



20 YEARS of the ERI

Twenty years ago when Bill Clinton was 42nd president of the United States, Tony Blair was Prime Minister and Britney Spears 'Did It Again' taking the number one spot in the UK singles chart. Meanwhile, change was in the air in Scotland: The Devolved Scottish Parliament was celebrating its first anniversary, and in the north the idea of a University in the Highlands and Islands was taking root.

In Thurso, the 9th of May saw the opening of the Environmental Research Institute following a £1.6M sympathetic refurbishment of the former Victorian 'West Public School'. The North Highland College, as one of the partners in the University of the Highlands and Islands project (UHIp), had secured the funding package from the European Regional Development Fund and the Millennium Commission in partnership with Caithness & Sutherland Enterprise, and the UKAEA, Dounreay.



The official opening was performed by Jamie Stone, then the MSP for Caithness, Sutherland and Easter Ross in a celebratory event bringing stakeholders from around the region.

In 2000, the Institute was positioned as a multifunctional facility, capable of 'undertaking research activities, delivering educational services and acting as a field unit and conference centre'. Its original mission was to address the educational, economic, social and cultural needs and aspirations of the region through undertaking high quality research and educational activities.

Twenty years later, the ERI is still a centre of aspiration, one seeking 'to be internationally recognised for distinctive and innovative environmental science'. It has developed strong, strategic partnerships and collaborations with academic, commercial and stakeholder organisations from within the region to around the world. Projects have ranged from a few thousand to several million pounds on subjects including environmental contamination, peatland restoration and marine energy.

The Institute's forty staff and research students had much to celebrate with College and University colleagues at this 20 year landmark. However, amid the Covid-19 pandemic, events to mark the anniversary have sadly been put on hold, and instead we plan to celebrate our 21st birthday in good style.

In the meantime, we will share some stories from the past twenty years on our website (eri.ac.uk) and through twitter (twitter.com/ERI_UHI) using #ERI20years, and extend our immense gratitude to all the individuals and organisations who have contributed to, or supported our work over these years: it has been quite an adventure – thank you all!

Prof Stuart Gibb (ERI's first employee, and current Director)

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Antimicrobial Resistance in Freshwater Invertebrates

Bacteria developing resistance to the drugs which inhibit or kill them is perfectly natural. Alexander Fleming warned of this in 1945, regarding the potential misuse of Penicillin. With our extensive, and in many cases irresponsible use of antibiotics in the past century, such antimicrobial resistance (AMR) is now responsible for around 700,000 human deaths every year. According to some estimates, AMR is predicted to result in millions of annual deaths within the next few decades. Fortunately, many areas have been identified where we can take action to prevent such a scenario coming to pass. Many bacterial pathogens (such as *E. coli*) become resistant through exposure to antibiotics at their site of use, e.g., hospitals. However, we know that AMR bacteria exist beyond these sites. What we are less aware of is how prevalent they are in the wider environment. Surveillance of AMR bacteria within wildlife populations has therefore been identified as a key research area to help shed light on this.

Following on from work looking at AMR *E. coli* in Scottish wild deer, ERI PhD research student Derek Elsby is also looking at AMR *E. coli* in freshwater invertebrates. Freshwater systems are particularly important in terms of AMR, as they are subject to an influx of antimicrobial residues from land run-off and sewage treatment effluents. Over the 2019 summer, and with the help of ERI's Paula Fernandez, invertebrate samples were gathered from three different rivers in the Scottish Highlands - the Naver, Wick and Thurso rivers. *E. coli* present in the guts of these invertebrates was assessed for resistance to a suite of antimicrobials. The results indicate that bacteria 'immune' to modern medicines do exist in the stomachs of these invertebrates. This is not entirely unexpected - and is not currently a cause for concern - but provides a valuable baseline for future monitoring of AMR spread.



The next step is to investigate if local factors within a river catchment - including forestry, livestock grazing, wastewater treatment and urban settlements - have any association with the AMR within the bacteria found in our river's smallest inhabitants. This work increases our understanding of AMR and, coupled with more responsible and informed use of our medicines, goes towards ensuring that our health care systems will continue to function into the future.

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You can also learn more about AMR at the WHO website:
<https://bit.ly/2diwKDH>



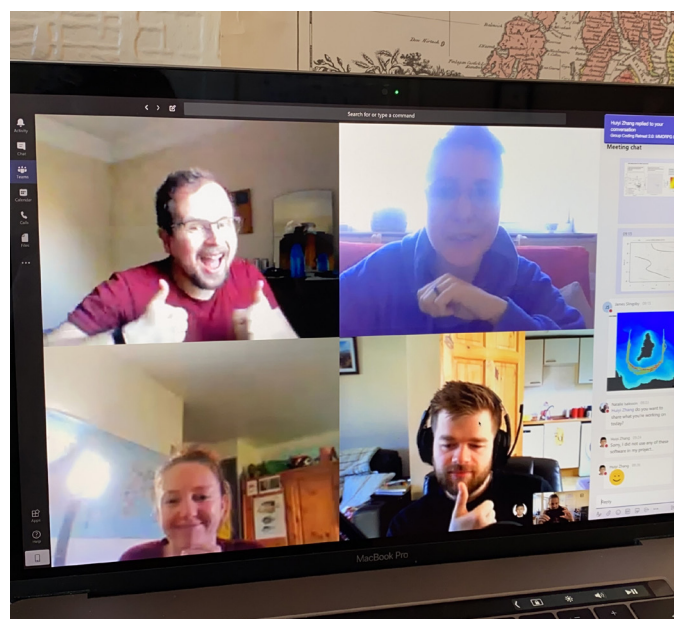
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ERI Coding Retreat moves online

With the Covid-19 'lock-down' impacting the way we all live and work, PhD students Natalie Isaksson and Henk Pieter Sterk decided to take the ERI coding retreat to an online platform. The aim was to provide an environment where research students and staff could learn, practise and share knowledge about software, mathematical coding and digital map-making - some of the tools used for data analysis, processing and visualization.

Using the power of Microsoft Teams, a full-day virtual meet-up was organised, that included students from across ERI and from the North Atlantic Fisheries College UHI on Shetland. Participants discussed their work, challenges and training resources throughout the day, with video chat breaks for 'lock-down' socialising. The online format of the retreat was given an enthusiastic stamp-of-approval by participants, plans to hold a similar event in the future are in the planning.

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Healthcare and the environment

A ground-breaking collaboration in the north Highlands has been shortlisted for a prestigious award by the British Medical Journal (BMJ).

The 'One Health Breakthrough Partnership' has been shortlisted in the 'Environmental Sustainability and Climate Action' category for the BMJ Awards for 2020. The Partnership involving NHS Highland, the University of the Highlands and Islands, Scottish Water, the James Hutton Institute and environmental regulator SEPA established new ways of working together to align effective healthcare and environmental stewardship.

The nomination saw a project at Caithness General located in Wick, becoming the first hospital in the world, and first site in Scotland, to secure certification from the Alliance for Water Stewardship (AWS). The award recognises the hospital is making positive and innovative moves towards becoming more environmentally sustainable.

Sharon Pfleger, NHS Highland Consultant in Pharmaceutical Public Health will present to the final judging panel on behalf

of the partnership members at the BMJ judging event in London later in the year. She commented 'The BMJ Awards are the UK's leading medical awards promoting excellence in healthcare and recognising the inspirational work of teams across the country. To be shortlisted as a finalist is recognition that the One Health Breakthrough Partnership is innovating in a space that hasn't yet been tackled in the NHS. We are truly at the forefront of ensuring that healthcare is sustainable and responsible, improving not just the health of the population but also the planet'.

The initiative has already attracted the attention of Jeanne Freeman, the Minister for Health and Sport, who recently visited Caithness General Hospital accompanied by local MSP Gail Ross. The minister was keen to learn about the activities of the 'One Health Breakthrough Partnership', and how its impacts could be realised at other hospitals across the country.

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The Carbon Footprint of a Highland Estate

In 2019, the Scottish Government declared a 'global climate emergency' and set a target of 'net-zero emissions' by 2045. While rural land-use change and business strategies may contribute to meeting this target, there are significant gaps in knowledge, including the role of highland estates.

To help address this deficit, a desk-based study was undertaken to estimate the carbon footprint of the Langwell & Braemore (Welbeck) Estate in Caithness. The estate has been already active in large-scale peatland restoration since 2015, through Peatland Action (the Scottish Government's funding for peatland management), with over 1000 hectares re-wetted through drain blocking and gully reprofiling so far.

The work was conducted by Pia Tappe, a third-year undergraduate environmental science student from the University of Münster in Germany with the ERI's Roxane Andersen and Magnus Davidson and was supported through the Erasmus+ programme.

The case study utilised data from IPCC reports as well as Scottish Natural Heritage, Peatland Action and more recent reports on UK specific emissions from peatlands, to assess potential emission savings from current peatland restoration activities on the estate and in the future. It also examined anthropogenic emissions from heating, power, transport, and fertilisers, and looked at savings from measures the estate had already undertaken, such as transitioning to biomass for heating.

Results showed that, using current reporting methods and estimates, peatland restoration has potentially reduced the estate's emissions by ca 3,754 tCO₂e year⁻² so far, and that if all drained areas were to be re-wetted, a further 6,034 tCO₂e year⁻²



could be saved. This dwarfs any further potential savings from changes in business activities, which currently only contribute 3% of all emissions on the estate.

The project concluded that undertaking peatland restoration is the best strategy for highland estates with large areas of drained peatlands, to contribute to the national net-zero emissions target. In this case, peatland restoration enabled the Langwell & Braemore (Welbeck) estate to potentially 'switch' from a net source (ca. 2140 tCO₂e year⁻²) to a net sink (-3640 tCO₂e year⁻²) of greenhouse gases. While the project identified changes specific to a Caithness estate, it is envisaged that methods and lessons learnt may translate to other estates across rural Scotland.

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Birds and Debris website

Last summer we launched the Birds and Debris website to help explore which bird species are most affected by anthropogenic debris – looking at where, as well as what type of debris, from different sources. Thank you to everyone who has submitted images to date. We are interested in images of entanglement or nest incorporation of debris from any time period, from anywhere in the world. Therefore, if you come across any images of birds and debris whilst sorting through boxes of photographs or memory cards then please submit them to our

website www.birdsanddebris.com. The oldest photograph that has been submitted so far is of a Northern Gannet nest with rope incorporated on Sule Stack (60 km west of the Orkney mainland) taken in 1967, highlighting that plastic pollution is not just a recent issue.

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APP4SEA project



Researchers from ERI recently presented in a Twitter conference on 'Challenges of the Arctic oil spill response' to mark the end of the APP4SEA project, in April 2020. Experts from across the Northern Periphery and Arctic (NPA) region, as well as further afield, discussed everything from oil spill responses in Arctic and icy conditions, to the ecological impacts of potential oil spills in the Arctic. You can see these presentations by searching for #APP4SEA2020.

APP4SEA was a three-year project that was launched in May 2017 to address the issue of oil spill accidents in the Arctic marine environment. The main goal was to 'improve our preparedness for such accidents, save the environment and keep communities and their sea food supply safe'.

ERI were one of eight partners from four different countries (Finland, Norway, Iceland and Scotland) involved in the project. Our main contribution was assessing the vulnerability of seabird species to oil pollution across the NPA region.

Seabirds are particularly vulnerable to oil pollution, which can cause mass mortality events, with even minor oil spills causing problems. In severe spills, such as Deepwater Horizon in the Mexican Gulf (in 2010) or Exxon Valdez off Alaska (in 1989),

tens if not hundreds of thousands of birds die. Although large oil spills and disasters can affect and kill large numbers of individuals, persistent oil pollution, for example from cleaning oil tanks at sea or continuous leakages from pipes, is thought to have the greatest impact on seabirds.

Due to their ecology, some seabird species are more likely to be affected by oil than others. Species that dive from the surface in search for food, such as seaducks and auks, will be more likely to come in to contact with oil than species such as gulls and terns, which spend less time on the sea surface. Therefore, we can estimate the vulnerability of different seabird species to oil by taking into account their behaviour and life history characteristics. This method allows us to create an index for the sensitivity of seabirds to oil – Oil Vulnerability Index (OVI). We can then identify where in the region these species may be most at risk from oil pollution by mapping the seabird's distributions.

You can explore the APP4SEA map, including the seabird layers, at <http://www.app4sea.com/>

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New faces @ ERI

Dea Blanus Erasmus+ student



Hi, my name is Dea and I am from the University of Novi Sad and part of the Erasmus+ mobility programme. I am currently completing a masters degree in Environmental Engineering.

I am very grateful for this opportunity to be in Scotland, to meet new people from various countries and to experience the Scottish culture.

At the ERI, I am working with Dr Mark Taggart and Dr Szabolcs Pap and my project is focused on the adsorption of arsenic from groundwater using magnetic adsorbents; their preparation and application for arsenic removal.

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Daria Ilic Erasmus+ student



Hello, my name is Daria Ilic and I am currently in my first year of an MSc in Water Treatment and Safety Engineering in Novi Sad, Serbia.

I am very thankful and excited to be in Scotland, and to have the opportunity to gather scientific knowledge, meet great people and explore the natural beauty of this area.

At ERI, I will be working with Dr Roxane Andersen and Iain Detrey (PhD student), on the project 'Bog in a Box – the effect of peat storage on dissolved organic matter properties'. The controls on production and consumption of dissolved organic carbon in peatlands are complex and the research question is 'what happens to the peat when it is extracted, disrupted and stored'?

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Rune Schmidt placement student



Hi, my name is Rune. I am an undergraduate studying environmental science at the university of Münster, Germany. Recently, I finished a placement at the ERI. I had the great opportunity to work on the Fire Blanket Project, which was supervised by Dr Roxane Andersen. The aim was to clarify the estimated carbon loss from burned peatlands in relation to different types of management and their severity of burn. After deciding which areas would be appropriate for this project, we began taking cores which were then processed in the laboratory. It is expected that

these results, in combination with the estimated fuel load, which is also part of the Fire Blanket Project, will provide a more accurate figure for the depth of combustion and carbon dioxide emitted.

Being part of this project, was a great experience, as it gave me first-hand insights into research related work.

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