxicology - Poster with 5 min Presentation

Ms. Enya Cody [1], ***Dr. Andrew Reynolds*** [1], ***Prof. Gordon Chambers*** [2], ***Prof. Orla Howe*** [3], ***Dr. Michelle Giltrap*** [4]

1. *Radiation and Environmental Science Centre, FOCAS Research Institute, Technological University Dublin, Aungier Street, D02 HW71, Ireland.,* ***2.*** *School of Physics, Clinical & Optometric Science, Technological University Dublin- City Campus, Central Quad, Grangegorman, Dublin, D07 ADY7, Ireland.,* ***3.*** *School of Biological and Health Sciences, Technological University Dublin-City Campus, Central Quad, Grangegorman, Dublin 7, D07 XT95, Ireland.,* ***4.*** *School of Food Science and Environmental Health, Technological University Dublin- City Campus, Central Quad, Grangegorman, Dublin, D07 ADY7, Ireland.*

Projections estimate that 445.25 million metric tonnes of plastic will be produced in 2025 and will continue to increase by 30% in 2050 (IEA, 2022). It has been predicted that 79% of plastic produced up to 2015 is residing in landfills and the environment (Greyer, Jambeck and Law, 2017) where plastic is degrading to micro/nanoparticles and having a negative effect on aquatic species (Galloway, Cole and Lewis, 2017). Bioplastics have been developed as a biodegradable alternative to traditional plastics, but little is known about their effect on aquatic species. Poly Lactic Acid (PLA), derived from fermented plant starch, is a promising biopolymer but has been reported to have toxic effects on bacterium *Aliivibrio fischeri* (Zimmermann et al, 2019), *Allium cepa* (Souza et al, 2013) and mice (Zhang et al, 2019).

This study aims to investigate the toxicity of three micro-biopolymers of interest: PLA, chitosan and cellulose while using nano-polystyrene (NP) as a control particle for the exposures. Mixture effects with emerging contaminants of concern are also investigated to determine if biopolymers exacerbate the toxicity of known pollutants of interest. Three freshwater fish cell lines will be used in this study: PLHC-1, topminnow liver (*Poeciliopsis lucida),* RTG-2, rainbow trout gonad (*Oncorhynchus mykiss*), and ZF4, zebrafish embryo (*Danio rerio*). Cytotoxicity and genotoxicity effects, as well as genomics are used to evaluate the biological effects at a cellular level. In addition, whole organism comparison studies of the effects of nano-polystyrene on zebrafish embryos will be compared to the ZF4 embryo cell line in order to evaluate the effects on lower levels of organisation when low levels of mortality in zebrafish embryos were seen after 96hr exposure. These comparisons should provide distinct results of the potential for chronic toxicity effects on aquatic species that is currently unseen in standard acute exposure findings.

The impact of indomethacin and ibuprofen on daphniids

S18 - Biodiversity, Ecosystems and Ecotoxicology - Poster with 5 min Presentation

Ms. Hannah Moynihan [1], ***Ms. Anna Michalaki*** [1], ***Dr. Konstantinos Grintzalis*** [1]

1. *Dublin City University*

Aquatic ecosystems have been under serious threat in recent decades. Pharmaceutical chemicals such as non-steroidal anti-inflammatory drugs (NSAIDs) are consumed by humans and discharged as effluent into waterways. NSAIDs have the ability to impact non target organisms such as *Daphnia magna* and have a detrimental impact on the sustainability of aquatic ecosystems.

In this study, the chronic toxicity of ibuprofen and indomethacin and their mixture was assessed on the enzyme activities of daphniids. Initially acute toxicity curves were carried out to calculate EC values and NSAID concentrations for chronic exposures. For first generation experiments, animals were collected after 7 and 14 days of exposure, and biochemical tests were carried out. For the second generation tests, neonates from the first generation were collected and exposed under the same conditions for 14 days. Following, neonates from the second generation were collected and cultured in the absence of NSAID for seven days to allow recovery from NSAIDs exposure. The enzymes assessed after each exposure were acid phosphatases, alkaline phosphatases, β-galactosidase, lipase, peptidase, and glutathione-S-transferase. Following first generation exposures, almost all enzyme activities showed decrease in activity, however, after 14 days exposure at the second generation results showed that all enzyme activities increased in comparison to the carrier solvent (DMSO), except for glutathione-S-transferase activity. Finally, in relation to the recovery, after 7 days from the second generation recovery, results indicated that daphniids exposed to indomethacin and the mixture had the ability to recover following exposures, however daphniids exposed to ibuprofen could not. This result showed that glutathione-S-transferase, which is an enzyme related to xenobiotic and drug metabolism, was the only enzyme that did not increase nor recover.

Investigation of a novel algal-based biostimulant against RLS on barley

S20 - Flash Presentations - Poster with 5 min Presentation

Ms. Wendy DELPONT [1], ***Dr. Zoë A. Popper*** [2]

1. *National University of Ireland, Galway,* ***2.*** *Botany and Plant Science, School of Natural Sciences, Ryan Institute for Environmental, Marine and Energy Research, National University of Ireland Galway, Galway, Ireland*

Barley, *Hordeum vulgare*, is a cereal grain mainly used for animal fodder, beer production and human consumption. Around 51 million hectares was cultivated for barley in 2019 worldwide, with a production reaching almost 159 million tones. Europe is the major barley producer with 60.2% of the total global yield. However, barley is threatened by many phytopathogen as *Ramularia collo-cygni*, the fungus who is responsible for the disease named RLS, or Ramularia Leaf Spot.

RLS incidence is widespread and increasing, driven by changes in global climate that favor growth and spread of the fungus. If the infection is untreated it can lead to loss in yield of up to 1.0t/ha as well as decreased seed size and quality. Many of the currently used treatments against RLS are chemical pesticides including many succinate dehydrogenase inhibitors. However, because of the risk they pose to the environment, the European Union has limited or banned their use. Effective, environmentally friendly, and sustainable alternatives are therefore essential to control RLS.

The Irish coastline has an abundant, diverse, species-rich, seaweed resource and seaweed extracts, including their cell wall components, have been reported to have antifungal properties but also to have the ability to stimulate the plant immune system.

By extracting cell wall components from a range of seaweeds collected from the Irish coastline, the aim of this project is to contribute to creating sustainable ecological solutions by identify algal-derived molecules that can either induce the barley immune system to protect it against *Ramularia collo-cygni* or molecules that have direct antifungal activity against the pathogen.

Cross-Laminated Timber: A sustainable solution for building construction

S20 - Flash Presentations - Poster with 5 min Presentation

Mr. Muhammad Yasir [1], ***Mr. Andrew Macilwraith*** [1], ***Mr. Kieran Ruane*** [1]

1. *Munster technological University*

Cross-laminated timber (CLT) possesses enhanced structural capabilities and is considered a sustainable structural product that can reduce emissions of carbon compared to traditional building materials, including steel and concrete. The current building sector is one of the major sources of producing greenhouse gases and carbon dioxide (CO_2) emissions. Therefore, this sector possesses the significant potential to mitigate climate change and reduce CO_2 emissions.

The main aim of this review is to study the sustainability performance of cross-laminated timber (CLT) as a construction material. An extensive literature review was undertaken to assess and analyze the carbon reduction and energy-saving performance of CLT structures and comparisons were made with the conventional reinforced concrete (RC) buildings. The study further focuses on the construction cost and time and a comparative analysis of the cost of traditional materials with CLT has been made. The study found that the construction time of CLT is considerably less than traditional buildings, while the cost is comparable. As a combustible material, the main concern about CLT is its performance in fire. The authors performed experimental fire testing on CLT panels to analyze their behaviour under fire and comparisons were made with Eurocode one-dimensional charring rate.

The presented research is a joint project between the National University of Ireland, Galway and Munster Technological University which is funded by the Department of Agriculture, Food and the Marine. The project aims to enhance the use of Irish timber in CLT buildings that will be optimized for fire, acoustics, structural integrity, and vibration.

Exploring the use of plant growth regulators on hemp.

S20 - Flash Presentations - Poster with 5 min Presentation

Ms. Grace Pender [1], ***Dr. Susanne Schilling*** [1], ***Dr. Rainer Melzer*** [1]

1. *School of Biology and Environmental Science, University College Dublin*

Background.
Hemp is a multipurpose crop with high potential for carbon sequestration. Hemp products can be used as building and insulation materials, biofuel and for oil production. Plant growth regulators have the potential to increase yield in hemp, however, while these have been studied extensively in other crops, virtually nothing is known about them in hemp.
Aims.
My objective is to elucidate how plant growth regulators, e.g. plant hormones their inhibitors, affect hemp plant growth and biomass, fibre and flower yield.
Methodology.
Hemp plants were treated with the plant hormones auxin, gibberellic acid, and inhibitors of those hormones. Plant height, internode length, time of branch initiation, and flowering time were recorded.
Findings.
Gibberellic acid treatment significantly increased plant height and internode length, and inhibited side branch initiation. Gibberellic acid inhibitors led to a reduction in height and internode length, and promoted earlier side-branch initiation.
Auxin impacted height differently depending on the concentration. The auxin inhibitor TIBA promoted earlier side branch initiation in comparison to controls.
Conclusions.
The use of plant growth regulators has the potential to enhance desirable traits in the high-value crop hemp in research and agriculture, e.g gibberellin treatment has the potential to increase yield of long hemp fibres, while gibberellic acid and auxin inhibitors could lead to increased flower yield due to increased side-branch initiation. Overall, increasing the yield of valuable hemp commodities with plant growth regulators will help incentivize hemp farming, and facilitate a transition towards a low-carbon economy.

Assessing Agricultural Biocide Usage Patterns in Ireland

S20 - Flash Presentations - Poster with 5 min Presentation

Ms. Meabh Dowler [1], ***Mr. Daniel Burke*** [2], ***Dr. Jean O'Dwyer*** [3], ***Dr. Paul Hynds*** [4]

1. *Environmental Sustainability & Health Institute, TUDublin,* ***2.*** *TUDublin,* ***3.*** *University College Cork,* ***4.*** *Environmental Health and Sustainability Institute, TU Dublin*

The use of biocides in the livestock sector is important for maintaining animal health through removal of harmful bacteria, fungi, and parasites. Biocides are defined as agents containing antimicrobial compounds for controlling harmful or unwanted organisms. Disinfectants have various uses in livestock farming ranging from routine disinfection to those used in a clinical veterinary environment, while others may only be necessary for disease outbreak situations. However, overuse or underuse of agricultural disinfectants represents a concern, as they may accumulate at sub-lethal concentrations, potentially driving antimicrobial resistance. To date, however, the use of biocides within the Irish agricultural sector and potential adverse consequences have not been investigated. Accordingly, the BIOSAFE survey sought to investigate the current use of disinfectants and cleaning agents in agriculture across Ireland.

The survey contained 40 filtered questions divided into sections on farmer demographics, specific beef/dairy/sheep farming questions, biocide usage, biocidal waste disposal, antibiotic use, and education/awareness. Preliminary results from 113 Irish farmers have been analysed. All four provinces are represented (Leinster – 60.7%; Munster – 23.8; Ulster – 9%; Connaught – 6.6%), with a mean and median farm size of 124.44 and 84 acres, respectively. Livestock agriculture accounted for 78% (n=103) of farming carried out by respondents. Farm (livestock) type exhibited significant associations ($p<0.05$) with the use of biocides at farm level, with beef (not mixed), goat, pig, and sheep farmers less likely to use biocides than surveyed dairy farmers. Additionally, while farm size was significantly associated with livestock type (beef and dairy farms were larger), there were no significant associations between farm size and biocide usage.

Findings will be used to make Irish agriculture safer, more cost-effective, and environmentally friendly by identifying the types, volumes, and frequency of biocide use in Irish agriculture and inform a laboratory study of the co-occurrence of biocides and AMR.

Irish Faba Beans as a sustainable food source

S20 - Flash Presentations - Poster with 5 min Presentation

Ms. Laura Mc Daid [1], ***Dr. Denis McCrudden*** [1], ***Dr. Sheila Alves*** [2]

1. *Atlantic Technological University, Donegal,* ***2.*** *Teagasc Crop Research Centre, Oakpark, Carlow, Ireland*

Demand for plant proteins grew by 20% in both 2018 and 2019 (KHNI, 2020). Increasing plant protein in the diet is beneficial (AICR 2020) and the use of plant proteins reduces the negative impact of animal alternatives on the environment (Aiking 2011). As fava beans are nutritional in the diets of both animals and humans there is huge market potential internationally (Teagasc 2019).

Faba beans have been used as animal feed due to their high protein and energy concentration but are increasing in popularity as an animal protein replacement in the human diet. They are well suited to the Irish temperate climate with a high yield potential and can be harvested in both winter and spring. The bean is easy to grow, has plant hardiness and can withstand harsh and cold climates. The beans produce fixed nitrogen improving soil quality for itself and succeeding crops. They have a low nitrogen requirement which results in lower greenhouse gas emissions.

Nutrient levels in faba beans were determined using Flame Atomic Absorption Spectroscopy: 620mg/kg calcium, 1199mg/kg magnesium, 36mg/kg iron, 38mg/kg zinc, 9mg/kg manganese and 9321mg/kg potassium. Crude protein concentration of faba beans was determined using the Kjeldahl method with a mean value of 28%. Faba beans were found to be rich in many minerals important in the diets of both humans and animals. Crude protein of 28% confirms faba bean's suitability for use as a protein rich animal feed alternative. The world is facing a huge shortage of protein sources for livestock feed.

With their suitability for growth in a range of climates and soils, large scale cultivation of faba bean could enhance Europe's capability of becoming self-sufficient in their animal feed requirements, greatly reducing need for importation which has negative impacts both financially and environmentally.

Temporal microplastic contamination of cockles from Dundalk Bay, Republic of Ireland

S20 - Flash Presentations - Poster with 5 min Presentation

Mr. Stephen Kneel [1], ***Dr. Suzanne Linnane*** [1], ***Dr. Caroline Gilleran Stephens*** [1], ***Dr. Alec Rolston*** [2]

1. *Centre for Freshwater and Environmental Studies, Dundalk Institute of Technology, A91K584 Dundalk, Co. Louth, Ireland,* ***2.*** *Goyder Institute for Water Research*

Harvesting of the common cockle *(Cerastoderma edule)* from Dundalk Bay equates to approximately €2 million to the local economy, operating as one of only two cockle fishing ground in the Republic of Ireland. The common cockle, assessed in this study has potential as a bioindicator of microplastic (plastics less than 5mm in size) pollution as it is: found in waters close to coastlines, has a large geographical range, is easy to collect and is used as a bioindicator for *E.coli* presence already. The assessment of microplastic marine pollution falls under descriptor 10 of the Marine Strategy Framework Directive and the contamination of marine species by microplastics has been well documented. This study represents a first look at temporal microplastic contamination in a natural non-cultured population of commercially valuable bivalves in Irish fishing grounds. Fourteen cockles were collected monthly from the same location for a period of 12 months. Microplastic extraction was carried out as per Thiele et al. (2019). Cockles were digested in 10% Potassium Hydroxide, neutralised with 1M Citric Acid and filtered onto 1.2µm filter papers before microscope examination was carried out and polymer identification was completed using raman spectroscopy. Of 168 specimens analysed for microplastic presence, 166 contained microparticles. Fibres were the most commonly noted microparticle and accounted for 607 (71.6%) of those recovered, fragments were the next common accounting for 151 (17.8%), followed by films with 81 (9.5%) particles and finally beads, the target of previous legislation were seen with the lowest frequency with 8 (0.9%) recovered in total. Microparticle shape composition varied between months. July and August exhibited the highest amount of fragments possibly due to increased UV degradation of macroplastics while the highest proportion of microfiber contamination was found in cockles sampled in November. Seven types of polymer were identified in cockles.

Bioplastics: An evaluation of sustainability

POSTERS (only) list - Poster

Ms. Cherrelle Johnson [1], ***Dr. Sinead Mitchell*** [1]

1. *National University of Ireland, Galway*

Billions of tonnes of fossil fuel-based plastic have been generated globally with over two-thirds being disposed of in landfills or ending up in the natural environment. The accumulation and continued production of oil-based plastics has been linked to adverse effects on human and environment health and is largely considered unsustainable. Ireland is the largest producer of plastic waste in the EU per capita and currently lacks the technical and industrial capabilities to manage plastic resources effectively.

Bio-based plastic (bioplastic) is a potentially viable and sustainable alternative. Being produced from renewable resources (e.g., maize or sugarcane) or food waste, bioplastics emit less greenhouse gases than their traditional counterparts, and could contribute to the transition to a more circular economy in Ireland. However, bioplastics are still plastics and can contain the same traits or properties of conventional plastics, and research has shown that bioplastics can result in higher negative environmental impacts, particularly during the production phase. The production of bioplastics is not a recently discovered technology, however, the manufacturing of bioplastics has grown exponentially in recent years to meet the market demand for greener products. Research into the overall sustainability of bioplastics from 'cradle-to-grave' (i.e. extraction of raw materials to disposal) is a research area that has yet to be extensively explored.

This research aims to investigate the long-term sustainability of bioplastics and their impacts on environmental health. Objectives include: 1) evaluate sustainability of bioplastic production during each stage of its life 2) contribute to knowledge on bioplastics and their environmental impact and 3) contribute to and stimulate the discussion around framework/policies relating to bioplastic production, use, and management.

Through a systematic literature review, field and lab trails, and life cycle assessments of bioplastics, this study will evaluate bioplastics for sustainability credentials and safety for the environment when compared to conventional plastics.

Recycle the Bicycle? Environmental Opportunities & Concerns from the E-Bike Revolution

POSTERS (only) list - Poster

Dr. Yvonne Ryan [1], ***Prof. Colin Fitzpatrick*** [1], ***Prof. Catherine Woods*** [1], ***Dr. James A. Green*** [1]

1. *University of Limerick (UL)*

Background: This poster presents the environmental aspects assessment framework for the ISCycle (Inclusive Sustainable Cycling) Demonstration Project Funded by Sustainable Energy Authority of Ireland, commencing September 2022 at the University of Limerick.

ISCycle will develop and test interventions centred on ebikes, an active travel mode, enabling replacement of the private car for families/individuals commuting short to medium distances. Ebike sharing schemes are growing in number, coupled with the extension of the bike to work scheme to include ebikes increased numbers are expected to be put on the market. This has implications for the production chain and waste management systems at end of life.

Methods: [C1] Sustainability aspects will be addressed through the assessment of environmental impacts due to modal shift, life cycle analysis and the circular economy implications of ebike uptake.

Expected results:

Assessing and optimising net environmental benefit from modal shift from car to ebike needs to be considered in a life cycle analysis framework.

Ebikes contain motors and batteries requiring critical raw materials for manufacture. Optimising their use over the life span is a key element of sustainable product use. Accessing suitable repair services and ease of correct disposal at eventual end of life are key to maintaining a circular economy for ebikes.

Policy recommendations on the effective use of e-bikes such as optimal distance travelled, and identification of recommendations based on ownership, leasing or shared ownership models.

Current stage of work: Background data collection underway.

Discussion: Modal shift from cars to ebikes holds benefit for human health and the environment. However, optimising the benefits needs further consideration.

Converting waste heat into electricity using cellulose membranes

POSTERS (only) list - Poster

Dr. Ievgen Nedrygailov [1], ***Dr. Kamil Rahme*** [1], ***Dr. Subhajit Biswas*** [1], ***Ms. Anjali Ashokan*** [1], ***Ms. Rupa Ranjani*** [1], ***Prof. Justin D. Holmes*** [1]

1. *School of Chemistry and the Environmental Research Institute (ERI), University College Cork, Cork*

- Background: Increasing energy consumption, the depletion of natural resources, climate change and decreasing air quality are amongst the biggest economic and social challenges that we face today. At the same time, waste heat energy discharged into the atmosphere is one of the largest sources of clean, fuel-free and inexpensive energies available. Significantly, 70 % of all energy generated daily is lost as waste heat. A vast amount (around 63 %) of this untapped energy exists in the form of low-grade heat from sources below 100°C, which includes power generation (burning of fossil fuels), industrial processes (oil refining, heat exchanges) and domestic heating. Generating electrical energy from low-grade waste heat is therefore a key enabler to meet the growing global energy demand, whilst reducing Europe's carbon footprint.
- Aim: To show that natural wood can be used to create thermoelectric converters of a new type with a high efficiency of converting heat into electricity.
- Findings: We are using cellulose membranes, made from the chemical treatment of wood, to convert waste heat into electricity. Nanochannels within the cellulose membranes are effective at separating ions in solution in the presence of a temperature gradient, which leads to the generation of a thermally induced voltage of up to 25 mV/K, significantly exceeding values reported for conventional thermoelectric converters based on solid materials.
- **Conclusions & Implications:** Natural wood, which is inexpensive, environmentally friendly and completely renewable, could potentially be used to create highly efficient thermoelectric energy converters for low-grade heat recovery on a large scale.
- References:
Zeb, K., Ali, S.M., Khan, B., Mehmood, C.A., Tareen, N., Din, W., Farid, U., Haider, A., 2017. A survey on waste heat recovery: Electric power generation and potential prospects within Pakistan, *Renewable and Sustainable Energy Reviews* 75, 1142-1155.

Sampling, identification and characterization of microplastics released from daily used plastic products

POSTERS (only) list - Poster

Ms. Luming Yang [1], ***Dr. Dunzhu Li*** [2], ***Dr. Yunhong Shi*** [2], ***Dr. Jing Jing Wang*** [3], ***Dr. Liwen Xiao*** [4], ***Prof. John Boland*** [3]

1. *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland,* ***2.*** *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland; AMBER Research Centre and Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Trinity College Dublin, Dublin 2, Ireland,* ***3.*** *AMBER Research Centre and Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Trinity College Dublin, D2, Ireland,* ***4.*** *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland; TrinityHaus, Trinity College Dublin, Dublin 2, Ireland*

Microplastics (MPs) have become a significant environmental health issue due to the potential risk to human health. Scientists are increasingly focusing on microplastics beyond the marine environment to daily used plastic products. Previous studies have explored the high level of MPs released from daily used plastic products, such as baby feeding bottles(Li et al., 2020) and plastic kettles(Shi et al., 2022). Therefore, the identification protocol of this test would be extremely important. Although the study protocol of MPs in marine or freshwater has been well developed, the daily-use conditions of plastic products are significantly different. This study indicated a proper protocol for identifying and analyzing the MPs release of daily used plastic products.

The daily used plastic products are frequently used under high temperatures (up to 100 °C), such as lunch boxes, water bottles, etc. It is crucial to develop a sampling protocol which can well mimic the most common daily-use scenarios. The protocol provided in this study takes baby feeding bottles as an example, which includes 1) mimicking the daily-use condition of the plastic products; 2) preventing the potential contamination during the experiments; 3) sample preparation and collection; 4) Quantitative and qualitative detection of MPs release. The developed methodology provided a reliable and cost-effective method for the determination of MPs released from commonly used plastic products. For the detection of other daily plastic products, the experimental conditions can be appropriately adjusted according to the actual application scenarios. The identification and analysis method provided in this study also can be applied to the future MPs study of plastic products.

Key words: Microplastics, plastics products, analysis method

Analysis of air quality and relationship with adverse mental health disorders in Ireland.

POSTERS (only) list - Poster

Ms. Kristina Leontjevaite [1], ***Dr. Aoife Donnelly*** [1], ***Dr. Tadhg MacIntyre*** [2]

1. *Technological University Dublin,* ***2.*** *Maynooth University*

Air pollution is one of the largest environmental health risks, accounting for about 7 million deaths worldwide per year (WHO, 2022; WHO, 2021). Current monitoring and research show that Ireland has an issue with air pollution. The main problem pollutants in Ireland remain PM2.5, which causes around 1'300 premature deaths per year, primarily due to cardiovascular and respiratory disease, and NO2 – responsible for urban air pollution and its concentration levels are projected to increase further in the future if no action is taken to mitigate its sources (OECD, 2021; EPA, 2022).

Mental Health is important at every stage of life, yet anxiety and depression are currently the leading disorders in Ireland (GoI, 2006; HI, 2021). Depression and anxiety both have enormous impacts on public health.

Currently, limited research exists on the relationship between mental health and air pollution exposure. Both living and working environments are often located near high trafficked and industrial areas that are prone to highly polluted air that could greatly contribute to added stress, anxiety, and depression.

The aims of this project are to estimate outdoor particulate matter and nitrogen dioxide (NO2) exposure to people living and working in urban and suburban areas near heavily trafficked roads in three major urban cities in Ireland and to investigate how air quality may affect mental health. The study will focus on psychological disorders of anxiety, depression, and stress. Measures of psychological resilience will be assessed in relation to the air quality in each of the categorized sample zones in Dublin, Cork and Limerick to establish whether any correlations exist. The research will contribute to the development of strategies to improve health and well-being through a better understanding of environmental stressors and improve sustainability goals in Ireland.

Encouraging Pro-Environmental Behaviour in Laboratories – A Plastics Challenge

POSTERS (only) list - Poster

Mr. Adam Boland [1], ***Mr. Adam Murphy*** [1], ***Ms. Samantha Fahy*** [1], ***Dr. Brian Freeland*** [1], ***Dr. Susan Kelleher*** [1], ***Dr. Keith Rochfort*** [1], ***Dr. Jennifer Gaughran*** [1]

1. *Dublin City University*

Throughout Ireland, there are thousands of diverse laboratories, working across many sectors. Many laboratories are incredibly resource-intensive, whilst producing large quantities of plastic waste. One 2015 study estimated that labs involved in biological, medical or agricultural research generate 5.5 million tonnes of plastic waste each year [1]. Funded under the SFI Plastics Challenge, DCU is working to replace much of the fossil-fuel based plastics and to reduce the total amount of single use plastics in labs.

Focusing on changing behaviour, a multi-stakeholder assessment was undertaken and plastic use and waste volumes were quantified within targeted pilot labs. Interventions have been identified, such as the implementation of the 'My Green Lab' (MGL) programme, a US based lab greening model currently being undertaken by over 900 labs, aiming to reduce the environmental impact of labs by encouraging users to make changes in the way labs are operated.

Alongside this, within pilot labs, full carbon footprints are being undertaken in order to achieve a cross-comparison between the current plastics being used in laboratories identifying those which are most environmentally impactful. Interviews have also been conducted with a variety of stakeholders to understand potential barriers to increasing laboratory sustainability.

Common themes have emerged which could guide policy and communication strategies around the greening of labs. The analysis revealed a high level of willingness to change, with institutional and infrastructural barriers constituting primary challenges to creating more sustainable laboratories. Recommendations for policy actions include the implementation of funding programmes designed to reduce the cost of more environmentally friendly choices, for example by allocating funds to make the price of eco-friendly alternatives to plastic consumables more competitive.

Acknowledgement: Research funded by Science Foundation Ireland (SFI), [20/FIP/PL/8940].

[1] Urbina, M., Watts, A. & Reardon, E., 2015, Labs should cut plastic waste too. *Nature* 528 (479), https://doi.org/10.1038/528479c

Preliminary Study on the Medicinal Properties of Irish Monofloral Honeys

POSTERS (only) list - Poster

Ms. Emma Browne [1], ***Dr. Siobhán Kavanagh*** [2], ***Dr. Sinead Devery*** [2]

1. *Bioscience Research Institute, Technological University of the Shannon: Midlands Midwest,* ***2.*** *Department of Pharmaceutical Sciences and Biotechnology, Technological University of the Shannon: Midlands Midwest, Midlands*

Background

Medicinal honeys are frequently used in hospitals and veterinary clinics for the treatment of surgical and traumatic wounds (Jull *et al*., 2015; Lukanc *et al.*, 2018). A preliminary sign that honey is medicinally active is the total phenolic content (TPC) which correlates with the honeys potential antioxidant and antimicrobial activity. Kavanagh, *et al.* (2019) detected TPC values in Irish heather honey that were comparable to manuka honey and reported higher than average TPC values for Irish ivy honey. As the medicinal properties of honey are related to floral origin and TPC, it is important to elucidate the potential of these two Irish honeys as medicinal agents.

Aim

This research aims to identify the medicinal properties of Irish honeys relative to their applicability as wound healing agents including an assessment of their immunomodulatory, antimicrobial, and antioxidant properties.

Methodology

A total of thirteen Irish monofloral honeys, six heather honeys (*Calluna vulgaris*) and seven ivy honeys (*Hedera helix*) were screened for TPC using the modified Folins-Ciocalteu assay and compared with manuka 250+, and 400+ MGO (Manuka Health) honey. Antimicrobial activity against three common wound pathogens (*E. coli, S. aureus,* and *P. aeruginosa*) was also assessed.

Findings

The heather honeys tested had the highest Irish TPC values 81.581 mg GAE/100g honey, versus 105.218 mg GAE/100g honey for manuka 250+ MGO honey. Ivy honey had 58.058 mg GAE/100g honey. Antimicrobial activity was observed for both heather honey and ivy honey.

Conclusion

The high TPC values for heather and ivy honey indicate potential medicinal properties. Further work will assess the direct immunomodulatory and antioxidant properties of these honeys and identify the minimum inhibitory concentrations (MIC) against several key wound pathogens. Confirming the medicinal properties of Irish honeys will provide benefits for Irish producers and add to conservation efforts for the Native Irish Honey Bee.

ContinuFor: Multifunctionality of Transformation to Continuous Cover Forestry.

POSTERS (only) list - Poster

Ms. Laura Harris [1], ***Dr. John Devaney*** [1], ***Prof. Áine Ní Dhubháin*** [2], ***Dr. Ian Short*** [3]

1. *Maynooth University,* ***2.*** *University College Dublin,* ***3.*** *Teagasc*

Authors: Laura Harris1, Áine Ní Dhubháin3, Ian Short4, John Devaney2

Affiliations: 1. Maynooth University. 2. Maynooth University. 3. University College Dublin. 4. Teagasc

Most Irish forests are even-aged plantations managed under a clearfelling silviculture system. National and European forest policy promotes the move to more environmentally sustainable forest management systems such as Continuous Cover Forestry (CCF). CCF is expected to increase forest structural diversity and enhance multiple ecosystem services.

ContinuFor is a newly funded research project that will assess the likely impact of transformation to CCF on multiple forest-related ecosystem services, including timber production, carbon sequestration, and biodiversity. Over the next three years, detailed assessment of carbon pools, vegetation diversity, and biotic and abiotic damage will be carried out across a network of Irish forest sites at different stages of CCF transformation. Natural regeneration is a crucial factor in successful CCF. This study will also assess the influence of CCF approaches and deer grazing pressure on the establishment and growth of natural regeneration. At selected CCF transformation trials, deer exclosure experiments will be established and the relationship between canopy openness, microclimate and deer browsing on the growth and physiological traits of tree seedlings and saplings will be quantified.

Finally, a framework for transforming even-aged conifer stands to CCF will be developed to identify stands suitable for CCF transformation. The framework will be applied to existing forest cover datasets to produce a spatially explicit map of CCF transformation suitability. This map of CCF transformation suitability is expected to be used by forest owners, managers and advisors as a tool to help guide decision making processes. Ultimately, ContinuFor will inform policy on how CCF transformation influences the delivery of forest-related ecosystem services.

Reverse genetic screen using comparative genomics

POSTERS (only) list - Poster

Mr. David F. G. Flores [1], ***Prof. Neil J. Rowan*** [1], ***Dr. Mark Daly*** [2], ***Dr. Ross Evans*** [3], ***Dr. Michael P. Mullen*** [1]

1. *Bioscience Research Institute, Technological University of the Shannon: Midlands,* ***2.*** *Software Research Institute, Technological University of the Shannon: Midlands,* ***3.*** *Irish Cattle Breeding Federation*

Livestock productivity has dramatically increased over the last 50 years, but pregnancy rates have decreased over the same period (Charlier *et al.*, 2016). An obvious economic loss is associated with poor fertility rates (Mee, 2013); additionally, gestating non-viable pregnancies wastes resources increasing methane emissions. A supported explanation for prenatal and perinatal mortality is homozygosity of lethal recessive (LR) mutations (Charlier *et al.*, 2016).

This study aimed to carry out a reverse genetic screen for bovine LRs using comparative genomics, utilising the growing number of open online repositories, including studies knocking out/inactivating genes, in conjunction with the ICBF genotyping programmes (McClure *et al.*, 2018).

Predicted LoF and damaging variants in alternative species were programmatically mined. Bovine homologs were prepared, and submitted to the ICBF for genotyping large (>300 k) cohorts. Putative LRs could be identified based on a significant depletion in homozygotes.
Numerous variants were present in the population, and completely absent the alternative homozygote. At the suggested Thermo Fisher Axiom™ array call rate threshold (≥ 97 %), 677 variants, 48.7 % of total variants submitted for genotyping were identified without any alternate homozygotes in the samples analysed; interestingly, the number of potentially fully penetrant LR variants was dependent on thresholds. Increasing sample stringency generally resulted in more variants absent a genotype class, i.e. missing homozygotes, thus potentially LR.
This study has identified new potential gene variants not previously associated with embryo survival in cattle. Recessive defects often go unnoticed as a low frequency, and marginal or lethal effect means they are difficult to detect (Derks *et al.*, 2017); thus, this research has availed of more focused genetic studies to identify potential LRs in cattle. Validation and inclusion into future genomic breeding programmes will support breeding decisions, likely improving fertility outcomes and reducing wastage.
Keywords: Cattle fertility, Embryonic lethality, Agri-food optimisation

Dealing with plastic packaging contaminated with residual amounts of food

POSTERS (only) list - Poster

Dr. Ashlene Vennard [1], Mr. Paul Cairns [1], Dr. Svetlana Tretsiakova-McNally [2], Mr. Ian Harvey [3], Dr. John Harrison [1], Dr. Charlie Farrell [1]

1. *South West College,* ***2.*** *Ulster University,* ***3.*** *Granville Ecopark*

Large quantities of packaged food wastes are used as a feedstock for renewable energy production through Anaerobic Digestion (AD). Although the packaging is separated from the food waste during processing, it remains heavily contaminated with the residues. For example, a local AD facility processes around 100,000 tonnes of food waste annually with around 8,000 tonnes of plastic packaging waste going directly to Refuse Derived Fuel (RDF) or landfill. This reduces a recycling potential of packaging polymers, increases the quantity of solid non-degradable waste and leads to an increase in methane emissions. There is potential to optimise this process by cleaning the packaging, making it attractive to recycle with the additional benefit of capturing residual food waste, which enhances renewable energy yield. The aim of the RE:Solve project, commenced in February 2022 and supported by Ecosurety, is to develop a novel process that effectively separates the waste plastic packaging from food.

Preliminary results indicated that significant amount of water (40 L/kg packaging) would be required to clean the packaging to a level acceptable for further reuse or recycling. Encouragingly, initial tests showed that food residues could be removed via a mechanical process, thus eliminating the need for large volumes of water in a cleaning process. This was achieved by processing the dried packaging in a cutting mill. Preliminary tests also indicated that particle density separation methods could separate out the cleaned material into different types of plastics.

Through this project, we endeavour not only to address the plastic pollution problem but also to recycle food waste packaging via development of process prototype that will effectively separate the food and the plastic wastes, with appropriate routes for reuse.

Prediction of radiant intensity using analytical and numerical simulation techniques

POSTERS (only) list - Poster

Mr. Adithya Pai Uppinakudru [1], ***Ms. Cintia Casado Merino*** [2], ***Dr. Ken Reynolds*** [3], ***Mr. Simon Stanley*** [3], ***Prof. Prof. Javier Marugan Aguado*** [2], ***Dr. Cristina Pablos*** [2]

1. *Universidad,* ***2.*** *Department of Chemical and Environmental Technology, ESCET, Universidad Rey Juan Carlos, C/Tulipán s/n, 28933 Móstoles, Madrid, Spain,* ***3.*** *ProPhotonix IRL LTD, 3020 Euro Business Park, Little Island, Cork, T45 X211, Ireland*

Measurement of irradiation reaching the surface of water has been the key to understanding the process of disinfection. There have been multiple challenges to achieving this measurement, including increased cost of detectors or sensors that work in water medium. Academia has employed use of chemical actinometry and discrete ordinate modelling to measure irradiation within a particular system. The lighting industry employs radiometry for light measurements in air-medium and uses high-cost sensors for measurements in water medium. This study demonstrates a simple and novel simulation method for prediction of radiant intensity reaching a point of interest using industrial optical modelling tool, ZeMax Optic Studio. ZeMax optic studio is a radiation modelling tool employed for design and production of new light emitting devices for different applications. The study compares the technique with literature and academically used analytical and numerical simulation tools to understand the validity of the simulation. Simulations have been conducted in two mediums (air and water) and compared with radiometric measurements, actinometric measurements and discrete ordinate modelling techniques. As a result, prediction of radiant intensity in a water-based medium was successfully simulated. In addition, the effect of quartz tube and increase in radiant intensity due to refraction of light within the water medium has been investigated and presented. Furthermore, the results from the simulations have been seen to be consistent with the results obtained from chemical actinometry, radiometry and discrete ordinate modelling. In conclusion, the novel technique enables precise measurement of light irradiation while reducing simulation time and enabling easier design of the system within the tool.

Biohydrogen Generation from Wastewater using Microbial Electrolysis Cells – A Study of Cost-Effective and Recycled Anode Materials

POSTERS (only) list - Poster

Mr. A K M Khabirul ISLAM [1], ***Dr. Patrick Dunlop*** [1], ***Prof. Neil Hewitt*** [1], ***Prof. Ye Huang*** [1], ***Dr. Nigel Ternan*** [1], ***Dr. Swati Jindal*** [2], ***Prof. Ke Zhang*** [3], ***Dr. Caterina Brandoni*** [1]

1. *Ulster University,* ***2.*** *Bournemouth University,* ***3.*** *North China Electric Power University*

Background: Biohydrogen production from wastewater has great potential to generate significant quantities of sustainable energy. Microbial electrolysis cells (MECs) not only treat wastewater but produce H_2 with substantial benefits over conventional fossil fuel-based H_2 production techniques, however, implementation has been restricted by high capital costs, particularly relating to the electrode materials.

Aim: The aim of this work focused on the use of cost-effective and recycled materials for electrodes in MEC and study the performance in terms of H_2 production and chemical oxygen demand (COD) reduction.

Methodology: The materials selected included, recycled carbon fibre (RCCF), recycled water filter powder (RWFP), and graphite flexible powder (GFG). Single-cell MECs were manufactured with the candidate material anodes and compared to industry standard carbon felt (CF) in terms of H_2 generation and reduction of COD from wastewater in a laboratory study. Electrochemical performance and scanning electron microscopy also conducted. To monitor the treatment potential of different anode based MECs, periodically influent and effluent COD also measured.

Findings: GFG anode based MECs exhibited the rates of highest H_2 production and COD reduction (0.26±0.02 L/L/d; 77.66 ±5.5%, respectively) while CF based MECs showed lower performance (0.212±0.009 L/L/d and 72.54±4.86%). RCCF anode based MECs showed comparable performance (H_2: 0.213± 0.02 and COD: 74± 5.29%) with CF, but RWFP did not perform as well (H_2: 0.075± 0.015 L/L/d and COD: 66.66± 4.5%).

Conclusion & Implications: Significant production cost savings were calculated for MEC anodes using RWFP, RCCF and GFG (94%, 75% & 81% respectively) compared to CF (based on $1m^2$ anode). Our work confirms that low-cost, recycled materials could play a critical role in reducing the capital costs of MECs, whilst attaining similar rates of hydrogen generation and levels of effluent quality empowering the wastewater treatment sector to embrace a circular economy approach and become more sustainable.

INACTIVATION OF Aeromonas hydrophila USING HOUSEFOLD WATER TREATMENT

POSTERS (only) list - Poster

Dr. Margarita Hincapie [1], ***Dr. Luis Javier Montoya*** [1], ***Dr. Liliana Botero*** [1], ***Dr. Laila Galeano*** [1], ***Dr. Gloria Carvajal*** [1]

1. *University of Medellin*

Background: *Aeromona hydrophila* is a common emerging pathogenic bacterium in natural waters that affects the quality of drinking water, becoming a challenge for alternative technologies that aim to provide drinking water to families in rural communities that lack treatment systems. The importance of detecting bacteria of the genus Aeromonas has increased due to public health concerns about their prevalence and distribution, as well as their potential pathogenicity. In Antioquia (Colombia), the rural communities studied reported high levels of Aeromonas in the drinking water, evidencing the health risk and the need to include the monitoring of these bacteria in the development processes of technologies to provide drinking water to communities. the families.
Objective: The inactivation of the *Aeromona hydrophila bacteria* was evaluated by synthetic and natural water, treated in the domestic water system (HWT) developed within the framework of the Safewater project.
Methodology: The domestic water treatment system (HWT) is composed of three processes: sedimentation, filtration, and disinfection, samples were treated with synthetic water and natural water in homes and schools in two rural areas of Antioquia (Colombia). For the quantification of *Aeromona hydrophila*, the modified Agar Base medium for Aeromonas RYAN (Oxoid™) was used. The detection limit (DL) of *Aeromona hydrophila* was 1 CFU/100ml.
Findings: The HWTS used to provide safe water are efficient in inactivating bacteria of the genus Aeromonas. High concentrations of Aeromonas show permanent health risk in the rural communities studied.
Conclusions and Implications: The HWTS showed high effectiveness in the inactivation of the bacteria of the Aeromonas genus present in synthetic waters, reducing the concentration in 3 Log, however, the results in treated natural waters showed persistence of wild Aeromonas, which continues to be a problem. The challenge for its inactivation in drinking water.

Socio-technical model for water provision in slums and migratory movements

POSTERS (only) list - Poster

Dr. Ester Guimaraes [1]

1. *SABESP WATER AND SANITATION COMPANY ESP*

The migratory movements of vulnerable populations to urban centers searching for better living conditions resulted in social exclusion and sprawl in recent decades. The access to water and sanitation services (WS&S) by the population in situation of social vulnerability is the purpose of this article. Exclusion mechanisms and the principle of human dignity characterize disputes and increase the complexity of the solutions. It is important to examine how decision-makers consider these citizens, and how governance procedures can help the effectiveness of essential services provision in compliance with human rights. It is necessary to adopt an innovative governance approach able to capture the exclusion conditions of people, promote social participation as well as social control and empowerment. The innovation was made by acting on the theoretical and practical discussion in 11 workshops supported by the theory-actor-network for the unique and participatory construction of requirements that have been tested in WS&S of 9 municipalities in Brazil. The essential dimensions to governance innovation have been identified considering the singularities of the exclusion mechanisms, and metrics (indicators) designed to meet the fundamental right of access to WS&S. After the mapping of controversies, the concept of Inclusive Governance was built with the corresponding metrics and socio-technical model to worldwide provision for migratory movements.

E.F. Guimarães, T.F. Malheiros, R.C. Marques, **Inclusive governance: New concept of water supply and sanitation services in social vulnerability areas**, Utilities Policy, Volume 43, Part A, 2016.

Juliano EF, Malheiros TF, Marques RC. **The involvement of community leaders in healthcare, the environment and sanitation in áreas of social vulnerability.** Cien Saude Colet. 2016.

Juliano EF, Feuerwerker LC, Coutinho SM, Malheiros TF. **Rationale and knowledge for the universal implementation of sanitation in areas of social vulnerability.** Cien Saude Colet. 2012.

3D-printed air-cathodes for microbial fuel cells

POSTERS (only) list - Poster

Mr. Yifan Sun [1], ***Ms. Zeena Wang*** [1], ***Dr. Dunzhu Li*** [2], ***Dr. Yunhong Shi*** [2], ***Ms. Luming Yang*** [1], ***Dr. Liwen Xiao*** [3]

1. *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland,* ***2.*** *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland; AMBER Research Centre and Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Trinity College Dublin, Dublin 2, Ireland,* ***3.*** *Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin 2, Ireland; TrinityHaus, Trinity College Dublin, Dublin 2, Ireland*

Additive manufacturing (AM), also known as three-dimensional printing (3D printing), has been applied to fabricate microbial fuel cells (MFC) reactors. However, very few studies have investigated 3D-printed cathodes, which could be due to the challenges of finding suitable filaments. So far only one commercial filament (ProtoPlant conductive PLA) has been successfully tested [1, 2]. This study aims to fabricate high electrical conductive filaments for 3D printed cathodes and assess the performance of MFCs with 3D printed air cathodes on wastewater treatment. The study successfully manufactured MFCs using filaments made from PLA and graphite. Its performance was compared with those made from Recreus 3D conductive TPU Filaflex and ProtoPlant conductive PLA.

Keywords: additive manufacturing; microbial fuel cells; air-cathodes;

National Wastewater Surveillance as an early warning system for SARS-CoV-2

POSTERS (only) list - Poster

Ms. Niamh Holohan [1], ***Ms. Alannah Byrne*** [1], ***Ms. Sanne Fennema*** [1], ***Ms. Natasha Sarwar*** [1], ***Ms. Sailusha Kuntamukkula*** [1], ***Mr. Wim Meijer*** [1]

1. *UCD School of Biomolecular and Biomedical Science*

Individuals infected with SARS-CoV-2, both symptomatic and asymptomatic, shed viral RNA in their stool. The RNA is stable and quantifiable in sewage for up to two weeks. This suggests that environmental surveillance of wastewater is an effective method to monitor the circulation of SARS-CoV-2 in the Irish population. The objective of this project is to monitor the prevalence of COVID-19 in communities across Ireland.

Wastewater samples from 68 plants, covering 84% of the Irish population are taken weekly. The polyethylene glycol precipitation method is used to concentrate the virus from the samples. RNA is extracted from the concentrated sample using the RNeasy PowerMicrobiome kit. Reverse Transcription-quantitative PCR is used to quantify SARS-CoV-2 in samples by targeting the nucleocapsid 1 gene sequence. Results are expressed in N1 gene copies/100ml and converted to gene copies/day (gc/day) by normalising against the 24hr flow data from each plant.

The findings reveal a strong positive correlation between regional clinical case numbers across Ireland and the concentration of SARS-CoV-2 in wastewater samples from their respective areas. Cumulative weekly results give insights into temporal trends in SARS-CoV-2 levels in the Irish population. This system is effective on a smaller scale and has been successful in tracking SARS-CoV-2 in universities and meat processing plants across the country. Retrospective variant analysis carried out on Dublin city samples has revealed that the alpha variant was circulating in the population before its detection in clinical samples.

Wastewater surveillance is an effective tool for monitoring SARS-CoV-2 trends across Ireland. The regional nature of our surveillance enables the identification of localised outbreaks and provides data for communities where clinical testing is limited or has ceased. Further variant analysis is to be carried out using Digital Droplet PCR and there is the potential to expand this research to investigate other human pathogens in Ireland.

Use of waste shell as a low-cost adsorbent for phosphate removal in wastewater

POSTERS (only) list - Poster

Ms. Brakemi Egbedi [1], ***Dr. Shiau Pin Tan (Graece)*** [1], ***Dr. Mike Kinsella*** [1], ***Dr. Helen Hughes*** [1]

1. *Eco-Innovation Research Centre, Waterford Institute of Technology, Cork Road, Waterford, Ireland*

Background: Seashell wastes are the largest by-products generated by shellfish processors in South-East Ireland and there is a growing stockpile of these shells which amount to approximately 3560 metric tonnes per annum by some shellfish processing companies in the region. One of the urgent research needs in South-East Ireland is that of wastewater purification. The efficiency of waste shells as low-cost adsorbents for the removal of phosphates from wastewater was thus investigated.

Methodology: The influence of different experimental parameters such as pH, initial concentration and adsorbent dose, and their interactions on phosphate adsorption capacity of the shells were investigated, informed by a central composite design (CCD) to optimise experimental conditions. Batch kinetics and equilibrium studies were conducted, and the adsorbent was characterized using scanning electron microscopy (SEM) with Energy Dispersive X-Ray Analysis (EDX), and Fourier transform infrared spectroscopy (FT-IR).

Findings: The optimized CCD values of pH, initial concentration and adsorbent dose was pH 4.5, 90 mg/L and 0.2 g respectively. The adsorption kinetic data showed excellent correlation with the pseudo-second order model. Adsorption equilibrium data were well described by the Freundlich isotherm which had the highest correlation coefficient (R^2) value. Characterization studies showed the appearance of phosphate on the surface of the shells post experiment thus, indicating that adsorption is the main mechanism for phosphate removal onto waste seashells.

Conclusion and Implications: The results indicate that waste shells in their natural state, have a potential for the sorption of phosphate. Ongoing studies are being done to increase the phosphate sorption capacity of the shells for use in the treatment of wastewater industrially.

Using Rainfall as a Parameter to Develop a Live Bathing Water Quality Prediction System

POSTERS (only) list - Poster

Ms. Megan Whitty [1]

1. *University College Dublin*

Over recent years, sea swimming has grown in popularity in Ireland, with many people using beaches both during and outside the designated bathing season. Several factors can influence bathing water quality such as point source pollution, tides, and weather conditions. Poor water quality can have a negative impact on human health, causing gastrointestinal issues and infection. The aim of this research is to determine whether increased rainfall or storm events impact bathing water quality. Rainfall is also explored as a parameter to develop a live bathing water quality prediction system.

Over 420 samples were collected from three beaches in the republic of Ireland (Clogherhead in County Louth, Enniscrone in County Sligo, and Lady's Bay in County Donegal) during the bathing season in 2019 and 2020. Faecal indicator bacteria, Intestinal Enterococci and *Escherichia coli*, were quantified (MPN/100ml) using IDEXX Quanti-Trays, Colilert and Enterolert. Samples were classified according to the EU Bathing Water Directive (2006/7/EC), with poor water quality defined as <500cfu/ml for *E.coli* and <185 cfu/ml for Intestinal Enterococci. Higher levels of both *E.coli* and Intestinal Enterococci were recorded after rainfall events at all three sites. Additionally, significant in-day variation of faecal indicator bacteria values was observed. Due to the observed in-day variation of faecal indicator bacteria levels, it can also be concluded that single compliance samples are not sufficient to determine water quality. Predictive modelling needs to include tide and rain events and most likely other parameters such as wind direction to generate reliable data. This is an issue of increasing importance country wide and should be considered for implementation by local authorities around the country.

Capability of granular activated carbon to remove Cryptosporidium oocysts from drinking water

POSTERS (only) list - Poster

Dr. Seila Couso-Pérez [1], ***Dr. María Jesús Abeledo-Lameiro*** [2], ***Ms. Ana Isabel Vidal-Varela*** [3], ***Dr. Hipólito Gómez-Couso*** [3]

1. *School of Engineering, Ulster University, Shore Road, Newtownabbey, BT37 0PB, United Kingdom,* ***2.*** *Plataforma Solar de Almería-CIEMAT, Ctra. Senés km 4, 04200 Tabernas, Almería, Spain,* ***3.*** *Laboratory of Parasitology, Department of Microbiology and Parasitology, Faculty of Pharmacy, University of Santiago de Compostela, 15782 Santiago de Compostela, A Coruña, Spain*

Cryptosporidium is a genus of protozoan parasites with a worldwide distribution that infect the epithelium of the gastrointestinal tract of many vertebrate hosts, including humans. These parasites are frequently detected in waterborne outbreaks in developed countries, being *Cryptosporidium* involved in 76.5% of the reported outbreaks between 2017-2020. Granular activated carbon (GAC) filters are mainly used to remove natural organic matter and micro-pollutants or control unpleasant taste and odour in water. In the last 20 years, the use of GAC to remove pathogenic microorganisms from water has been extended.

The aim of the present work was to evaluate the capability of GAC in the removal of *Cryptosporidium* oocysts from drinking water. Thus, well water was spiked with 10^5 oocysts of *Cryptosporidium parvum* per litre and pass through a column loaded with bed heights of fresh GAC from 5 to 50 cm, at a flow rate of approximately 0.1 L/min. The number of oocysts was quantified in the influent and effluent water samples in each assay by a direct immunofluorescence test.

The results showed high efficiencies of GAC to eliminate *C. parvum* oocysts from water. The capability of GAC increased as the filter bed height increases. Thus, removal efficiencies >2 log were achieved with bed height ≥30 cm and >3 log reductions were observed with bed height ≥45 cm. Even, for a GAC bed height of 50 cm, the removal of *C. parvum* oocysts was 3.47±0.31 log.

Considering the results of the experiments and the filtration conditions, the *C. parvum* oocysts were removed significantly and, therefore, GAC adsorption filters can be additional serious barriers against this waterborne protozoan parasite in water treatment facilities.

This study was funded by the European Union's Horizon 2020 Research and Innovation Programme (grant agreement number 820718). SC-P is granted by the Margarita Salas Mobility Fellowship Programme.

Investigating Ireland's Blue Carbon Potential Through a Scientific, Socio-economic and Legislative Approach (BlueC)

POSTERS (only) list - Poster

Dr. Grace Cott [1], ***Dr. Pedro Beca-Carretero*** [2], ***Dr. Rachel Cave*** [3], ***Prof. Mark Johnson*** [3], ***Prof. Stephen Hynes*** [3], ***Dr. Anne Marie O'Hagan*** [4], ***Prof. Tasman Crowe*** [5], ***Prof. Dagmar B. Stengel*** [6]

1. *School of Biology and Environmental Science, University College Dublin,* ***2.*** *Department of Theoretical Ecology and Modelling, Leibniz Centre for Tropical Marine Research, and Department of Oceanography, Institute of Marine Research, Vigo, Spain,* ***3.*** *National University of Ireland, Galway,* ***4.*** *University College Cork,* ***5.*** *University College Dublin,* ***6.*** *Botany and Plant Science, School of Natural Sciences, and Ryan Institute, National University of Ireland Galway, University Road, Galway, Ireland, H91 TK33.*

Oceans and coastal systems play a significant role in the global carbon cycle, representing the largest long-term sink of carbon (C). Ireland has two blue carbon (BC) habitats; saltmarsh and seagrass meadows, and a vast marine territory containing potential BC systems, such as C-rich macroalgae, phytoplankton and sediments. Specifically for Ireland, there is a paucity of data on the C storage capacity of these ecosystems, and a lack of coherent management strategies hampers the ability to integrate these ecosystems into climate policy frameworks. Here, we outline how the BlueC project aims to advance scientific understanding of the C dynamics in Irish coastal and marine environments, whilst simultaneously improving management and harnessing their potential for climate mitigation, adaptation and other ecosystem services to underpin policy development. Cross-cutting work packages will be carried out by the multidisciplinary team focusing on: C stocks and sequestration rates in seagrass meadows; C provenance and C fluxes in saltmarsh habitats; an assessment of the extent of BC habitats; the establishment of a long-term monitoring site for saltmarsh and seagrasses enabling experimental manipulation of climate change factors; a detailed evaluation of "potential" BC ecosystems and hotspots; a quantification of the socio-economic, biodiversity and coastal protection relevance of BC habitats; and development of long-term management strategies for BC habitats in line with existing and future legislative mechanisms. Engagement with stakeholders will be a key goal throughout this project in addition to building national capacity for BC research. A key deliverable from this project will be a validated national inventory of the C storage capacity of BC habitats which will enable inclusion in National Inventory Greenhouse Gas reporting to the UNFCCC. Moreover, through improved management of BC ecosystems this project will assist Ireland and the EU in meeting climate change objectives, thus realising significant benefits for society.

Toxicity bioassays in water clarified by the natural coagulant Opuntia cochenillifera

POSTERS (only) list - Poster

Dr. Bárbara Freitas [1], Dr. Ulisses Costa Terin [1], Dr. Natália de Melo Nasser Fava [1], Prof. Lyda Patricia Sabogal Paz [1]

1. *Department of Hydraulics and Sanitation, São Carlos School of Engineering, University of São Paulo, 400 Trabalhador São-carlense Avenue, São Carlos/SP, 13566-590*

Background: Natural coagulants are more suitable to isolate communities than chemical products due to its availability, biodegradability and low cost. Among them, *Opuntia* spp. cacti stand out with promises results in turbidity removal (Freitas & Sabogal-Paz, 2020). However, being efficient does not guarantee its applicability, especially as cactus is a natural product subject to contamination. For that, bioassays emerge as an option to evaluate the toxicity of *Opuntia* spp. in water.

Aim: To assess the toxic potential of *Opuntia cochenillifera* as a natural coagulant to clarify water by acute bioassays

Methodology: *O. cochenillifera was* extracted from an urban area of São Carlos/SP/Brazil and used for water clarification as natural powdered coagulants (30 mg/L and pH 6.5). We carried out toxicity tests by four replicates in non-toxic polypropylene containers, one with distilled water and three with clarified water (OECD, 2011). In each, we added 200mL of referring solution and 6IV instar larvae previously fed. Bioassays were kept without any aeration for 96h with 12h photoperiod at 22-26°C.

Findings: All the *C. xanthus* larvae survived the acute bioassays; therefore we were not able to calculate the lethal doses to organisms (LC_{50}).

Conclusions & implications: Although the bioassays do not show evidence of acute toxicity to *C. xanthus* larvae, this still does not prove the inexistence of others toxic effects of *O. cochenillifera* in drinking water. Nonetheless, our study contributed to expand the knowledge about this natural coagulant, in order to enable its safe use in isolated communities.

Acknowledgment: Global Challenges Research Fund UK Research and Innovation (EP/P032427/1); The Royal Society (ICA\R1\201373); and CNPq (308070/2021-6).

References:

Freitas, B.L.S., Sabogal-Paz, L.P.,2020. Pretreatment using *Opuntia cochenillifera* followed by household slow sand filters: technological alternatives for supplying isolated communities. Environmental Technology, 41, 2783-2794.

OECD. 2011. Test No 235: *Chironomus* sp. - Acute Immobilisation Test. OECD Publishing.

Unmanned aerial vehicles for mapping seaweed: RGB and multispectral sensors

POSTERS (only) list - Poster

Mr. Damir Akhmetshin [1], ***Dr. Owen Naughton*** [1], ***Dr. Leon Cavanagh*** [1], ***Dr. Dean Callaghan*** [1]

1. *South East Technological University*

Progress in development of unmanned aerial vehicles (UAVs) and off-the-shelf cameras and sensors have led to an expansion of their use in environmental monitoring. Multispectral sensors allow for more in-depth analysis of habitats. However, visible range cameras have limitations when applied to finer analysis and differentiation between taxa. Here RGB and multispectral sensors mounted on a UAV for mapping seaweed in the intertidal zone of the Irish coastline are compared. The applicability of RGB imagery for classification of features and species in the intertidal zone is shown. RGB sensors, despite poorer performance for inter-species classification, were effectively used for broad class segmentation and large-scale monitoring. Furthermore, it is demonstrated that multispectral sensors allow for better segmentation between seaweed species. It is also shown that certain limitations can be overcome by combining broad RGB channels and narrow-band multispectral sensors, improving accuracy of classification and ability to detect seaweed in the shallow subtidal zone.

Authors Index