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# scrr

Scottish Consortium  
for Rural Research

formerly the Edinburgh Consortium for Rural Research

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PHOTOGRAPH: SRUC



## 2015 – a year of challenges

Our urban communities make demands on the rural environment that we need to understand better, says Prof Stuart Monro, scientific director of the SCRR

AS WE ENTER 2015, the Year of Food and Drink in Scotland, there is both good news and bad news. The good news is that the agricultural and veterinary research at Scotland's Rural College and the University of Edinburgh has been ranked as most powerful in the UK in the Research Excellence Framework (REF).

The bad news relates to the effect of the urban community looking for cheap milk in supermarkets, on the rural community that needs a sustainable dairy industry. SCRR members can help with this issue bringing the evidence base and scientific approach to the debate.

The Peter Wilson Lecture on February 9 in the Royal Society of Edinburgh addresses the issue 'Feeding the Future: Can we do it sustainably?' There are also plans with

Scotland's Rural College to examine rural-urban interconnectedness and interdependency.

The sustainable use of the rural environment depends more and more on diversification including aspects such as mountain biking and nature-based tourism, developing food products from field to table and engaging rural communities in local tourism development. These are all elements of the research done by SCRR members, but particularly in Edinburgh Napier University, that are contributing to a successful Year of Food and Drink, one which promotes businesses which are sustainable and where there is a better public understanding of the tension that exists between the dynamics of a rural environment and the expectations of an urban population.



## This issue in numbers

**365** archaeological events will take place in Scotland during the Dig It! 2015 celebrations – **page 2**

**7** maps of Scotland's soil types have been released on the web by James Hutton Institute – **page 2**

**25%** of Scotland should be forest by 2050 according to the Scottish Forest Strategy – **page 5**

**5** different strains of blue tongue virus in sheep and cattle are spread by midges – **page 7**

**50%** of European species depend on agricultural habitats for their survival – **page 7**

**£1bn** or greater is the annual contribution made by aquaculture to the Scottish economy – **page 8**

## About SCRR

**THE SCOTTISH CONSORTIUM FOR RURAL RESEARCH** – known until May 2012 as the Edinburgh Consortium – exists to promote sharing of ideas and techniques among a group of organisations active in research into land, freshwater, coastal and marine resources, and their uses.

Our member organisations have bases throughout Scotland and are at work all over the world: details on the back page.

Members' reports

Archaeology Scotland, Society of Antiquaries of Scotland and UHI; James Hutton Institute

# Dig It! 2015 celebrates Scottish archaeology

Jeff Sanders of the Society of Antiquaries of Scotland introduces a year-long programme of hands-on events

DIG IT! 2015 IS a year-long celebration of Scottish archaeology that aims to connect communities throughout Scotland to their unique stories and identities. Working in partnership with hundreds of organisations, Dig It! 2015 is developing a Scotland-wide programme of events to increase public understanding of and participation in archaeology.

Dig It! 2015 is funded by Historic Scotland and co-ordinated by two charities, Archaeology Scotland and the Society of Antiquaries of Scotland. The Society of Antiquaries actively promotes the study and enjoyment of Scotland's history and archaeology ([www.socantscot.org](http://www.socantscot.org)), while Archaeology Scotland helps people from all walks of life to get more involved through learning, promotion and support ([www.archaeology-scotland.org.uk](http://www.archaeology-scotland.org.uk)).

From January to December, Dig It! 2015 will offer over three hundred and sixty-five events, ensuring that young people and adults alike have the chance to discover and tell Scotland's stories through archaeology.

Some of the more rural offerings include The Moncreiffe Hillfort Dig (April 21 to May 2), the Kilmartin Archaeology Festival (June 8 to 21 ),

**Students from the UHI Archaeology Institute get into the spirit of Dig It! 2015 at the Ness of Brodgar excavation in Orkney**



PHOTOGRAPH: NICK CARD, ORKNEY RESEARCH CENTRE FOR ARCHAEOLOGY

Historical Land Rover Safaris through Glencoe (May 6 and June 3) and Clayfest: The Culture of Earth Buildings in Errol (June 8 to 13).

Want to join the celebrations? The current programme of events from across Scotland can be accessed via the website at [digit2015.com](http://digit2015.com).

For monthly updates and events delivered straight to your inbox, the newsletter sign-up is available at [digit2015.com/contactus](http://digit2015.com/contactus).

Dig It! 2015 is also on Facebook ([www.facebook.com/digit2015](http://www.facebook.com/digit2015)) and Twitter (@DigIt2015).

# Time to take a closer look at what's beneath your feet

Bernardo Rodriguez-Salcedo of JHI on the International Year of Soils and the new National Soil Map of Scotland

ALTHOUGH YOU DON'T notice it often, soil underpins everything in our lives – our roads, our homes, the food we eat, and the water we drink. At the start of this International Year of Soils, scientists at the James Hutton Institute are making the point that soils are our most treasured resource, and the key to overcoming global challenges.

Here in Scotland, the vitality of our agriculture is reliant upon our fertile and healthy soils, while our peatland soils are making a valuable contribution to mitigating climate change and halting biodiversity losses.

In celebration of the importance of soils, the James Hutton Institute has released seven maps that make up the National Soil Map of Scotland at 1:250,000 scale for download from its



Soils@Hutton website (see below). The soil maps released illustrate the diversity of our soils and are a small demonstration of the wealth of soil data and information that is available to help people make choices about how we best use and manage our soils

**Scottish soil: a treasured resource**

to meet current food, water and land demands while safeguarding this resource for future generations.

Soils around the world are under increasing pressure to support growing, but often conflicting, demands for more food, water and energy while helping to mitigate climate change and protect biodiversity. The United Nations predicts that there will be a 50% increase in food demands by 2030 to support a growing world population and changing food preferences.

National Soil Map of Scotland: [www.hutton.ac.uk/research/themes/safeguarding-natural-capital/soilshutton](http://www.hutton.ac.uk/research/themes/safeguarding-natural-capital/soilshutton) or the Scotland's Soils website, [www.soils-scotland.gov.uk](http://www.soils-scotland.gov.uk)

PHOTOGRAPH © JAMES HUTTON INSTITUTE



Members' reports

University of Glasgow; Royal Botanic Garden Edinburgh

AS ALEXANDER FENTON observed in *The Food of the Scots* (2007), the study of food is extremely important to understanding communities. At the Solway Centre, we are developing a new project: 'Foodways of South West Scotland: Regional Revival, Traditional Strengths'. It approaches food as culturally, socially and environmentally-rich, with links to tourism, health and wellbeing, sustainability and education.

Dumfries and Galloway is at the heart of 2015's aim to celebrate 'Scotland's natural larder and quality products' with wider-than-regional reach. Well-networked producers, supported by initiatives like [dgfoodanddrink.org](http://dgfoodanddrink.org) and [dgmmarkets.org](http://dgmmarkets.org), promote food in novel ways, exploiting web-based platforms. They promote holistic experiences ([dosomethingdelicious.com](http://dosomethingdelicious.com)), traditional means of production ([blackface.co.uk](http://blackface.co.uk)), niche marketing ([cd-foodtown.org](http://cd-foodtown.org)) and social enterprise ([locharthur.org.uk](http://locharthur.org.uk)).

Equally, Dumfries and Galloway enjoys rich heritage foodways: the persistent, distinctive traditions around 'haaf netting' for salmon and sea trout on the Solway, for instance. In the 18th century, the region was known for pigs and meat production; Hoddum had a weekly swine market, with bacon exported to London; in Langholm there were five butcher's shops. Prior to this, fresh meat was rare, 'an unremitting succession of broths and broses,

Right: Dumfries farmers' market



PHOTOGRAPH: DUMFRIES FARMERS MARKET

## Food in south-west Scotland: regional and traditional

Valentina Bold of the Solway Centre for Environment and Culture explains the richness of Dumfries and Galloway's food heritage

potatoes and herring, neeps and kail'. The Centre seeks funding to support an audit of regional food traditions, through in-depth interviews and archival-based research. Our research will focus on cultural identity expressed in traditions and on the impact of time (land use, production, economy,

demography, migration and habits of consumption). We shall attempt to reconnect production and people: from farmers' markets to foraging; restaurant culture; everyday, festival and celebration foodways as an aid to understanding the culture of south-west Scotland.

## A plot to encourage 'edible gardening'

Jenny Foulkes of RBGE describes a project that is helping people to learn how to grow their own food

THE EDIBLE GARDENING PROJECT at the Royal Botanic Garden Edinburgh, funded by the players of the People's Postcode Lottery, teaches people the skills to grow their own food. Having made more than 20,000 interactions with the public since the project started in 2011, we are inspiring people to grow food in whatever space they have available.

The Edible Gardening volunteer team work on Monday and Tuesday afternoons in the Botanics on the vegetable plots and are on hand to talk to visitors about growing their own food. Volunteers work alongside our community gardener and are able to give seasonal gardening advice and show people around the productive areas of the garden. We hold events throughout the year, such as our Spring Festival (April 17 to 19, 2015).



These help us to champion local, seasonal and sustainable food to our visitors – especially pertinent in this Year of Food and Drink in Scotland.

Growing food on a small plot at the Botanics, Edinburgh

This is only a part of the project. We worked with 28 community groups in 2014, both at the garden and on outreach visits. There are vegetable plots at the Botanics dedicated for community use. Groups such as the Rock Trust, which works with vulnerable young adults, visit the garden on a weekly basis over the summer to tend plots under the guidance of the team. More than 100 people worked on the plots in 2014. As well as growing food, there is an emphasis on what to do with crops: harvesting and cooking are important to our programme and we make sure that growers get a chance to prepare and taste the healthy fresh crops that they have grown.

What's on: [www.rbge.org.uk/ediblegardening](http://www.rbge.org.uk/ediblegardening). Blog stories: [stories.rbge.org.uk/edible-garden-project](http://rbge.org.uk/edible-garden-project)

Members' reports

School of GeoSciences, Edinburgh; BioSS and Rowett Institute of Nutrition and Health, Aberdeen

# A creative approach to community challenges

Emily Creamer of the University of Edinburgh explains how 'design thinking' might facilitate public input

THE SCOTTISH GOVERNMENT is committed to a 'Low Carbon Scotland'. However, there is no 'right' answer when it comes to 'wicked' problems such as climate change. Individuals have a range of equally valid perspectives based on their values and to date, policymaking has not always been able to effectively integrate these different voices in a way that facilitates decisions which best meet people's needs while respecting environmental constraints.

R&Dialogue ([www.rndialogue.eu](http://www.rndialogue.eu)) is an EU project seeking to establish a productive dialogue across all sectors of society to facilitate a transition to a sustainable, low carbon Europe. As the UK partners, a team in the School of GeoSciences at the University of Edinburgh is using 'design thinking' as a tool to bring together people with a range of experience and knowledge to develop solutions to current low-carbon challenges in Scotland.

Design thinking, a human-centred, output-driven process, is a radical departure from traditional forms of engagement such as discussion and focus groups. It takes a much more hands-on, imaginative, emotional,



**At a workshop in North Berwick, teams used the new techniques to explore transport, travel and food**

entertaining and team-based approach to problem-solving. It also aims to create prototypes of potential solutions very rapidly (within a couple of hours) in order to then test these – invariably imperfect – solutions and obtain additional insights for further (re)design.

The first series of low-carbon design thinking workshops were held in North Berwick in autumn 2014. Teams applied design thinking to the



PHOTOGRAPHS: EMILY CREAMER

challenges of rural transport, food purchasing and leisure travel. Each team generated an innovative solution with one of these, a web platform for improving local food networks, now in further development.

As part of the next stage of the project, the team is working with a Development Trust in a rural Scottish community to test whether design thinking may be an effective tool for bringing together the different perspectives, experiences and skills of community members to find the best solutions to local challenges.

*Low carbon Dialogue Scotland:* [lowcarbdialogue.org.uk](http://lowcarbdialogue.org.uk)

# Designing a diet to suit the planet and your pocket

Graham Horgan of BioSS on how maths can help us choose what's best to eat, not just what tastes good

THE DIETS PEOPLE CHOOSE to eat are determined by a range of different influences: personal preferences, cost and social settings are foremost among these. The recommendations of health professionals can be added to this list; and more recently a desire for environmental sustainability had prompted campaigns to eat 'for the benefit of the planet'. It is not obvious how to aggregate all this advice into a whole diet while also keeping individual preference and cost in view.

Working in close collaboration with researchers at the Rowett Institute of Nutrition and Health, Biomathematics and Statistics Scotland (BioSS) has been using the mathematical technique of linear programming to construct whole diets that satisfy all current dietary recommendations for health and also find the best value of some

other objective. Our initial interest was to minimise the greenhouse gas emissions associated with the diet, but we are currently also exploring minimising the cost, which is an important influence on diet for people in low-income groups. Another objective could be to maximise a person's liking for the different food items.

The mathematical approach taken is highly flexible: we can aim to get the best result for combinations of environmental impact, cost and preferences. We have investigated the design of diets based on the foods a person already eats, modifying only



**Left: a week's diet for a woman designed to achieve a 36% reduction in dietary greenhouse gas emissions**

the amounts of each; or introducing only a small number of new foods, thereby minimising the change an individual would need to make.

By experimenting with different objectives, we can investigate where conflicts exist between nutritional, environmental, economic and social ambitions. Understanding such conflicts can be important

in informing government policy and making dietary recommendations more likely to be adopted.



## Do black grouse prefer forestry or moorland?

Patrick White of Edinburgh Napier University describes a study into how wildlife copes with changing habitats

THE SCOTTISH FORESTRY STRATEGY proposes an increase to 25% forest cover by 2050. A recent study funded by Scottish Natural Heritage, the Cairngorms National Park Authority and Forest Enterprise Scotland has contributed towards the debate on the impacts on rural wildlife. In the study, 89 black grouse (*Tetrao tetrix*) were radio-tagged so that their habitat use in a mixed moorland-forest landscape in highland Perthshire could be investigated over three years.

Black grouse are a species of moorland-forest ecotones. It is known that they thrive in young forest plantations, but only for the first few years of a plantation's establishment.

We found that birds selected strongly for moorland throughout the year and that both moorland and young native pine plantations were important breeding habitats.

Large-scale mature forestry appeared to restrict their distribution, with birds preferring to remain within 300 m of the



**Black grouse male (top) and female being ringed (above)**

moorland edge. Young forests provided an optimal breeding habitat, but remained suitable for a short time: significantly shorter than the rotation period of most forestry systems. Moorland may offer a more persistent breeding habitat.

Landscape-scale planning of forest expansion in upland areas may need to maintain a sufficient component of moorland. Mature forests are,

nevertheless, an important component of black grouse habitat, particularly for feeding above deep snow.

An additional finding was a notable difference in how males and females used forests in the landscape, with males preferring birch forests over conifers, and vice versa. This suggests that planning for a diversity of forest types within future landscape would benefit black grouse.

PHOTOGRAPHS: MALE GROUSE: VPJN VIA WIKIMEDIA COMMONS; FEMALE GROUSE: GRAEME NEISH

A NEW REPORT and a summary research note have been published on the Forest Research website entitled 'Behavioural policy "nudges" to encourage woodland creation for climate change mitigation'. Evidence indicates that woodland creation is generally a cost-effective method of climate change mitigation, compared with a range of alternatives. However, engaging landowners and land managers can prove difficult, and this affects prospects for meeting national woodland planting targets and climate change mitigation objectives.

Although reluctance to plant woodland is often attributed to the low financial attractiveness of such schemes, wider factors – including long-held cultural views on changing land use and

## Behavioural policy 'nudges' to encourage woodland creation

Darren Moseley and Gregory Valatin of Forest Research discuss research that looks at influencing people's actions, rather than imposing change



**Tree planting is now a national priority**

perceptions of the urgency of tackling climate change – can also be important.

Insights from behavioural economics indicate that individuals are influenced by a number of cognitive factors in making decisions and that certain 'nudges' may help direct choices. Nudges are ways of influencing people's choices without limiting the options, or appreciably altering their relative costs.

A range of nudge type approaches could be used to encourage woodland

creation for climate change mitigation. These include addressing perceived barriers to woodland creation; encouraging private woodland creation by highlighting successes; and the public sector leading by example. Nudge type approaches should be tailored towards different types of landowners and land managers, who may vary in their attitudes, motivations and willingness to plant trees.

Forestry Commission, new publications: [www.forestry.gov.uk/forestry/HCOU-4VXJ5B](http://www.forestry.gov.uk/forestry/HCOU-4VXJ5B)

PHOTOGRAPH: FOREST RESEARCH

Members' reports

RSPB Scotland and Scottish Natural Heritage; Moredun Research Institute

# RSPB/SNH national golden eagle survey 2015

Daniel Hayhow of RSPB Scotland describes a mammoth effort to find birds that might not normally be counted

THE RSPB/SNH NATIONAL golden eagle survey kicked off on January 12, 2015 with fieldworkers heading out for the next six months into wild and remote regions of the Highlands. The survey is organised by Scottish Raptor Study Group golden eagle coordinators and RSPB staff. Field-workers will survey all known golden eagle home ranges until the end of July 2015.

This fourth national survey (previous surveys were carried out in 1982/83, 1992 and 2003) will provide updated population estimates, distribution and productivity data. It will also provide data on factors influencing golden eagle habitat use and the location of breeding sites for species protection purposes. Early-season sightings are essential to identify the established occupation of territories.

Many golden eagle territories are surveyed annually, but this year, in addition to surveying ranges known to be occupied, surveyors will visit ranges that have not been occupied or visited

Typical habitat in which golden eagle surveyors are found (right); eagle at a nesting site (below)



EAGLE PHOTOGRAPH: CHRIS GOMERSALL, RSPB-IMAGES.COM



in recent years, and in some cases not for many years. An important component of the survey will be to check for non-breeding birds that may be resident or passing through.

Fieldworkers will cover many miles and spend many hours looking up glens and across ridges for evidence of birds in the area. To quote Stuart Benn,

an experienced golden eagle surveyor: 'Surveying golden eagles properly is difficult. You'll often get cold, wet, tired and frustrated; but there will be plenty of absolutely golden days too, when you would rather be nowhere else in the whole world.'

Scottish Raptor Study Group:  
[www.scottishraptorstudygroup.org](http://www.scottishraptorstudygroup.org)

# Control of cryptosporidium in the Cairngorms

Beth Wells of Moredun on efforts to combat a parasite that causes disease in livestock and humans

THE MICROSCOPIC PARASITE *Cryptosporidium parvum* is a zoonotic species causing gastro-intestinal disease in livestock and humans that can be very serious in the young, elderly or immune compromised.

A major transmission route to humans is through water, where the parasite can live for several years and is resistant to chemical treatment normally used for drinking water. Cattle, and calves in particular, are considered the main reservoir of the parasite. Many public water supplies in the UK have problems with cycles of contamination with cryptosporidium.

This study arose through collaboration between the Moredun Research Institute, the Crown Estate (landowners) and Scottish Water. Cattle, calves, sheep, lambs, red deer, roe deer and water were sampled and analysed; results indicated high levels



PHOTOGRAPH: BETH WELLS

of *C. parvum* in both livestock and wildlife. Further analysis using genotyping suggested that deer as well as livestock were contributing to the parasite loading in the environment, and that the parasite was transmitted between livestock and wildlife, most

**Pathogens in the water supply can be reduced by fencing the source upstream**

likely through shared grazing. Solutions for this particular catchment as a whole are ongoing. The catchment above the public water supply intake is to be fenced and water troughs provided for livestock, resulting in reduced cryptosporidium loading in the water supply as well as reduced turbidity of the water. This may also reduce other potential waterborne pathogens in the water supply, such as *E. coli* and salmonella, and could also improve animal health by reducing the risk of liver fluke infection and coccidiosis as it removes livestock from wet and boggy areas.

Management solutions to help reduce cryptosporidium levels on farms were recently made available at a farmers' meeting, potentially leading to improvements in animal health and production, as well as water quality and public health.



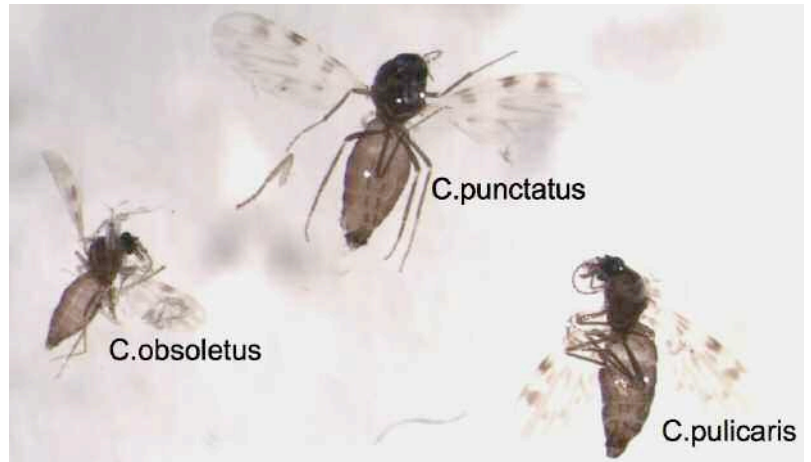
Members' reports

Centre for Ecology and Hydrology and BioSS; Scotland's Rural College

A BETTER UNDERSTANDING of midge activity can be used to reduce disease risk from viruses in sheep and cattle. Since 2006, five different strains of bluetongue virus (BTV), which is transmitted by midges, have entered Europe, causing disruption and economic losses within the livestock industry. During midge-borne disease epidemics, farmers have to restrict livestock movements to periods in winter when the risk of disease transmission by midges is low. The current EU livestock movement regulations rely on a network of traps to monitor the activity of midges.

The study by CEH, working with Biomathematics and Statistics Scotland (BioSS), the Institute of Animal Health, Pirbright and the Met Office, analysed five years of midge-trapping data from across the UK. The results show that the period for which midges were absent as adults over winter varied substantially between different Avaritia midge species

Common species of midge (*Culicoides*) and (below) trapping



PHOTOGRAPHS: STUART MAY

## Midge behaviour and reducing livestock disease

Kate Searle of CEH finds that a detailed appreciation of when midges are active can help farmers during disease outbreaks

by up to eight weeks, and also differed between years. These differences seem to be caused by subtle changes in climate as well as differences in the local availability of livestock and land use types. Consequently we might be able to predict in advance how the period of inactivity will vary from region to region and year to year.

Differences of several weeks in adult season between years or species may be particularly important for viruses such as Schmallenberg virus,

which has its greatest impact in terms of abortions and foetal abnormalities when infection occurs during a critical window of pregnancy. Rather than setting a single period for midge trapping over a broad area, a cheaper predictive model could be used that would be responsive to natural variation in midge activity caused by environmental factors.

Searle, K. R., et al, 2014. *Plos One*, 9: e111876



## A framework for identifying EU High Nature Value farming

More than half of Europe's species are reliant on agricultural habitats, explains Davy McCracken of SRUC

A CONSORTIUM OF researchers has had the importance of its research into High Nature Value (HNV) farming recognised by the European Commission. They recommend a new framework for ensuring a co-ordinated, EU-wide approach to the identification and assessment of such farmland<sup>1</sup>.

Their recently published paper<sup>2</sup> was highlighted in Science for Environmental Policy, an EC news and information service designed to help the busy policymaker keep up-to-date with the latest environmental research. The paper explains that with over half of Europe's species dependent on agricultural habitats, protecting HNV farmland is vital to biodiversity



Highland sheep farm – classic High Nature Value land

conservation; consequently, the EU requires that all member states monitor HNV farmland in their assessment of Rural Development Programmes.

However, the approaches taken to assess HNV farming vary across member states. As a result there is a lack of accurate data and it is difficult to gain an EU-wide perspective on the extent and condition of HNV farmland. The paper highlights that the identification and assessment of HNV farmland requires careful co-ordination and presents a framework to help the process, together with a set of key recommendations.

1. [www.sruc.ac.uk/info/120464/research\\_impact/937/high\\_nature\\_value\\_farming](http://www.sruc.ac.uk/info/120464/research_impact/937/high_nature_value_farming) 2. Lomba et al. 2014. *Journal of Environmental Management* 143 140-150

PHOTOGRAPH: TONY WATERHOUSE, SRUC

Members' reports

Forest Research, Royal Zoological Society Scotland, RBGE, University of Edinburgh; SAMS



PHOTOGRAPH: MIKE SMITH

The restoration of the giant panda's forest habitat is a vital part of the conservation effort

visited partners in Sichuan province in western China to set up a framework for collaborative research on forest landscape restoration. Forest Research has experience and expertise in forest landscape restoration that complements the knowledge and skill of the partner organisations, which include: Royal Zoological Society Scotland, Royal Botanic Garden Edinburgh, University of Edinburgh, Forestry Department of Sichuan Province, Sichuan Giant Panda Conservation Foundation and Sichuan Wildlife Management Station.

The group discussed how by strengthening international links and sharing expertise we would all benefit by finding new ways to improve our capacity to restore and maintain important forest landscapes.

Also discussed with Chinese colleagues was whether lessons from the conservation of iconic species like the giant panda could be used to help restore Chinese and Scottish forest landscapes for many other species.

The framework for research and collaboration will be further developed during a workshop in April 2015.

News story, Forest Research website: [www.forestry.gov.uk/fr/beeH-9sgkgt](http://www.forestry.gov.uk/fr/beeH-9sgkgt)

## International partnership to restore giant panda habitats

Stephen J Penny of Forest Research describes a project that involves strengthening links between Scotland and China

THE GIANT PANDA is one of the world's most endangered species and efforts to restore its natural habitat are at the heart of global conservation. At a time when two of Edinburgh's most

famous inhabitants are giant pandas from China, Forest Research is building links with its Chinese counterparts.

Chief Executive James Pendlebury and ecologist Mike Smith recently

## The impact of marine cage fish farming on the seabed

Kenneth D Black of SAMS reports on the AutoDEPOMOD model for predicting organic deposits

SCOTTISH AQUACULTURE is a major industry with a retail value greater than £1 billion. Scotland is also the largest producer of farmed salmon in the EU. Where adequate regulation is absent, aquaculture can have a detrimental environmental impact, affecting not only the marine environment but the overall sustainability and performance of a site. Discharges are a primary environmental concern when it comes to planning or expanding sites.

Determining appropriate limits for discharges has been a difficult task for environmental regulators. In Scotland, SEPA are responsible for the monitoring and regulation of aquaculture sites, enforcing environmental quality standards for sea-floor sediment at all aquaculture sites in Scotland.

Fish-farms discharge waste (fish faeces, food waste and chemical treatments) which can accumulate on the seabed causing organic enrichment which can lead to conditions toxic to marine life. AutoDEPOMOD is a model



Intensive fieldwork took place at several salmon farms

developed at SAMS for predicting the impact of fish-farm discharges on the seabed in order to optimise the operation of aquaculture sites to match the environmental capacity.

AutoDEPOMOD (originally co-funded by NERC in 1998) uses site specific conditions such as current speed, water depth, fish biomass and feed volume to predict discharge

amount and deposition area. In 2001, SEPA supported further development of the model to examine the discharge of sea-lice medicines from fish-farm sites in order to derive appropriate limiting license conditions for discharge. In 2005, AUTODEPOMOD was adopted by SEPA as a compulsory step in the planning process for new and expanding aquaculture sites.

The model is also licenced in about 25 other countries, with Mediterranean and Philippine variants funded through EU projects.

The Scottish Government has recently funded a major project to re-parameterize and recode AutoDEPOMOD to allow it to better simulate sediment resuspension processes, and accept spatially varying currents from hydrodynamical model outputs. This version has improved code and architecture that can efficiently utilise modern computing options (PC to cluster).

PHOTOGRAPH © SAMS



SAMS; Heriot-Watt, Edinburgh Napier, UHI, University of Stirling, University of Aberdeen

## Integrated aquaculture and sustainable growth

Marieke Steuben of SAMS on farming mussels, oysters, scallops, seaweed and sea urchins alongside fish

THE NEAT ROWS of buoys floating on the surface of Loch Fyne belie the complexity of what's going on below. This integrated multi-trophic aquaculture (IMTA) site, run by Loch Fyne Oysters, is experimenting with growing mussels, oysters, scallops, seaweed and sea urchins adjacent to a salmon farm run by Scottish Salmon Company.

In collaboration with SAMS and other partners, Loch Fyne Oysters is one of six aquaculture producers across Europe growing new seafood products using IMTA systems, as part of the IDREEM

project. Coordinated by Kenny Black and Adam Hughes at SAMS, the IDREEM project consortium is spending four years designing, implementing and assessing new IMTA production systems in various environments.

The concept driving this research is that of economic and resource efficiency: how can fish farms grow more products and diversify their profits while using resources more efficiently? In an ideal IMTA system,



PHOTOGRAPHS: MARIEKE STEUBEN ©SAMS

**The IMTA site in Loch Fyne, managed by Loch Fyne Oysters (top); checking growth of queen scallops**

additional 'extractive' species are able to feed on the nutrients left behind by the fed species (typically fin fish such as salmon or sea bream) without needing any additional inputs.

By removing excess nutrients from the water and sediments, IMTA systems have potential environmental benefits and offer a sustainable model for aquaculture industry growth. In the partners' fish farm sites in Italy,

Cyprus, Israel, Norway, Ireland and Scotland, various combinations of fish, shellfish, seaweed and bottom feeders such as sea urchins and sea cucumbers are being tested in IMTA arrangements. Now halfway through the project, the producers are marketing their first IMTA products and fine-tuning their production methods.

More details: [www.IDREEM.eu](http://www.IDREEM.eu)

## Marine researchers work with Colombian colleagues

MASTS is a joint venture involving Heriot-Watt, Edinburgh Napier, UHI, Stirling and Aberdeen universities

THE MARINE ALLIANCE for Science and Technology for Scotland (MASTS) is a consortium of organisations engaged in marine science and represents the majority of Scotland's marine research capacity. In December 2014 a number of its members took part in a British Council Early Career Researchers (ECR) links workshop on Marine Science and Technology in Santa Marta, Colombia.

Professor Hamish Mair (Heriot-Watt University), the executive member of MASTS was the UK coordinator together with mentors Dr Joanne Porter (Heriot-Watt University) and Professor Richard Preziosi (University of Manchester). The other MASTS



participants in the workshop were Drs Karen Diele (Edinburgh Napier University), Natalie Higgs, Kate Duncan and Diego de Villar (University of the Highlands and Islands), Sonia Rey

**Researchers gather in Santa Marta, northern Colombia**

(University of Stirling IoA), Jose Farinas and Bob Beharie (Heriot-Watt) and Fredryk Mandey (Aberdeen).

The Colombian coordinator and mentors of the Workshop came from Valle University in Cali and Antioquia University in Medellin.

In total 20 other researchers from a number of Colombian institutions joined to work together to form partnerships for the future proposals under the £375m Newton-Caldas fund, which promotes the long-term economic development and welfare of people in 15 partner countries and unlocks new opportunities for higher education institutes to engage and build partnerships.

Members' reports

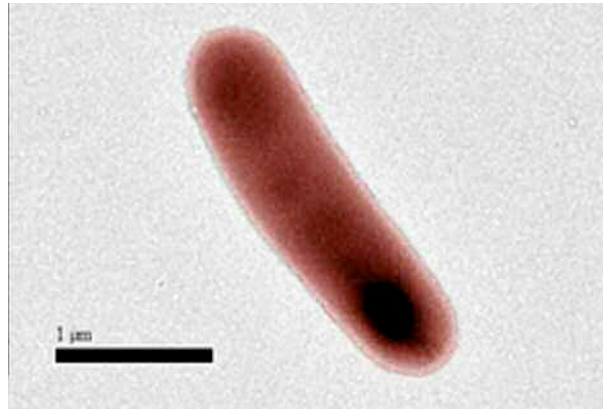
School of Biological Sciences, University of Edinburgh; Moredun Research Institute and BioSS

# Whisky distillation co-product capture

Louise Horsfall, University of Edinburgh, on biological methods that could remove copper from waste

WHISKY IS A SPIRIT enjoyed by millions of people around the globe and many people know that distillation is a vital step in its production. But what happens to the material left after distillation? These distillation co-products contain copper ions that are harmful to plants and animals if disposed of in the environment. Therefore removal of the copper is required prior to co-product disposal.

We have been researching biological ways of remediating distillation co-products. The prime research focus has been treating the co-products to remove copper and turning this into something valuable for use in other sectors. Current methods of copper removal are impractical and costly. However, biological copper ion

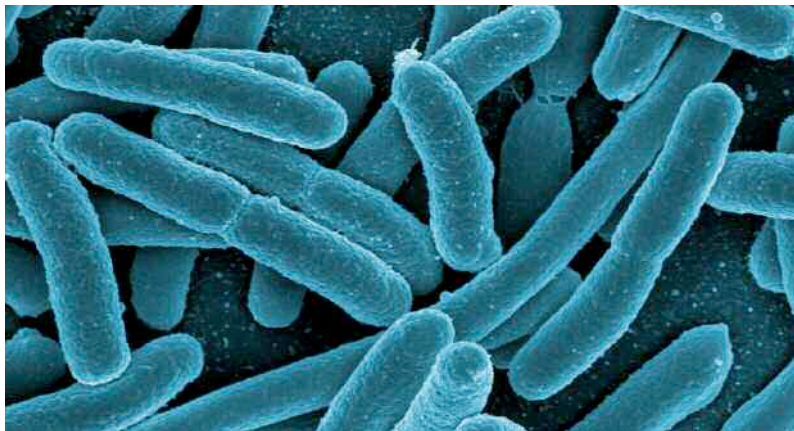


removal from contaminated co-products has been shown to be quite effective. There are two biological methods available. One is to bind the

The *morganella* bacterium used to remove copper (artificially coloured)

heavy metal ions onto the surface of bacterial cells and by then removing the bacteria, clean the co-products. The other method involves the bacterial transformation of soluble copper ions into insoluble nanoparticles: tiny bits of copper a few millionths of a millimetre in size. Potentially, the nanoparticles could be isolated, effectively recycling the metal and allowing it to be used in many different applications, such as catalysts and antimicrobials.

By studying the genes responsible for nanoparticle production, we believe we might not only find ways to improve nanoparticle production but also create nanoparticles of different metals to expand the potential of this bioremediation process.



PHOTOGRAPH: NIAID NIH VIA WIKIMEDIA COMMONS

# Rapid typing of E. coli isolates using whole cell MALDI mass spectrometry

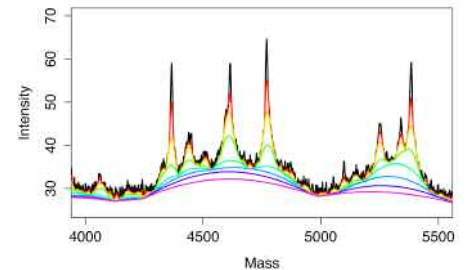
Javier Palarea of BioSS describes a method that may help during outbreaks

FOOD-BORNE PATHOGENS including *E. coli* O157 and related strains (collectively called enterohaemorrhagic *E. coli* – EHEC) remain a public health problem requiring typing of strains in outbreak investigation. Conventional bacterial identification and typing can be laborious and time-consuming. In order to fulfil the need for timely public health laboratory reporting, complementary rapid typing methods that can be easily applied to a large numbers of isolates during an outbreak would be a valuable addition

to current tests. The possibility of identifying and differentiating strain types within 24 hours using rapidly obtained and cost-effective MALDI mass spectrometry (MS) proteomic profiles has been explored.

MS is a technologically advanced approach used to detect biological molecules. The complex spectra obtained require a series of pre-processing steps to convert data into formats suitable for bacterial identification and typing. High-quality pre-processing of spectra involves a

Above right: typical MALDI-MS spectrum showing pre-processing options for baseline correction. Above left: scanning electron micrograph of *E. coli*



number of steps including smoothing, baseline correction, peak extraction and alignment, and normalisation. Collaboration between scientists at Moredun Research Institute and Biomathematics and Statistics Scotland has produced a rapid, widely applicable, semi-automatic and statistically robust MS data pre-processing pipeline to facilitate this task.

Processed data are compatible with statistical clustering and phylogenetic methods to investigate relationships amongst strains. Initial application of the developed methods and software to study relationships among 92 EHEC isolates indicates a good level of reproducibility and differentiation among biological samples. The relationships observed using MALDI-MS are being further evaluated to determine their similarity to previous genomic approaches for strain differentiation.

Near future plans include applying these procedures to other bacterial species such as campylobacter.



Royal (Dick) School of Veterinary Studies, Roslin Institute, University of Edinburgh and SRUC

THE CHANCELLOR of the University of Edinburgh, HRH the Princess Royal, visited Easter Bush on Friday 16th January. As part of the tour and visit, the Princess planted a tree to mark the start of construction of the Easter Bush Innovation Centre, which will bring together the University's veterinary teaching, research and enterprise activities in a vibrant, interactive core at the heart of the campus.

The occasion marks the beginning of the third phase of development for the Easter Bush Campus, which also includes the building of an Energy Centre and extensive infrastructure work.

Staff and students from the Royal (Dick) School of Veterinary Studies and The Roslin Institute gave HRH The Princess Royal an overview of their work to improve animal health and welfare. Professor Susan Rhind, Deputy Head of School, said: 'We were delighted to welcome our Patron, HRH The Princess Royal, to the campus to allow us to highlight some of our innovative teaching methods and hear about our approach to student



## Start of a new era for Easter Bush

HRH The Princess Royal plants a tree as work begins on Innovation Centre

A model of the new centre (above); the Princess Royal with Susan Rhind (above right)

support, international links and the major developments taking place here.

'The princess did us the very great honour of performing the official opening of our Veterinary Teaching building in 2011. This building is now firmly established as the Dick Vet's home, while the Easter Bush Campus's reputation internationally as a centre of

excellence in veterinary teaching, clinical practice and research continues to grow. We look forward to keeping Her Royal Highness updated on the campus's progress and welcoming her back to Easter Bush to meet our students and staff and review the developments in the coming years.'

## REF identifies an agricultural and veterinary research powerhouse

AGRICULTURAL AND VETERINARY research at the University of Edinburgh and Scotland's Rural College (SRUC) has been ranked as the most powerful in the UK in the Research Excellence Framework (REF). The REF process is an assessment of the quality of the research being undertaken at UK Higher Education Institutions (HEIs) and the impact it has in society.

Building on a long history of collaboration and complementary activities, SRUC and the University's Royal (Dick) School of Veterinary Studies and Roslin Institute made a joint REF submission. The collective strength and depth of agricultural and

Research to protect salmon from disease will save about £26 million a year

veterinary research at the University and SRUC was reflected in its top research power ranking. Three quarters of the research and related activity submitted by the University and SRUC was judged to be 'world leading' (the top REF grading of four stars) or 'internationally excellent' (three stars).

The impact of research was scored particularly highly. This is important because it shows that the research undertaken leads to practical benefits for society – for example in animal health and welfare, agricultural productivity and environmental protection. More than 76% of the impacts described in the submission were judged to be 'outstanding' and more than 83% either 'outstanding' or 'very considerable'.

The REF panel considered case studies that demonstrated the impact of research on the UK and worldwide economies. For example, work at Roslin is helping salmon farmers to breed fish that are more resistant to a deadly virus called infectious pancreatic necrosis (IPN), a discovery estimated to be worth £26m per year to the UK salmon-farming industry.



PHOTOGRAPH: HANS-PETTER FJELD VIA WIKIMEDIA COMMONS

### NEWS FROM SCRR

#### SCRR appoints new Secretary/Treasurer

We are glad to announce that Prof Willie Donachie has agreed to become our new Secretary/Treasurer. Recently retired as managing director of Moredun Scientific, he expressed happiness to continue on the SCRR Executive in this new role.

Please, therefore, note the change in SCRR contact name and address (page 12).

#### SCRR Forum: Exploring and exploiting the microbiome

Monday February 23, 2015  
Our Dynamic Earth, Edinburgh

THE AIM OF THIS EVENT is to raise awareness about Scotland's considerable expertise in Metagenomics and to build links to support collaboration for the future.

For full details, please see [www.scrr.ac.uk/events.php](http://www.scrr.ac.uk/events.php).

## SCRR member organisations

The University of Edinburgh . . . . .	www.ed.ac.uk
Moray House School of Education . . . . .	www.ed.ac.uk/schools-departments/education
Royal (Dick) School of Veterinary Studies . . . . .	www.ed.ac.uk/schools-departments/vet
School of Biological Sciences . . . . .	www.ed.ac.uk/schools-departments/biology
School of Engineering . . . . .	www.see.ed.ac.uk
School of GeoSciences . . . . .	www.ed.ac.uk/schools-departments/geosciences
School of History, Classics and Archaeology . . . . .	www.shca.ed.ac.uk/Research/
School of Social and Political Studies . . . . .	www.sps.ed.ac.uk
Biomathematics and Statistics Scotland . . . . .	www.bioss.ac.uk
British Geological Survey, Edinburgh . . . . .	www.bgs.ac.uk
Centre for Ecology & Hydrology, Edinburgh . . . . .	www.ceh.ac.uk
Crichton Carbon Centre . . . . .	www.carboncentre.org
Field Studies Council, Millport . . . . .	enquiries.sco@field-studies-council.org
Forest Research, Northern Research Station . . . . .	www.forestry.gov.uk/forestresearch
Heriot Watt University, School of Life Sciences . . . . .	www.sls.hw.ac.uk
University of Stirling, Institute of Aquaculture . . . . .	www.aquaculture.stir.ac.uk
James Hutton Institute . . . . .	www.hutton.ac.uk
Moredun Research Institute . . . . .	www.moredun.ac.uk
Napier University, School of Life, Sport & Social Sciences . . . . .	www.napier.ac.uk/fhlss/SLSS
National Museums of Scotland . . . . .	www.nms.ac.uk
Roslin Institute, University of Edinburgh . . . . .	www.roslin.ed.ac.uk
Royal Botanic Garden Edinburgh . . . . .	www.rbge.org.uk
Royal Society for the Protection of Birds - Scotland . . . . .	www.rspb.org.uk/scotland
Royal Zoological Society of Scotland . . . . .	www.rzss.org.uk
Science & Advice for Scottish Agriculture . . . . .	www.sasa.gov.uk
Scotland's Rural College (formerly Scottish Agricultural College) . . . . .	www.sruc.ac.uk
Scottish Association for Marine Science, Oban . . . . .	www.sams.ac.uk
Scottish Natural Heritage . . . . .	www.snh.gov.uk
SNIFFER . . . . .	www.sniffer.org.uk
Society, Religion and Technology Project . . . . .	www.srtp.org.uk
University of Glasgow . . . . .	www.gla.ac.uk
College of Medical, Veterinary and Life Sciences . . . . .	www.gla.ac.uk/colleges/mvls/
College of Social Sciences . . . . .	www.gla.ac.uk/colleges/socialsciences/
University of the Highlands and Islands (UHI) . . . . .	www.uhi.ac.uk
Agronomy Institute, Orkney College . . . . .	www.agronomy.uhi.ac.uk
Centre for Mountain Studies, Perth College . . . . .	www.perth.uhi.ac.uk/specialistcentres/cms
Centre for Remote and Rural Studies, Inverness College . . . . .	www.crrs.uhi.ac.uk
Environmental Research Institute, North Highland College . . . . .	www.eri.ac.uk
Lews Castle College, Stornoway . . . . .	www.lews.uhi.ac.uk/research
NAFC Marine Centre, Shetland . . . . .	www.nafc.ac.uk
West Highland College, Fort William . . . . .	www.whc.uhi.ac.uk

## Members' meetings

[www.scrr.ac.uk/events.php](http://www.scrr.ac.uk/events.php)

MONDAY MARCH 16, 2015 • 11.00  
Executive Committee meeting and  
Directors' Research Lunch  
Forest Research, Easter Bush, Midlothian

MONDAY MAY 4, 2015 • 11.00  
Executive Committee meeting and  
Directors' Research Lunch  
Institute of Aquaculture, Stirling

## Events

[www.scrr.ac.uk/events.php](http://www.scrr.ac.uk/events.php)

MONDAY FEBRUARY 9, 2015  
SCRR PETER WILSON LECTURE -  
FEEDING THE FUTURE: CAN WE DO IT  
SUSTAINABLY?

- The Royal Society of Edinburgh, 6pm  
Given by Prof Tim Benton, UK Champion  
for Global Food Security and Professor of  
Population Ecology, University of Leeds

MONDAY FEBRUARY 23, 2015  
SCRR FORUM: EXPLORING AND  
EXPLOITING THE MICROBIOME

- Our Dynamic Earth, Edinburgh  
The aim of this event is to raise awareness  
about Scotland's considerable expertise in  
this area and to build links to support  
collaboration for the future.

## PEOPLE AT SCRR

Scientific Director:  
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[Stuart.Monro@blueyonder.co.uk](mailto:Stuart.Monro@blueyonder.co.uk)

Secretary/Treasurer:  
Prof Willie Donachie  
[willie.donachie@moredun.org.uk](mailto:willie.donachie@moredun.org.uk)

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West Lothian EH53 0QA

01506 880929 or 07990 595217

## COPY DEADLINE

The deadline for copy in the next issue  
is May 8th, 2015

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For all queries about distribution, please  
contact the Secretary/ Treasurer by email.

## FUTURE ISSUES

Contributions to the SCRR newsletter are  
welcomed. All contributions, comments and  
suggestions should be emailed to the  
Secretary/Treasurer as above.

## ON THE WEB

Back issues:  
[www.scrr.ac.uk/newsletters.php](http://www.scrr.ac.uk/newsletters.php)