Last October, the ERI successfully hosted the first conference dedicated to peatland “Research in the Flow Country”. Over 40 researchers, students and stakeholders from universities, institutes and organisations across the UK met in Thurso to share their knowledge and exchange ideas on topics relating to the peatlands of the Flows.

The event was organised by the ERI in collaboration with the Royal Society for the Protection of Birds (RSPB) and the NERC Centre for Ecology and Hydrology with the support of Highlands and Islands Enterprise (HIE). The event made use of the recently re-opened Thurso cinema and the ERI’s new Centre for Energy and Environment with a praiseworthy conference dinner being held at Flagstones, the North Highland Colleges’ Hospitality training venue.

The conference highlighted latest research findings on some of the important functions of the peatlands such as their role in regulating carbon and freshwater, and their value to specialised bog plants, birds and other wildlife. During discussion the participants identified key areas of research that should be prioritised for these peatlands in the future including soil ecology and palaeo-ecology.

It was agreed that the establishment of a “Flow Country Research Hub” based upon a co-ordinated, multi-disciplinary and collaborative network of researchers would be effective in improving our understanding of how the vast expanse of blanket bogs in Caithness and Sutherland might respond to changes in land-use such as restoration of afforested blanket bogs or wind farm development, and to climate change. This new initiative, co-ordinated by the ERI and its partners, will aim to provide a focal point for contemporary peatland research. Already, new ideas have been circulated and several proposals submitted for funding. A follow-up conference is anticipated for spring 2014 but, in the meantime, a quarterly newsletter will help keep the network active.

For more information about the ‘Flow Country Research Hub’ activities please contact Dr Roxane Andersen (co-ordinator) at Roxane.Andersen@uhi.ac.uk.
In the national, and global, context of reducing greenhouse gas (GHG) emissions to slow up increase in atmospheric GHG levels, it is important to consider the value of our natural carbon stores. Peatlands cover a small percentage of global land area (~ 3%) but are a huge carbon store. It is estimated that one third of the world soil carbon is held in the boreal and subarctic peatlands. In Scotland, peatlands cover 22% of the land area and store an estimated to 56% of soil carbon. They are also of high conservation importance and are protected under the EU Habitats Directive due to their rich biodiversity, supporting a wide range of plant, breeding bird and insect species.

Intact peatlands naturally capture atmospheric carbon dioxide (CO₂) because photosynthesis by plants occurs at a greater rate than decomposition, resulting in accumulation of peat and a net store of carbon. The decomposition of vegetation and peat leads to emission of carbon dioxide (CO₂) and methane (CH₄) gases and the production of dissolved organic carbon (DOC) in peat pore waters which are lost from the catchment by drainage. Non-methane Biogenic Volatile Organic Compounds (BVOCs) are also released as gases although these are a lesser known component of the peatland carbon cycle. When disturbed, peatlands lose their ability to capture CO₂ i.e. under drier conditions *Sphagnum* is replaced by non-peat forming plant species.

Large areas of the Flow Country were drained and afforested during the 1980s. Restoration management has been carried out in some areas with conifer felling and drain blocks used to restore forest sites to open blanket bog, primarily to conserve this special habitat and its unique species. More recently, restoration has also been driven by efforts to halt carbon losses and re-initiate carbon sequestration. At their Forsinard Reserve in Sutherland RSPB have been restoring peatland since 1997 and have recently been awarded funding to carry out forest- to- bog restoration in the Dyke Forest. This programme includes various research projects involving RSPB Research, the ERI and the Universities of Stirling and St Andrews.

For further information contact: Paul.Gaffney@uhi.ac.uk

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**Oceanflux Greenhouse Gases Project**

This two year project, funded by the European Space Agency, aims to improve the quantification of air-sea exchange of greenhouse gases. Work involves developing and validating new and innovative products which combine field data, satellite observations and models. Exchange of gas between the ocean and atmosphere has been studied for decades because of its role in understanding climate change, global carbon cycle and ocean acidification. The oceans absorb more carbon dioxide (CO₂) than they release but there are major differences in net carbon uptake calculations.

Short wind waves can be observed by satellite altimeters; their relation to gas transfer velocity through the sea surface is used to develop gas transfer algorithms. Using field and satellite observations ERI hope to show that better velocity parameterizations will result in improved calculations of the total oceanic CO₂ budget.

Satellite altimeters can be used to measure the slope of short wind waves and our study is the first to directly correlate gas transfer velocity, $K$, measured at sea with the altimeter signal. As the wave steepness increases the backscatter that the altimeter picks up decreases. $K$ measured at sea during eight worldwide cruises was correlated with concurring backscatter data taken from seven different satellites. Disappointingly, the $K$ algorithm based on altimeter backscatter was no better than the traditional wind speed algorithms. A likely explanation is that, in the open ocean, longer swell waves affect the backscatter and muddy the signal of the short wind waves. A way to reduce this ‘noise’ is to subtract the signal of lower frequency backscattering. Recently, lower frequency band data were made available from JASON 1 and 2 altimeters and we found evidence that the dual–frequency algorithm was an improvement on previous parameterizations. More information can be found at: [http://www.oceanflux-ghg-org/](http://www.oceanflux-ghg-org/) or contact: Lonneke.Goddijn-Murphy@uhi.ac.uk
New Faces at ERI

Paul Gaffney, PhD Researcher
I started my PhD at ERI in September 2012, researching the effects of forest-to-bog restoration on water quality and carbon losses via flowing water. My project is part funded by RSPB whom I work closely with. My research will contribute to our understanding of the carbon balance of restored peatlands (see article in this newsletter). Previously, I worked on the Shetland Islands Council Graduate Placement Scheme. I have an MSc in Applied Marine Science from University of Plymouth while my undergraduate degree is in Environmental Chemistry from the University of Glasgow, where I worked on peatland stream chemistry.  Paul.Gaffney@uhi.ac.uk

Jill Noble, Administrative Assistant
I provide administrative support for ERI and am based at our Castle Street office. I have many years experience in administration and retail and have worked in a variety of jobs over the years including auxiliary coastguard, department manager at Harrods in London and actress to name a few! Originally from Yorkshire, I completed a BSc. in Behavioural Sciences at Huddersfield University and moved to Scotland in 2001. I enjoy the opportunity to work with and support ERI in its day-to-day activities.  Jill.Noble@uhi.ac.uk

Pete Brown, Research IT Support Technician
I provide IT Technical Support for ERI and am based in the UHI Computing Office at North Highland College. I worked originally as a Glass Engraver with Caithness Glass but have been employed in the IT industry for nearly 30 years, either self-employed or as a contractor providing IT support for private companies and corporates including BT and Fujitsu. I enjoy the variety of work at ERI and meeting with the staff to discuss and resolve their IT problems.  Peter.Brown@uhi.ac.uk

Marco Cuscov, Master by Research Student
My project aims to characterise the surface active substances in Thurso Bay waters by using an electrochemical method. I have a Masters in Industrial Chemistry from the University of Padua in Italy where I worked on electrochemical methods for the removal of heavy metals from waste waters for my thesis project. Since then, my interests have focused on the environmental aspects of electrochemistry particularly those related to water chemistry. My current project fits very well with both my scientific background and my future career aspirations.  Marco.Cuscov@uhi.ac.uk

Double PhD Success for ERI

Congratulations to Dr Danishta Dumur for successfully defending her PhD thesis “Using phytoplankton and bacterioplankton to assess the ecological status of freshwaters in Scotland” in February. Danishta’s supervisors were Prof. Stuart Gibb, Dr Kenny Boyd, Dr Martina Burtscher with additional advice provided by Dr Alan Youngson.

Congratulations also to Dr Irina Foss for defending her PhD entitled “Towards understanding the potential predictability of Scottish Climate”. Irina’s supervisors were Dr David Woolf, Dr Christopher Merchant (University of Edinburgh) and Dr Alexandre Gagnon (University of the West of Scotland). Irina now works as a statistician for the HM Revenue and Customs in London.
Rural areas on Europe’s northern fringes support a variety of indigenous renewable energy sources, especially biomass from wood, but also energy crops and marine biomass. RASLRES, a transnational project funded by the Northern Periphery Programme (NPP) (www.northernperiphery.eu) and involving the ERI, began in late 2009 with the aim of creating thriving local fuel markets which could tap into these renewable resources.

With partners in Republic of Ireland, Sweden, Northern Ireland RASLRES’s main aim was to increase the uptake of locally produced, renewable, bio-energy solutions in rural areas in the NPP region. The project closed in November 2012 - so what did it achieve? Amongst many things, RASLRES worked with 11 pilot projects to build sustainable, local fuel supply and demand chains around new (or existing) wood boilers as well as offering best practice approaches to support industry development. This resulted in 29 new FTE jobs and 10 new businesses created with business growth totalling a minimum of €1.3 million p.a. to date.

RASLRES provided staff at ERI with an opportunity to apply their expertise and engage with communities not only in Scotland but across the Northern Periphery region, contributing towards regional, national and European renewable energy targets. An important output from RASLRES was the creation of an intelligent Bioenergy Tool which allows an assessment of the economic feasibility of a project at an early stage (www.raslres.eu/bioenergy-tool). ERI developed the Greenhouse Gas calculator which was incorporated into the Bioenergy Tool providing a simple means by which to estimate the reduction of the emissions that result from the switch from a fossil fuel or electricity-based energy heating system to a biomass fuelled system.

ERI is looking forward to collaborating again on BioPAD (BioEnergy Proliferation and Deployment). This project will help Northern Periphery communities to access, and interact with, local renewable bioenergy supply chains driving enterprise and job growth in communities. For further information contact: Neil.James@uhi.ac.uk

ERI already works with partners throughout Scotland and Europe but, recognising the global interest in marine renewable energy, the aim is to expand these relationships to include world-class research. In line with this aspiration a group of senior Chinese academics from the East China Institute of Technology (ECIT), Jiangxi Province visited ERI in November to find out about online courses and the potential for research collaboration.

The ECIT delegation, led by the University’s Vice President - Professor Hua Ming and Professor Lu Renshen, Director of International Co-operation and Exchanges, learned about the unique UHI collegiate model and ERI-led courses in ‘Sustainable Energy Solutions’ and ‘Developing Low Carbon communities’. These include modules such as ‘Wind Wave and Tidal Energy’ that can also be studied as short courses. All these courses are delivered online and have the potential to interest students anywhere in the world. Professor Stuart Gibb commented “As population and energy consumption increases on a worldwide basis, issues of resource limitation, energy security and the transition to a low carbon economy have global resonance. These are challenges that face the people of China as they do those living in Caithness. It is therefore most encouraging that our courses are attracting such international attention. I am sure that we have laid the foundations of a sound relationship with ECIT and its students and we look forward to working more closely with them in the future.” For further information contact: John.McClatchey@uhi.ac.uk
ERI maintains very good links with the Brno University of Technology in the Czech Republic. This long term cooperation has allowed several PhD students from Brno to stay in Thurso on Erasmus placement and to work at ERI on analytical chemistry projects. This exchange has brought good results and the students have been very happy with the experience gained at the ERI.

The most recent Brno student to come to the ERI is Dagmar Svobodova. Dagmar will be working on her PhD project investigating the use of chiral analysis to detect pharmaceuticals in surface and waste water samples. Pharmaceuticals have been detected in waste and surface water and even in drinking water in parts of the world. Possible adverse effects on the environment and on human health mean that it is important to monitor their presence. Dagmar’s work is takes account of the chirality of pharmaceuticals.

Chirality is a property of molecules that allows one compound to exist in two spatially different forms called enantiomers. These have the same physical and chemical properties such as density and melting point but they have different toxicities. This means that while one enantiomer could be harmless the other could be toxic. Standard methods of pharmaceutical monitoring do not assess the presence of enantiomers so toxicity could be over or underestimated depending on the enantiomeric ratio of the compound. Chiral analysis can determine this ratio. Therefore, its application in environmental chemistry is important in order to understand the fate and impact of chiral pharmaceuticals in the environment.

Dagmar is very grateful for the opportunity to work at the ERI and has very much enjoyed the calmer pace of life in Thurso and the beautiful scenery of the Scottish Highlands. She would like to thank all the people who have made her stay enjoyable, especially Bill and Isobel Gray for making her feel at home, Dr Mark Taggart for supervision and Mona Larsen for taking care of her in and out of the lab. For further information contact: Mark.Taggart@uhi.ac.uk

Knowledge Exchange Between Brno and Thurso

Dr Elizabeth Masden has been awarded a NERC Funded Business and Policy Internship to work with RSPB on ‘Developing methods for cumulative impact assessments in relation to marine renewables and seabirds’. The main objective of the project is to determine if it is possible to turn cumulative impact assessment into a more quantitative process. Over four months the team will assess the suitability of current methods for cumulative impact assessment to include variability and uncertainty. For example, the environment is highly variable and consequently any assessment of a development e.g. a wind farm, has an element of uncertainty surrounding the measurement of impacts. In a cumulative impact assessment the number of measurements increases and thus the level of uncertainty will also increase. To enable judgements to be made on acceptable level of impacts, the amount of uncertainty associated with the impact must be acknowledged or better still, quantified. Without this, assessments of impacts will likely be viewed with scepticism and the value to decision makers will be limited. Contact: Elizabeth.Masden@uhi.ac.uk

Senior Research Fellow Dr Angus Jackson has been invited to join the newly-formed International Council for Exploration of the Sea (ICES) Working Group on Marine Benthal and Renewable Energy Developments (WGMBRED). The first meeting was held at the Université de Caen Basse Normandie, France between March 19-22, 2013. The aim of the Working Group is to increase efficiency of seabed related to developments in renewable energy, to specify cause-effect relationships resulting from construction and operation of offshore renewable energy installations, and to develop guidelines and an overview of existing data for cumulative impact research by future international collaboration. Contact: Angus.Jackson@uhi.ac.uk
On 26th February S3 pupils from Wick High School came to North Highland College to learn about opportunities to study and work in Caithness. The ASPIRENorth schools programme, funded by Scottish Funding Council, aims to encourage pupils to realise their full academic potential and stimulate interest in progressing to higher education. Along with activities at ETEC (engineering) and the Equestrian Unit (equine studies), Angus Jackson and Barbara Bremner from the ERI provided a ‘hands on’ taster session for the pupils to learn about microscopy and the scientific techniques we use to get ‘up close and personal’ with several marine animals.

Staff from ERI were delighted to be involved with this event as it provides an opportunity to introduce young people to research and, more importantly, allows pupils to see that science subjects can be interesting and fun. Using hand lenses and optical microscopes the pupils learned how to study objects that cannot normally be seen with the unaided eye. Rotating around a number of sample stations, the pupils investigated how marine invertebrates feed and move, using magnification to zoom in on the delicate filter-feeding organs of barnacles. Firm favourites included the ‘squirt- ing’ solitary tunicates and the power of limpets to stick to surfaces - including (much to his horror) one boy’s hand!

The event was well received with very positive feedback from pupils and the ASPIRENorth team. Hopefully these pupils now have a clearer idea of the opportunities available to them to study science in Caithness. For information visit www.scotland-aspirenorth.ac.uk

Organised by STEM North of Scotland, speed career events are designed to give second year pupils the opportunity to find out what Scientists, Technicians, Engineers & Mathematicians do for a living. Pupils also get the chance to ask about the subjects they might need to follow these careers. In February, 5 staff and students from ERI visited Golspie, Thurso and Farr High Schools to talk about their research and careers. Pupils are only given a short time to quiz each ‘employer’ but over the three days we managed to stimulate interest in water sampling; underwater photography; carbon capture in peat and red deer morphology. These events provide a great opportunity for ERI to promote science at an early stage in the school curriculum and hopefully the one hundred pupils that we spoke to will now consider taking science subjects at school. Thanks to Andrew French, Paul Gaffney, Melanie Hayes and Neil James for providing input and a great deal of enthusiasm. For more information contact Barbara.Bremner@uhi.ac.uk