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Scottish Consortium
for Rural Research

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The Edinburgh Consortium for Rural Research goes Scottish!

Professor Stuart K Monro, scientific director, explains our change of name

IF YOU LOOK at the distribution of members of our consortium, you will see that they are scattered throughout Scotland. From its humble beginnings as a way of encouraging collaboration among the various organisations based at the Bush Estate on the outskirts of Edinburgh, the ECRR became a very effective, 'light touch' way to connect a wide variety of organisations across the whole of Scotland.

To reflect this change in our role, the Main Board has decided to change our name to the Scottish Consortium for Rural Research.

The challenge that now faces the executive is how we can reflect the Scotland-wide character of the consortium in the way we operate. Recently, a seminar held on the

communication of the research we do was oversubscribed; and it is now very obvious that engaging with the public is moving rapidly up the agenda of all the members of the consortium.

For the rural community, the Royal Highland and Agricultural Society of Scotland provides a showcase for rural science and so much more. The Society was founded in 1784 to promote the regeneration of rural Scotland, as well as the preservation of its poetry, language and music. Today, in the 21st century, the Society is a point of engagement for all people who value the rural aspects of Scottish life and the role these areas play in our land-based and allied industries. The Society, like our consortium, has a history of

encouraging advances in education, science and technology, although it has been in existence for very much longer. The Royal Highland Show not only engages with the rural community, but also with the public at large, who are the main consumers of our agricultural industries. There are many consortium members who will have a presence at the Royal Highland Show and copies of this newsletter will be available for anyone who is interested in what is going on in rural research in Scotland.

The former ECRR, now SCRR, will continue to foster collaboration among all the various organisations who are concerned with research into aspects of rural activity and contribute to the rural economy of Scotland.

Main picture:
the Royal Highland Showground, near Edinburgh airport

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Larches throughout Scotland are in danger from the fungal disease *Phytophthora ramorum* – **page 3**

Mountains in the north of Europe have nothing in common with mountains in the south – **page 4**

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Improved farmland can not easily be transformed into species-rich grassland – **page 6**

Puffins will struggle if the sandeels they eat continue to decline, but there's good news for anglers – **page 6**

Orchids in Iraq will benefit from a joint project by the Royal Botanic Garden Edinburgh – **page 7**

Golden eagles make a regular appearance, along with sparrowhawks and red kites, as victims of suspected wildlife crime – **page 8**



Tree species trials to 'Reinforce' forestry's ability to adapt to climate change

AS YOU MAY have seen recently on the [BBC news](#), Forest Research is taking part in an international research project to identify tree species that could thrive in the type of climate expected over the next century.

Funded by the European Union, the 'REINFFORCE' project ('REsource INFrastructures for monitoring, adapting and protecting European Atlantic FORests under Changing climatE') is establishing trials of 30 tree species at 37 locations on Europe's Atlantic seaboard, from the Azores in Portugal to the Isle of Mull in Scotland.

The aim of the project is find ways to help Atlantic forests to adapt to projected climate change. Three sites have been planted in Britain this spring as part of the project: in Scotland, on Mull; in England, at the National Arboretum at Westonbirt; and in Wales at Crychan, near Llandovery.

In addition, Forest Research is planting supplementary trials with additional species not just at the three REINFFORCE sites, but also at Cardrona near Peebles and Swinley in Surrey.

The tree species to be planted include familiar ones – pedunculate oak, Scots pine, silver birch and sweet chestnut – as well as less usual ones, such as Atlas cedar and Macedonian and Monterey pines.

A warming climate may make it easier to grow some species that were previously thought to be too tender for British conditions other than in the most sheltered locations in the south and west of the country.

Each of the sites will contain a common set of tree species and where possible material from up to three seed provenances per species.

Researchers will assess survival, health, height, stem diameter and form, dates of flushing and budset, as well as the ways in which the trees respond to climatic factors such as temperature and water availability. The plots are designed to be large enough so that the trees of each species can grow for several decades without interference from neighbours, assuming they survive the vagaries of cold winters (like 2010-11) or unseasonal frosts.

The importance of these trials is all the greater because recent decades have seen a rise in the number of pests



and diseases affecting British forests. Examples include *Dothistroma* needle blight, which has seriously damaged Corsican and lodegpole pines; *Phytophthora ramorum*, which has caused significant mortality in larch forests; and bleeding canker, which has spread widely among horse chestnuts.

The tree species to be planted include familiar ones such as pedunculate oak, Scots pine and silver birch, along with rarer ones like Atlas cedars and Macedonian and Monterey pines

Having good information on the growth and performance of alternative tree species is a prudent component of a strategy of adapting forests to projected climate, as highlighted by the 2009 Read report, 'Combating climate change: a role for UK forests'.

Further information on a number of the species being used in the REINFFORCE trials can be found on the Forest Research website.

In Scotland, there is a history of introducing new tree species that goes back several centuries. Species such as Sitka spruce, Norway spruce, Douglas fir, larches, and lodegpole pine are now prominent in the Scottish

Above: the Cardrona trial site in April 2012 before planting

landscape and help to support a timber industry that is increasingly important to the Scottish rural economy. A recent initiative, the National Tree Collections of Scotland, has been established to bring together some of the premium collections of trees to increase public awareness and to safeguard their heritage value.

Some of these collections, such as the Forestry Commission Scotland's Forest Garden at Kilmun near Dunoon, also provide valuable information about the potential of alternative tree species under a changing climate.

For further details, contact Bill Mason (bill.mason@forestry.gsi.gov.uk) or Richard Jinks (richard.jinks@forestry.gsi.gov.uk)

Links

REINFFORCE project, IEFC website: reinforce.iefc.net
 The Read Report, 2009: www.forestry.gov.uk/readreport
 Tree species: www.forestry.gov.uk/fr/treespecies
 National Tree Collections of Scotland: www.ntcs.org.uk/
 Forestry Commission arboreta (eg Forest Garden Kilmun): www.forestry.gov.uk/forestry/INFD-8M7JVC

Sustainable ingredients for salmon feeds

Douglas R. Tocher and J. Gordon Bell of the Institute of Aquaculture at the University of Stirling report on two new projects to develop vegetable feeds

A CHALLENGE FOR AQUACULTURE

is to farm fish in a sustainable and environmentally friendly manner, and yet maintain the nutritional quality of fish and its status as a healthy part of human diet. Two projects at the Stirling University's Institute of Aquaculture are addressing these issues in a highly integrated manner in collaboration with industrial and academic partners.

Dietary omega-3 long-chain polyunsaturated fatty acids (LC-PUFA) have well established beneficial effects in human health. The primary source of these fatty acids in our diet is fish and seafood. With declining fisheries worldwide, an increasing proportion is now supplied by aquaculture.

High levels of omega-3 in farmed fish have in the past been ensured by the use of fish oil and fishmeal as ingredients in feed, but this is clearly not sustainable. Vegetable oils are an obvious alternative but are largely devoid of omega-3 LC-PUFA.

The Nutrition Group at Stirling aims to produce vegetable oils enhanced specifically for aquaculture in a project entitled 'Evaluating novel plant oilseeds enriched in omega-3 LC-PUFA to support sustainable development of aquaculture'. The project is supported by a £1.1 million Industrial Partnership Award from the Biotechnology and Biological Science Research Council (BBSRC) and is an interdisciplinary collaboration between Stirling, plant scientists at Rothamsted Research, and a major international fish-feed company, BioMar.

It aims to take an oilseed crop, *Camelina sativa*, a relative of rapeseed, and to modify it using a synthetic biology approach, with the inclusion of algal genes to manufacture omega-3 LC-PUFA, usually produced only in marine phytoplankton. Oils will be trialled in feeds for Atlantic salmon.

Although GM plant technology currently has a limited role in Europe, GM products already have wide application in animal feeds in many other parts of the world.

A second project, entitled 'Development of protein-rich and starch-rich fractions from faba beans for salmon and terrestrial animal production respectively', will develop new replacements for fishmeal as an alternative to the current over-reliance



Above: a farmed Atlantic salmon. Below: bee on faba bean crop

on imported soy. This project will process faba (field) beans to produce a protein concentrate for use in salmon feeds, and a starch concentrate for pig and poultry feeds, thus replacing a significant proportion of imported soy and fishmeal.

Increased bean cultivation could also reduce the use of artificial fertiliser thanks to the nitrogen-fixing properties of bean plants. The £2.6 million award from the UK Technology Strategy Board involves six industrial partners including feed companies (EWOS, BioMar, Harbro), a fish producer (Marine Harvest Scotland), crop trader (WN Lindsay), and plant breeder/seed company (Limagrain UK), as well as five academic partners, including Stirling, Aberdeen and St. Andrews universities, the James Hutton Institute and the Scottish Agricultural College.

Nutrition Group, Institute of Aquaculture:
www.aqua.stir.ac.uk/research/nutrition



NEWS

On the lookout for larch infection

LANDOWNERS AND WOODLAND MANAGERS in the west of Scotland are urged to keep their eyes open over the next few weeks for early signs of infection in larch.

Forestry Commission Scotland is enlisting the help of woodland owners and managers to contain the spread of *Phytophthora ramorum*.

Hugh Clayden, the Commission's Tree Health Policy Adviser, says: 'As the disease has the capacity to spread very quickly, infecting and killing trees, affected crops need to be felled or killed as soon as possible to prevent wider spread.'

'The disease has the potential to devastate larch woodland and cause substantial landscape, biodiversity and economic damage.'

Symptoms include:

- Dead and partially flushed trees present in groups, patches or distributed throughout stand.
 - Crown and branch dieback likely to be present with distinctive yellowing or ginger colour when branches are girdled.
- Additional symptoms within stands of mature larch include:**
- Individual or many branches with partial or complete dieback in crown.
 - Epicormic growth protruding through dead branches (sometimes extending down stem below dead crown).
 - Profuse resin bleeds on main stem at crown level and on branches (may only be visible with binoculars).

All woodland owners and managers have a role to play in trying to contain the rapid spread of this highly damaging disease.

If you suspect that you have located an infected stand, please report it without delay to ddas.nrs@forestry.gsi.gov.uk or phone 0131 445 2176.

NB Owners or managers of individual garden, parkland, street or amenity trees who think their trees might be infected should contact the Forest Research Tree Health Diagnostic Advisory Service. Contact details are on the website at www.forestry.gov.uk/fr/ddas

Territorial similarities in Europe: what do mountains, coastal areas and islands have in common?

Diana Borowski of the Centre for Mountain Studies at UHI Stirling describes a project on an epic scale

IS FARMING MORE COSTLY in the Alps than in the plains of northern France? Does it take longer to get to school when living in Shetland than in Edinburgh? Do vacation homes outweigh permanent population along the coasts of Ireland? Would the Canary Islands be able to survive without imports from Europe? How long does it take to visit your next neighbour when living in northern Norway? On the Dutch border, is it quicker to call a Belgian ambulance or a Dutch one in case of emergency?

While these questions and more have been answered in previous research projects, GEOSPECS takes a new approach by looking at types of 'geographically specific' area. The project investigates mountains, islands, coasts, border areas, sparsely populated areas, outermost regions and inner peripheries in Europe. The Centre for Mountain Studies at the University of the Highlands and Islands is responsible for the research on mountain areas and for the external communication of the project (website and newsletter).

The approach of GEOSPECS (**GEO**graphic **SPEC**ificities and **Dev**elopment Potentials in Europe) is new in two regards. First, by combining all these different types of geographic specificities, it is possible to identify commonalities and differences between them, and consequently answer the question whether any European policy should be adapted to these particular territories. Second, GEOSPECS analyses these questions at a much more detailed level.

After working on the geographic specificities for almost two years, only one clear message emerges: Europe is diverse. It is impossible to make generalisations that hold true for all geographic specificities

While many previous projects have looked at the 'regional' level – which would correspond to council areas in Scotland – GEOSPECS looks at the 'municipality' level, which corresponds to wards in Scotland. This is important as it gives a much clearer picture.

For instance, any council area might be partly mountainous and partly



Map showing mountain regions across Europe

'flat', and by aggregating statistical data for the entire region, a distorted picture may emerge. Accumulating the data only at the municipality level allows for a more distinct view of what life is like in mountainous areas (or in the islands, on the coasts, and so on).

The project looks into many different aspects of daily life: from employment structure to road networks, and from age structure of the local population to extent of national parks.

After working on these geographic specificities for almost two years – delineating them, analysing data for each one, comparing to other parts of Europe, implementing case studies – only one clear message emerges: Europe is diverse. It is impossible to make any generalisations that hold true

for all geographic specificities, but equally impossible to make generalisations about just one of them.

'The mountains' are not a homogenous entity, nor are 'the islands' or 'the borders'.

Differences are particularly pronounced between the north and south of Europe and between west and east, but some indicators even vary between the different countries.

The findings of the project are at: www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/geospecs.html

The Draft Final Report has been published in May 2012. The project – which unites researchers from 10 different countries – started in summer 2010 and was financed by the European ESPON Programme



Methane from livestock and climate change – what do farmers really think?

Dr Ann Bruce of the ESRC Innogen centre at the University of Edinburgh asks if farmers might consider animal genetics as a way to reduce emissions

AS GOVERNMENTS INCREASINGLY place climate change towards the top of the political agenda, all sectors of society are encouraged to reduce their emissions of greenhouse gases; for livestock producers, this means finding ways to reduce the methane produced by the animals they raise. Methane has 23 times the global warming impact of CO₂.

But how realistic are the demands upon farmers to alter their practices in order to reduce methane emissions, and what are their attitudes to these?

Recent research undertaken by Dr Ann Bruce at the ESRC Innogen Centre at the University of Edinburgh has set out to examine these questions. Entitled 'Mitigating the environmental impact of cattle and sheep: animal genetics and farmers' readiness for uptake', the project interviewed 40 farmers across the UK in order to understand their attitude to, and uptake of, breeding technologies as a means of reducing global warming impacts from sheep and beef cattle.

Previous scientific research has indicated that genetics and genomics can be used to significantly reduce the amount of methane generated per kilogram of livestock produced, as well as increasing profit margins.

However, despite the potential economic and environmental benefits from breeding sheep and cattle to produce reduced amounts of methane when digesting feed, Dr Bruce's research has revealed a number of barriers to farmers adopting these mitigation measures. These include:

- A number of farmers found it difficult to accept the assertion that methane produced by cattle and sheep is a major contributor to global warming. As a result, they are likely to be unreceptive to calls to reduce livestock-derived methane emissions.
- A number of those interviewed felt that there should be a focus on addressing climate change at a global, rather than national, level and that unilateral action might be detrimental to the livestock industry within the UK.
- While some farmers were either already adopting, or were amenable to,



Above: a lamb on a hill farm. Marginal land often has no other obvious agricultural use.

technologies designed to reduce methane emissions, others – and in particular organic farmers and those selling direct to consumers – perceived there to be a conflict between such technologies and their customers' requirements for 'natural' food.

- Some farmers felt helpless in the face of the 'methane challenge' as they believed that technology would only have a minor impact on agricultural methane emissions.

Some farmers – particularly organic farmers and those selling direct to consumers – perceived there to be a conflict between such technologies and their customers' requirements for 'natural' food

The research indicates that there are significant challenges in encouraging sheep and cattle farmers to adopt measures that will reduce methane emissions from agriculture.

However, there may also be ways to encourage greater acceptance of methane-reducing measures: including emphasising that such measures can also result in increased production efficiency (rather than focusing on the importance of reducing methane emissions) and promoting actions at farm level – such as improving grass and soil management, and planting trees – as well as the adoption of breeding-related technologies.

Further information can be found on the Innogen website at bit.ly/KIXtrY or at www.burpingsheep.org

NEWS

More funding to improve barley

THE JAMES HUTTON INSTITUTE has been awarded £1.25 million for four projects to help improve the quality and reliability of malting barley, increase knowledge of root development, and identify disease resistance in barley.

The awards have been made as part of the Crop Improvement Research Club, which aims to deliver improvements to oilseed rape and the two main UK cereal crops, wheat and barley, thereby boosting efforts to ensure food security.

The projects are among nine announced by the Biotechnology and Biological Sciences Research Council (BBSRC) which together represent an investment of more than £4 million by BBSRC, the Scottish Government and 14 companies including plant breeders, farmers and food processors.

Dr Bill Thomas, an expert in barley genetics at the James Hutton Institute in Dundee, said: 'This new funding will enable us to work towards new, improved crop varieties which will not only result in better yields and quality, but will also require less inputs, making them more sustainable too.'

Two projects will work with the whisky and brewing industries to help improve malting barley varieties. In the first, researchers will identify DNA markers for use in barley breeding programmes, to eliminate varieties with potential processing problems, saving plant breeders up to £1million in development costs.

The second project, led by the Scottish Agricultural College (SAC), will use genetic markers to identify varieties susceptible to skinning, which can result in variation in water uptake and uneven germination when malting.

The James Hutton Institute will lead a project to identify and select novel sources of resistance to *Rhynchosporium*, which should result in a reduction of fungicide use in line with new European regulations; and researchers in Dundee will collaborate on a project led by the University of Nottingham to improve resource use, establishment and yield in barley, oilseed rape and wheat.

For more, see the News section of the James Hutton Institute website, www.hutton.ac.uk/news

Members' reports

School of Geosciences, University of Edinburgh



The legacy of intensive agriculture: implications for providing ecosystem services from agri-environment schemes

Can you successfully turn intensively farmed land into species-rich grassland?

ONE COMPONENT OF the Scotland Rural Development Programme (SRDP) encourages land-use change from intensive agriculture to species-rich grassland to increase biodiversity. However, many attempts at restoring species-rich grassland on former intensively managed agricultural sites have met with limited success.

This is often due to high levels of nutrients present in the soil preventing the establishment of high-diversity ecosystems. Furthermore, little is known about the impacts of extensification on nutrient cycling; and specifically about harmful and costly nutrient losses from soils, such as nitrate leaching, which may cause eutrophication in downstream waters or the emission of nitrous oxide, a powerful greenhouse gas.

The study was conducted on four working farms in south-east Scotland from 2010 to 2012. At each farm, two adjacent 10.6m x 10.6m plots were monitored: one in newly created species-rich grassland (SRG), and one still under intensive management (IM). The SRG plots were converted three to eight years before the start of the research in 2010. Soil was sampled at depths of 0cm-10cm and 30cm-40cm in each plot on four occasions and analysed for moisture content, pH, organic matter content, nitrogen,



Claire Horrocks (on left) measures gas fluxes on species-rich grassland, above; Oliver Edmonds counts and identifies plant species in a quadrat, right.



phosphorus and carbon content. In July 2010 and 2011, the plant species present in the SRG plots were identified and compared to those in the grassland seed mix sown at the time of SRG establishment. Below-ground microbial diversity and

fluxes of greenhouse gases are also being assessed.

From the preliminary results, the soil properties in the IM and SRG plots at each site do not differ significantly, regardless of the time since SRG establishment. The majority of plants in the SRG plots are grass species not present in the sown seed mix, and are plants that favour an environment moderately rich in nutrients. Plant diversity increased slightly with time since SRG establishment, although a larger data set would be required to verify this finding.

These findings, although based on a small number of sites, suggest that the hoped-for increase in biodiversity provided by converting intensively managed agricultural land to species rich grassland may be small. Further, such conversion schemes may need to be funded for more than eight years to achieve an increase in biodiversity.

Funding for Claire Horrocks was provided by NERC and SEPA, and for Rothamsted Research North Wyke by the BBSRC. We are also grateful to the farmers for permission to access their land and to ecological science students at The University of Edinburgh who helped with fieldwork and laboratory analyses.

Claire Horrocks¹, Kate Heal¹, Laura Cardenas², Jenni Dungait² and Barbra Harvie¹

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Effects of climate change on UK marine life

Report involves scientists at Scottish Association for Marine Science (SAMS)

THE MARINE CLIMATE CHANGE IMPACTS PARTNERSHIP (MCCIP) launched its latest report card in May at the World Fisheries Congress in Edinburgh, focusing on how climate change is affecting fish and shellfish around the UK and Ireland.

The MCCIP commissioned three groups of scientists to consider how climate change is affecting marine fish, fisheries and aquaculture, and what the social and economic consequences could be. The key findings of the 2012 report card include that there are clear changes in the depth, distribution, migration and spawning behaviours of

fish, many of which can be related to warming sea temperatures; that cultivated fish and shellfish are both susceptible to climate change, although fish farming offers potential for adaptation; and that controlled or closed fishing areas that can be adapted in response to climate change could help protect commercial and vulnerable fish stocks.

The report notes that recreational sea fishing is an important socio-economic activity that could be positively affected by climate change, due to the increasing abundance of species of interest to anglers.



Puffins rely largely on sandeels to feed their young

However, shifting distributions of fish stocks will continue to have international implications. Some species essential to marine food chains may be particularly affected, so that extensive restructuring of food chains will follow: the decline in sandeels in the North Sea may prove to be an example.

The aquaculture and climate change review, in which SAMS scientists participated, is at www.mccip.org.uk

Detailed peer-reviewed journal papers on all topics can be accessed through 'Aquatic Conservation – Marine and Freshwater Ecosystems', [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1099-0755](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-0755)



Joint UK and Iraqi conservation initiative in Iraq

RBGE joins with BirdLife International and Nature Iraq to assess risks to biodiversity in mountainous Kurdistan

THANKS TO A £300,000 GRANT from Defra's Darwin Initiative, a major new three-year conservation programme is starting in Iraq. Focusing on the mountainous region of Kurdistan, the project will involve experts from the Royal Botanic Garden Edinburgh (RBGE) and BirdLife International (BirdLife), in partnership with Iraqi NGO Nature Iraq (NI).

The project will generate new data for conservation and resources for management of protected areas and environmental education. The team's aim is to make serious progress in addressing the challenges of conservation resulting from nearly 30 years of scientific isolation.

'The biodiversity of Iraq is extremely vulnerable following years of unstable government, breakdown in traditional land management and recent rapid development,' explains Tony Miller, director of RBGE's Centre for Middle Eastern Plants and project leader in the UK. 'What's more, the country has limited capacity to deal with threats to the environment. At present, the only internal organisation engaged in conservation work is Nature Iraq. Supported by BirdLife International, since 2005, it has adopted a Key Biodiversity Areas approach to identifying biodiverse-rich regions. The new funding will allow us to work with the two agencies towards conserving the country's fragile environment.'

This is not the UK teams' first involvement in Iraq. Both BirdLife and RBGE have been working with NI for several years, delivering training to Iraqi scientists. These activities have involved staff, students and personnel from all major Iraqi organisations with an interest in the environment, including the major universities and ministries in both Iraq and the Kurdish Autonomous Region.

Richard Benyon, minister for the Natural Environment in the UK government, says: 'Iraq has suffered many years of war and conflict, and protecting its wildlife has understandably been a low priority.

Cinereous bunting, right: using an Iraqi bird guide, below; the native orchid *Cephalanthera kurdica*, bottom



Things are now changing, and with work already under way to tackle threats to the environment, it is clear Iraq has stepped up its efforts to conserve its vulnerable wildlife.

'The Darwin Initiative is all about helping the world's poorest countries protect their wildlife, and I hope that the money and expertise provided by the UK will allow them to focus on this once more.'

'This project brings together the foremost

British expertise in both Middle Eastern plants and birds to work in partnership with the Iraqi environmental NGO Nature Iraq', says Dr Sophie Neale, head of biodiversity programmes at the Centre for Middle Eastern Plants, who is UK project manager. 'It will involve extensive fieldwork in the Kurdistan region of northern Iraq and will have a significant impact on conservation in the country. One legacy will be interactive identification guides to the biological diversity of Piramagroon, a Key Biodiversity Area, including photographic guides which can be downloaded to mobile phones. This technology has been recognised as a particularly appropriate, accessible and user-friendly way to disseminate information in the Middle East. Nevertheless, this will be the first time it has been achieved for biodiversity information in Iraq.'

Richard Porter, of BirdLife, says: 'Working with Nature Iraq for the past seven years has been inspiring and a great privilege. Their extensive wildlife surveys have produced a wealth of information and now there is a great opportunity to use this for an exciting education programme.'

Welcoming news of the grant, Nadheer Abood, CEO of NI, says: 'In Iraq, conservation of species and habitats has languished far behind the rest of the world due to decades of war and civil unrest. Nature Iraq has been active in trying to change this situation since 2004 through conservation research and field studies. Now, in a partnership with the Royal Botanic Garden Edinburgh and BirdLife International, we will work together to plan and implement specific conservation tools at a proposed protected area in northern Iraq. Once developed these tools will help us in our efforts to create and expand a protected area network within Iraq.'

The project, entitled 'Building Capacity For In-situ Conservation in Iraq', is one of 33 to receive a total £8.5 million UK government funding under Defra's Darwin Initiative. Since its launch in 1992, the Darwin Initiative has committed £88 million to 762 projects in over 150 countries.

Details of the 33 new Darwin Initiative projects and previous projects are at <http://darwin.defra.gov.uk>



Members' reports

Science and Advice for Scottish Agriculture (SASA)



Edinburgh students explore the role played by the Pesticides and Wildlife branch at SASA

A visit in March this year uncovered many of the surprising and little-known aspects of pesticide regulation

FOR THE PAST SIX YEARS, students and staff from the University of Edinburgh's School of Geosciences have come to SASA to see at first hand the range of regulatory and scientific functions delivered by the Pesticides & Wildlife branch (P&W) on behalf of the Scottish Government.

Degree courses including Environmental Sciences, Ecological Sciences with Management, Environmental Geosciences, Geography with Environmental Studies, Biological Sciences and Economics with Environmental Studies are represented.

This year, a group of 30 junior honours (3rd year) students from the Pollution of the Biosphere course learned about the activities of the wildlife incident investigation team, food surveillance analysts and pesticide usage surveyors. They were also introduced to the complex process of pesticide approvals.

Dr Mike Taylor, head of P&W, delivered an overview and, despite the inclusion of gruesome images of mouldy raspberries, deceased rats and poison baits, prompted some insightful questions, particularly from overseas visitors from the USA. The links between pesticide approvals, usage surveys and food analysis illuminated many aspects of the degree courses: i.e. what can legally be released into the biosphere, how much is released, and how consequences are assessed.

Gillian Reay, pesticide usage survey manager, explained how SASA gathers and collates data on pesticide usage throughout Scotland and how this informs pesticide regulation and Scottish Government policy.

Dr Jackie Hughes, pesticide adviser, described the detailed and complex process followed prior to the approval for use of any new pesticide in the UK or EU. Scientific evaluation, fate and distribution in the environment and ecotoxicology of new pesticides were all highlighted.

By the time Dr George Keenan, senior pesticide analyst, introduced the history of pesticide surveillance in the UK and the modern analytical techniques in use at SASA, the students were looking forward to escaping the confines of the lecture



Above: applying dessiccant to a lupin crop. Below: golden eagle in the Wildlife Incident Investigation Scheme laboratory

theatre to visit P&W's laboratories, where they would see our state-of-the-art facilities and a few of the unfortunate victims of wildlife crime.

Anna Giela, lead Analyst, introduced some recent investigations by Wildlife Incident Investigation Scheme – Scotland, involving red kite, sparrowhawk and golden eagle.

Students were interested in the advanced analytical systems we use, and the growing importance of computer technology in the operation of such complex instruments

The aim of the scheme is to identify adverse effects on non-target animals that might arise from the approved use of pesticides. Seeing these birds first-hand emphasised to the students the

pivotal role played by SASA scientists in monitoring the impact of pesticide use on animals and supporting the fight against wildlife crime in Scotland.

The visitors then moved on to the instrument laboratory where Kirsty Reid, team manager for pesticide residues in food surveillance, highlighted the demands of the European Union-coordinated pesticide surveillance programme and our continuing contribution to its delivery. The students were particularly interested in the advanced analytical systems required to meet our obligations and the growing importance of computer technology in the control and operation of such complex instruments.

By the end of the visit it was felt that a greater understanding had been gained of the role played by the Scottish Government in protecting our food, wildlife and environment.

These visits are very popular with students, allowing a rare peek behind the scenes of a working laboratory. A common comment following the visit is 'We had no idea that this work is going on right on our own doorstep'. Hopefully we have remedied this and we look forward to future visits.



Further information: www.sasa.gov.uk



Environmental engineers plan a low-carbon future for your community thanks to anaerobic digestion

The aim is to be both greener and cleaner, explains Blanca Antizar-Ladislao of the School of Engineering

THE SUSTAINABLE Environmental Engineering and Development (SEED) research group at the University of Edinburgh focuses on developing treatment systems that not only capture or develop renewable resources, but also prevent or clean up environmental pollution. The group combines engineering with biology and chemistry to gain an integrated understanding of how natural and engineered systems work, and how they can be controlled. The result is new ways to reclaim polluted water, generate energy from waste, improve the public health and manage waste more sustainably.

The group's long-term vision is to address the specific needs of particular communities, in terms of sustainable waste treatment and water and energy supplies, by developing programmes that couple appropriate technology and innovative education approaches.

One major driver towards a low carbon economy is promoting the wider use of anaerobic digestion (AD) of organic waste. Ongoing research funded by the Engineering and Physical Sciences Research Council (EPSRC) and Scottish Water focuses on optimising anaerobic digestion of mixed organic wastes – incorporating food waste and algal biomass – as a source of combined heat and power generation, with the added benefit of fertiliser production. One particular concern is the effect of plastics and potential emerging contaminants during biological treatment of municipal solid waste. Potential emerging contaminants that can enter into municipal waste streams are nanomaterials (eg sunscreen), pharmaceuticals and hormone-like substances.

Additionally, the research group is investigating the sustainability of biofuel production from algal biomass, with a key interest in the growth of

Both household waste (right) and algal biomass (bottom) can be used as 'fuel' for the anaerobic digestion process, to generate heat and power. Middle: anaerobic digestion plant.



algae for wastewater treatment and conversion of waste to energy through anaerobic digestion.

Current UK water industry installed anaerobic digestion capacity is estimated at up to 1,000 GWh (representing 90 percent of the energy currently produced from AD in the UK). Anaerobic digestion produces biogas – (60% methane (CH₄) and 40% carbon dioxide (CO₂) – and digestate that contains nitrogen, phosphorous and trace elements (eg heavy metals and persistent organic contaminants) and it has to conform to PAS 110. The AD Strategy and Action Plan makes clear that the UK Government and its partners are committed to facilitating biomethane injection into the national gas grid (ie upgrading biogas after CO₂ and other unwanted compounds are removed) and the use of biomethane as a transport fuel. With a medium

expansion curve of AD plants, and allowing for Government policy on reducing the amount of food waste in general, a reasonable expectation for

England could be in the range of 5Mt of food waste realistically available for AD and 40Mt of animal waste. This quantity of waste gives the potential to generate approximately 3,500 GWh of electricity and savings of 1.8 Mt of CO₂-equivalent greenhouse gases from grid-based electricity production.

An additional benefit is the recovery of phosphorous – a limited natural resource, that needs to be recycled – through land spreading of sludge (where phosphorous is bioavailable), which is estimated as 55% of the current phosphorous demand.

Organic waste that has traditionally been buried in landfills can now be diverted and used as biomass feedstock for novel and/or adapted treatment process like anaerobic digestion, preventing the emission of CH₄ that could have 25 times more green house effect than CO₂. Integrated and optimised bioenergy systems have the potential of contributing to the global greenhouse-gas reductions and the local environmental and societal benefits.

For more information, please contact B.Antizar-Ladislao@ed.ac.uk or visit www.see.ed.ac.uk/seed

Mountain plants on the move across Europe

A new study shows that plants are climbing to higher altitudes; and species diversity is declining in some regions

A NEW PAN-EUROPEAN STUDY has shown that mountain plants across the continent are moving to higher altitudes and that such upward shifts can lead to a reduction in species richness.

The results are described in two recent papers published in *Science* and *Nature Climate Change*. They are based on detailed vegetation surveys of 66 mountain summits in all major European mountain systems between the north of Europe and the Mediterranean. An international research group led by the Austrian Academy of Sciences and the University of Vienna mapped all plant species at each site in 2001 and again in 2008 using the same standardised procedures. The group includes Dr Jan Dick of the Edinburgh Centre for Ecology & Hydrology (CEH) who monitors vegetation change at an Environmental Change Network (ECN) site in the Cairngorms.

Climate change is gradually transforming mountain plant communities. The changes may not be obvious on individual mountains, but at the continental level they become apparent and significant. In general, species have moved to higher altitudes. Cold-adapted species decline and warm-adapted species increase. However, increasing species numbers were only found on summits of northern and central Europe. By contrast, species numbers were stagnating or declining at nearly all sites in the Mediterranean region. Although the data show an average increase in summit species richness across the region, continuing climatic trends may reduce European mountain flora because

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Mediterranean mountains are particularly rich in endemic species. A progressive decline in cold mountain habitats and their biota is predicted.

Dr Harald Pauli, from the Global Observation Research Initiative in Alpine Environments (GLORIA), the study's lead author, says: 'Our results showing a decline at the Mediterranean sites are worrying



Above: Dr Jan Dick at the study site in the Cairngorms. Right: surveying mountain flora



because these are the mountains with a very unique flora and a large proportion of their species occur only there and nowhere else on Earth.'

On summits further north in Europe, more plant species are prospering. This could be taken to indicate that these are much safer sites for alpine flowers. But Dr Michael Gottfried, from GLORIA's coordination team says: 'I'm afraid that this is not necessarily the case, because the newly appearing plants are predominantly more widespread species from lower elevations and will pose increasing competition pressure on the rarer cold-loving alpine flowers.'

The uppermost tips of Mediterranean mountains are rather small patches of cold habitats, spread like islands over a sea of much warmer

lowlands. Lowland areas and the mountains are exposed to a characteristic dry season in summer. In the higher altitudes, precipitation falls mainly as snow and mainly during winter and spring, with snowmelt crucial for water supply of mountain plants during the arid growing season.

Dr Pauli added: 'The observed species losses were most pronounced on the lower summits, where plants are expected to suffer earlier from water deficiency, rather than on the snowier high peaks. Climate warming and decreasing precipitation in the Mediterranean during the past decades fit well to the pattern of shrinking species occurrences. Much of the Mediterranean region is projected to become even drier during the upcoming decades.'

Pauli, H. et al (2012) Recent plant diversity changes on Europe's mountain summits. Science 336: 353-355. DOI: 10.1126/science.1219033

Gottfried, M. et al (2012) Continent-wide response of mountain vegetation to climate change. Nature Climate Change 2: 111-115. DOI: 10.1038/NCLIMATE1329

‘People and the planet’: ideas for a sustainable future from The Royal Society’s Science Policy Centre

THE ‘PEOPLE AND THE PLANET’

project from the Royal Society’s Science Policy Centre is a major study investigating the links between global population and consumption, and the implications for a finite planet. Its final report was published in April.

The aims of the study were to provide policy guidance to decision-makers and to inform interested members of the public, through a dispassionate assessment of the best available evidence. The scope was global. The study acknowledged regional variations in population dynamics, and the inequality that exists in consumption patterns around the world.

The report is offered not as a definitive statement on these complex topics, but as an overview of the impacts of human population and consumption on the planet. It raises questions about how best to seize the opportunities that changes in population could bring – and how to avoid the most harmful impacts.



RECOMMENDATION 2

‘The most developed and the emerging economies must stabilise and then reduce material consumption levels through: dramatic improvements in resource use efficiency including reducing waste; investment in sustainable resources, technologies and infrastructures; and systematically decoupling economic activity from environmental impact.’

RECOMMENDATION 4

‘Population and the environment should not be considered as two separate issues. Demographic changes, and the influences on them, should be factored into economic and environmental debate and planning at international meetings, such as the Rio+20 Conference on Sustainable Development and subsequent meetings.’

RECOMMENDATION 5

‘Governments should realise the potential of urbanisation to reduce material consumption and environmental impact through efficiency measures. The well planned provision of water supply, waste disposal, power and other services will avoid slum conditions and increase the welfare of inhabitants.’

RECOMMENDATION 7

‘Natural and social scientists need to increase their research efforts on the interactions between consumption, demographic change and environmental impact. They have a unique and vital role in developing a fuller picture of the problems, the uncertainties found in all such analyses, the efficacy of potential solutions, and providing an open, trusted source of information for policy makers and the public.’

RECOMMENDATION 8

‘National Governments should accelerate the development of comprehensive wealth measures. This should include reforms to the system of national accounts and improvement in natural asset accounting.’

RECOMMENDATION 9

‘Collaboration between National Governments is needed to develop socio-economic systems and institutions that are not dependent on continued material consumption growth. This will inform the development and implementation of policies that allow both people and the planet to flourish.’

Find out more at <http://royalsociety.org/policy/projects/people-planet/>

Scottish Natural Heritage nature photography competition

Send in your pictures and win a one-to-one tutorial with top nature photographer Lorne Gill



AS PART OF SCOTTISH BIODIVERSITY WEEK in May, Scottish Natural Heritage (SNH) launched its sixth annual Nature Photography Competition, open to both amateurs and professional photographers.

First prize is a one-to-one tutorial with one of Scotland’s leading professional nature photographers, Lorne Gill; second prize is a Nikon D5100 Digital SLR; third prize is a Panasonic Lumix LX5 camera.

Send your picture of animals, plants or landscapes as an attachment in an email, with ‘Photo Contest’ in the subject line, to bit@snh.gov.uk by July 31 2012.

Entries must be original, have a title, indicate where in Scotland the photo was taken, and include the entrant’s name and contact details. Each person may submit up to two entries. Entrants must be residents of Scotland. SNH will notify winners in September.

More information at www.snh.gov.uk/biodiversityweek

Left: ‘Stormy evening light, Elgol’ by Tom Gardner, one of last year’s winning photographs

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Moray House School of Education	www.ed.ac.uk/schools-departments/education
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School of History, Classics and Archaeology	www.shca.ed.ac.uk/Research/
School of Social and Political Studies	www.sps.ed.ac.uk
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Royal Zoological Society of Scotland	www.rzss.org.uk
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Scottish Agricultural College	www.sac.ac.uk
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Society, Religion and Technology Project	www.srtp.org.uk
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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
Scottish Association for Marine Science, Oban	www.sams.ac.uk
West Highland College, Fort William	www.whc.uhi.ac.uk

Members' meetings

Monday August 20, 2012
 Scottish Agricultural College, Edinburgh
 Directors' lunch
 Host, Prof Geoff Simm

Monday October 8, 2012
 Perth College,
 University of the Highlands and Islands
 Executive Committee meeting
 Directors' lunch, 12:30
 Host, Prof Martin Price

Monday December 3, 2012
 Old Moray House,
 The University of Edinburgh
 Board meeting, 11:00
 Directors lunch, 13:00
 Host, Prof Steve Yearley

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FUTURE ISSUES

Contributions to the SCRR newsletter
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 All contributions, comments and
 suggestions should be emailed to the
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