

## Keeping track of red squirrels

Research that aims to help squirrel-friendly management of forests

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# scrr

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PHOTOGRAPH: WIKIMEDIA COMMONS

## Evidence based conservation

Prof Stuart Monro, scientific director of SCRR, on issues of scientific method raised by the latest television wildlife blockbuster

CONSERVATION OF ANIMALS in the wild is a topic which stirs the conscience of many. In the latest *Planet Earth* series, Sir David Attenborough explores life in a range of different environments and in concluding the series, he says: 'It is surely our responsibility to do everything in our power to create a planet that provides a home not just for us, but for all life on Earth.'

This is a powerful statement that needs to be translated into evidence-based actions. While humanity must take responsibility for the loss of species through poaching or loss of natural habitat to agriculture, human intervention through effective management of the ecosystem can

bring about a healthy balanced diversity in the animal population. This applies as much to the re-introduction of species into the Scottish ecosystem as it does for the exotic locations featured in *Planet Earth II*.

Today, there is a need to be more rigorous in evaluating the consequences of interventions with good pre-intervention benchmarking against which post-intervention data can be compared. The outcomes from this scientific approach provide the evidence of successful interventions as well as alerting us to when things might be going wrong. This is methodology which should be applied to the essential and successful management of any ecosystem.

**The red squirrel is one of the UK's most endangered species, with about 160,000 individuals surviving; efforts are already under way to improve the evidence base for its conservation**

## This issue in numbers

**120,000** red squirrels (or fewer) are believed to survive in Scotland – **page 2**

**17%** forest cover by land area puts Scotland pretty low down in the European league – **page 3**

**14** Scottish trees have been added to the Millennium Seed Bank at Kew in the past year – **page 3**

**70%** of Europe's Natura 2000 area has an excess of nitrogen nutrient deposits – **page 5**

**2,000** hectares of blanket bog is being restored in the Flow Country by the RSPB – **page 7**

**40%** of the land area of Scotland lies within 44 upland Deer Management Areas – **page 8**

**7,000** people are employed in producing salmon, Scotland's number one food export – **page 9**

## About SCRR

**THE SCOTTISH CONSORTIUM FOR RURAL RESEARCH** 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

Inverness College UHI; Royal Botanic Garden Edinburgh

DUE TO COMPETITION, disease and habitat loss, fewer than 120,000 red squirrels remain in Scotland. Forest Enterprise Scotland, an agency of Forestry Commission Scotland (FCS), manages over 400,000 ha of Scotland's publicly owned, multifunctional forests, which are used for timber production, recreation and wildlife conservation.

Many of these forests support populations of red squirrels. As these squirrels and their dreys (nests used for shelter and breeding) are protected under UK and Scottish legislation, their presence needs to be considered when planning forest management

# Optimising mitigation for red squirrel conservation in productive forests

Integrating timber production with red squirrel conservation – a joint research project between Forest Enterprise Scotland and Inverness College UHI

operations. Any potential disturbance or damage to squirrels or their dreys needs to be mitigated, with mitigation measures potentially being costly or impractical in the field. FCS has therefore developed detailed guidance on managing forests with red squirrels, but there are knowledge gaps about the impact of forest operations on red squirrels and the effectiveness of current mitigation measures.

In January 2017, Dr Louise de Raad, Research Fellow at Inverness College UHI, will lead a research project to develop science-based mitigation measures to inform the licensing process. The study aims to investigate how red squirrels respond to habitat

fragmentation and habitat loss caused by forest operations and will also look at the potential of using nest boxes as a possible mitigation measure on sensitive sites or at sensitive times

of year. Squirrels will be trapped and tagged with state-of-the-art, lightweight GPS equipment, through which their movements will be followed for a six-month period while forest operations are taking place. The study should lead to a better understanding of the relationship between forest practices and red squirrel

ecology, and allow timber production to be effectively integrated with red squirrel conservation.

To find out more about the study, contact [louise.de-raad.ic@uhi.ac.uk](mailto:louise.de-raad.ic@uhi.ac.uk)

**Squirrels will be tagged with state-of-the-art, lightweight GPS equipment and their movements will be followed for six months**

Below: trapping a red squirrel for a GPS tag to be fitted



# Edinburgh's botanic garden strikes gold for green tourism

THE ROYAL BOTANIC Garden Edinburgh (RBGE), one of Scotland's leading visitor attractions, has achieved a Green Tourism Gold Award. The internationally renowned institute for plant research and conservation has been awarded Gold status after scoring highly in all categories including innovation, energy savings and purchasing. The Botanic is the largest of the 10 visitor attractions in Edinburgh which hold the coveted Green Tourism Gold Award.

Green Tourism recognition requires an independent assessment of how an organisation operates sustainably to meet the needs of the environment, local residents, businesses and visitors – both now and in the future. Its standards are respected for their stringency. Welcoming news of the Gold Award, Kevin Reid, director of horticulture at RBGE, said: 'It is without doubt the commitment and dedication of RBGE staff that has helped us achieve the Green Tourism Gold Award. With a site of around 70 acres and numerous buildings, some



of which date back to the 1800s, we have had many challenges to overcome. We will continue to work across the board to underscore our commitment to sustainability and renewable energy.' He added: 'Our intention is to be progressive. For instance, all recent capital projects have incorporated renewable technologies and over the next couple of years we will change to LED lighting to reduce our environmental impact.'

Stuart Park, lead assessor at Green Tourism, said: 'The Royal

**James Salomons (left) of RBGE's Green Tourism Group and Kevin Reid, director of horticulture at RBGE**

Botanic Garden Edinburgh is very worthy of this award. The organisation brings many modern elements to older buildings while communicating the green message very effectively to thousands of visitors each year.

'The Edible Gardening Project teaches growing skills so even in a city centre you can make use of the space to grow your own fruit, vegetables and herbs. Supporting this is very good food provenance in the cafes and a shop that showcases some great Scottish crafts and art.

'The John Hope Gateway was purpose-built utilising green technology and renewable energy to reduce its carbon footprint, while the Botanic Cottage is a fantastic example of innovation when it comes to conservation. The cottage was painstakingly moved and rebuilt using original stone and other materials – but with a modern twist, utilising solar panels, an air source heat pump and ensuring access for all.

'Congratulations to the team, who are fully committed to sustainability.'

## School video game players recruited to save trees

WITH NEW THREATS to tree health never far from the news, the plan for seven Scottish research institutes has been to work with computer game designers and create a freely available platform on which young players can pit their wits against pests and diseases in the virtual forest survival strategy game CALEDON. The aim is to encourage a new generation of much-needed tree health specialists.

Forest cover is low in Scotland compared to many other European countries at 17 per cent of the total land area. Scottish Government targets to increase cover by 100,000 hectares by 2022 are driven by the need to tackle climate change, diversify rural economies and create wildlife habitat. However, a growing number of threats to tree health are set against a shortfall in plant science expertise, presenting a major hurdle in achieving ambitious targets for forest renewal.

CALEDON, inspired by the popularity of virtual worlds in gaming,



is first and foremost intended to be fun to play. Players make changes to their forest by planting, logging and curing trees and then advance through time towards their next turn. To succeed in the game, players must learn the conditions that particular tree species favour so that they can plant wisely. They must also make choices about the type of planting stock to use.

**A gamer tries out the software at the Royal Botanic Garden Edinburgh**

Learning to develop successful strategies is aided through an in-game encyclopaedia with a wealth of information including: details of the ecology for six tree species; the yield and resilience characteristics of three different types of saplings; and information on nine pests and diseases. It also has details of terrain types and forest wildlife.

The science that underpins the game is championed by the seven research partners in the UK's PROTREE project and is part of the Tree Health and Plant Biosecurity Initiative, a £7million fund to support research on and engagement with plant health. The aim is to identify natural processes that promote resilience: in essence, helping nature to help itself.

The game can be played online or downloaded free and is also available for iPads via the App Store.

To play or download the game, go to [www.rbge.org.uk/caledon](http://www.rbge.org.uk/caledon)

## Protecting Scotland's trees and herbs for the future at the Millennium Seed Bank

Dr Aline Finger, conservation geneticist and RBGE project co-ordinator, describes a new initiative to strengthen Scotland's conservation efforts by storing seeds for future needs

SEEDS FROM FOURTEEN trees and 29 conservation priority herbs have been collected by the Royal Botanic Garden Edinburgh (RBGE) this year, to help deliver Scottish species into the UK National Tree Seed Project and the UK Flora Project. Both projects aim to protect British plants and are coordinated across the UK nations by the Royal Botanic Gardens Kew's Millennium Seed Bank (MSB), with funding from players of People's Postcode Lottery.

With the co-operation and support of landowners and volunteers, the projects are working to increase the diversity of British native plant species that are collected, seed-banked and then made available for wider use. Collected seeds are processed and stored at the MSB, which already

stores seed from over 30,000 plant species from across the globe.

The collections will serve as insurance in case species are lost from the landscape. But they also provide seed material for current research needs, such as testing for disease resistance and to increase our understanding of the biology and ecology of British plants. Seeds of trees form the UK's first national collection of this type.

RBGE staff and volunteers have been searching for natural, non-planted plant populations to ensure



**Saxifraga hirculus field work at Fealar Estate, Perthshire**

that all collected seeds are local origin and genetically diverse. The first collections started in June with elm trees, and finished seasonally with holly in December. RBGE staff and volunteers have worked together to ensure that more than 200,000 seeds have been collected.

Members' reports

Forest Research; Royal Botanic Garden Edinburgh

# Past trees, future lessons

Kevin Watts from Forest Research describes the use of historical woodland creation to provide evidence to inform future conservation: the WrEN project



Right: an example WrEN woodland shows how historic maps can establish the age of creation. The woodland called 'Eleven Acre Covert' appeared on the maps between 1890 and 1900, making it approximately 115 years old (Crown copyright 2014).



Left: surveying a WrEN woodland

THE CONCEPT OF adopting a landscape-scale approach to conservation, in an attempt to combat habitat loss and fragmentation, has been widely embraced by the conservation community. The approach involves a combination of site-based actions to protect, restore and expand existing habitats, along with landscape actions to reconnect existing habitat fragments. However, there is uncertainty and debate over the most effective combination of actions and empirical evidence is sorely needed.

Ideally, robust experiments would be established to unpick the various components of landscape-scale conservation and assess their merits. However, such experiments would be difficult to arrange on a large scale,

and would need to be conducted for a long time as it may take biodiversity decades or centuries to respond.

In an attempt to overcome these challenges, an innovative project, Woodland Creation and Ecological Networks (WrEN), has been established by Forest Research, the University of Stirling and Natural England. WrEN uses historic maps to identify long-term, large-scale 'natural experiment' sites in the form of woodland planted over the past 160 years. In contrast to 'true' experiments, which directly manipulate the study system, natural experiments overlay an experimental design on an existing ecosystem.

To date, WrEN has selected more than 100 woodland sites in the UK, 67 in Scotland and 39 in England, which

vary in size, age, quality and spatial configuration – the main components of landscape-scale conservation. Surveys are under way of species groups with different traits and characteristics whose populations are likely to respond at different spatial and temporal scales.

The combination in the UK of a long history of woodland planting with comprehensive historical mapping offers an excellent – possibly unique – opportunity for this experiment. It is hoped that WrEN can supply the evidence we're currently lacking.

Further information is available at [tinyurl.com/wren-project](http://tinyurl.com/wren-project) and [doi.wiley.com/10.1002/ece3.2066](https://doi.org/10.1002/ece3.2066), or on Twitter @WrENproject

# Double awards celebration for leading lichenologists

BRIAN AND SANDY Coppins, Scotland's leading lichenologists, were awarded two top accolades within the same week for their research and conservation work. The husband-and-wife duo received a lifetime achievement award at the RSPB's Nature of Scotland Awards, hosted by Chris Packham, presenter of BBC's *Springwatch*, in Edinburgh on November 24, 2016. Two days later, they were given the Bob Saville Award at the Wildlife Information Centre's annual dinner in Bo'ness.

Brian, a research associate at the Royal Botanic Garden Edinburgh (RBGE), said: 'Sandy and I were honoured to get the RSPB Scotland's



Lifetime Achievement Award. It was our second joint award and was made even more amazing when we received another just two days later. We knew Bob Saville personally since his earlier

Brian and Sandy Coppins at the Nature of Scotland awards ceremony

days at Scottish Wildlife Trust and the Lothian Wildlife Information Centre. It is a real honour to be formally linked to such an inspirational naturalist."

Dr Chris Ellis, RBGE's head of cryptogams, said Brian and Sandy were worthy recipients of the two accolades. 'Brian spent his career working on lichens at RBGE, and with his wife Sandy made a formidable team for biodiversity conservation. Together they ventured to document Scotland's globally-important lichens, discovered ancient temperate rainforests on Scotland's west coast, and determinedly championed the conservation of previously overlooked lichen species.'

PHOTOGRAPH: SIMON WILLIAMS PHOTOGRAPHY

## Agroforestry systems for ammonia air quality management

TREES ARE EFFECTIVE scavengers of both gaseous and particulate pollutants from the atmosphere, writes *Bill Bealey of the Centre for Ecology and Hydrology, Edinburgh*. This makes tree-belts potentially effective landscape features to support the abatement of ammonia from intensive agriculture. Impacts on ecosystems from atmospheric nitrogen (N) pollution are still seen as a major threat for European biodiversity. Across Europe over 70 per cent of the Natura 2000 area in Europe (EU28) exceeds critical loads for nutrient nitrogen deposition.

Recent research using field measurements, wind tunnel studies and modelling has shown that the recapture of ammonia by trees can range from around 20 per cent (trees planted around housing systems) up to 45 per cent recapture (for under-storey livestock silvopastoral systems).



Model results also suggest that tree planting in hot spot areas of ammonia emissions would lead to reduced N deposition on nearby sensitive habitats. Moreover, increased capture by the planted trees also generated an added benefit of reducing long-range transport effects.

The cost-effectiveness of planting trees for ammonia recapture was also calculated showing that planting trees

**Hens in a woodland environment**

is highly cost effective when costs to society were taken into account. Comparing the cost per kg of NH<sub>3</sub> abated showed that planting trees is a method of ammonia emission mitigation comparable with other (technical) measures.

Agroforestry for ammonia abatement offers multiple benefits for the farmer and synergistic effects for society as a whole including i) carbon sequestration, ii) visibility screening around housing, iii) improved animal welfare for silvopastoral systems, iv) reducing critical load exceedance on protected sites, v) price advantage of 'woodland chicken' products, vi) supporting IED requirements for emission reduction, vii) supporting national afforestation policies.

For more details, contact *Bill Bealey, CEH Edinburgh*, [bib@ceh.ac.uk](mailto:bib@ceh.ac.uk)

PHOTOGRAPH: WOODLAND TRUST

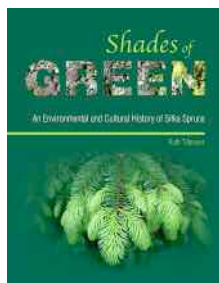
## A fresh look at a familiar forest species

A new book from Forest Research examines the history behind Sitka spruce, one of our most important commercial trees

SITKA SPRUCE has been the mainstay of Scottish commercial forestry since the early 20th century. Brought to this country from the Pacific North West of America by the famous plant explorer David Douglas, it was introduced into policy woodlands and plant collections in central and western Scotland. Very soon the versatility and productivity of the species was recognised, and it became key to the afforestation of marginal agricultural land throughout much of the past century.

Improving the scientific understanding of the tree's performance on a range of sites; methods of encouraging best growth and timber; and the development of novel assemblages of native plants and animals in different stages of the forest growth have all been the focus of research conducted by staff at Forest Research's Northern Research Station.

Now in a fresh look, independent academic and cultural historian Dr Ruth Tittensor has reviewed the fascinating back story to this familiar



**Above right: sitka spruce forest in Perthshire**



species, from its cultural significance to the indigenous people of the Pacific North West, to its widespread use in western Europe – and the mixed emotions, from vilification to valued, often associated with it.

Her book, 'Shades of Green: an Environmental and Cultural History of Sitka Spruce' combines insights from numerous sources: visits to Alaska, access to FR's archive and retired and current scientists, and interviews with those responsible for the management and use of forests throughout Scotland.

The book was launched at the Northern Research Station with a talk from Professor Richard Oram, an environmental historian from Stirling University, and an exhibition organised by Ruth of a range of artefacts and products sourced from Sitka spruce. The book, which received support from the Scottish Forestry Trust and a number of other organisations, is published by the WINDgather Press, an imprint of Oxbow Books.

See [www.oxbowbooks.com](http://www.oxbowbooks.com)

PHOTOGRAPH: © CROWN COPYRIGHT; FORESTRY COMMISSION

Members' reports

Forest Research

# What should we do about forests on peat bogs?

Russell Anderson from Forest Research explains new research that focuses on ecosystem service provision

WE NO LONGER plant forests on deep peat in the UK. Peat bogs were once regarded by some as wastelands: too infertile for agriculture, except as poor grazing. From the 1960s to the 1980s, forestry was pursued as one way to put this land into production and the process involved fencing, draining, ploughing, planting and applying fertiliser.

However, the case for conservation of peatlands as habitats is now widely accepted and there is greater understanding of the value of peat bogs to society for a range of ecosystem services. In an intact condition, they take in carbon from the atmosphere, slowing down the rate of climate change. They also preserve carbon already accumulated in peat up to 10m thick, preventing its release, which would exacerbate climate change. The vegetation on bogs presents a rough surface, slowing down rainwater runoff and helping to reduce floods downstream. On healthy bogs, vegetation and peat filter the water, ensuring that it is clean and suitable for supplying communities as well as supporting aquatic life.

Peatland restoration has become an important option in some land-use decisions and the forestry industry needs guidance on what to do with forests already established on peatland. It is not a simple case of 'forest bad, bogs good'. Like bogs, forests absorb carbon, fixing it in the trees, litter and soil organic matter, and helping to slow climate change. At the same time, they dry the upper peat,



promoting microbial activity and releasing carbon to the atmosphere. There is as yet little empirical evidence on how the two processes balance out in Scottish climates.

Forest Research has begun a programme of studies to find out how use of afforested peat bogs affects the mix of ecosystem services. A trio of PhD projects focused on hydrology, greenhouse gases and soil microbiology are being set up in

**Forestry alongside peat bog at A'Chuil bothy in the West Highlands**

collaboration with Forestry Commission Scotland, SEPA and the James Hutton Institute to compare an afforested area with a similar area restored from forestry and an area of intact bog never afforested. The aim is to inform future policy-making in relation to forests on peat.

*Further information is available at Peatland Ecosystem Services: [www.forestry.gov.uk/fr/BEEH-AB7CLY](http://www.forestry.gov.uk/fr/BEEH-AB7CLY)*

SCRR Peter Wilson Lecture • Monday February 6, 2017 6:00pm-7:30pm • The Royal Society of Edinburgh

## 'Policy Making in Uncertain Environments'

Professor William J Sutherland, Miriam Rothschild Chair in Conservation Biology, University of Cambridge

EVIDENCE-BASED MEDICINE is one of the triumphs of recent decades and has indisputably saved innumerable lives and resulted in more cost-effective practice. However, is this the right approach for other areas of policy, such as conservation biology, education or crime reduction? Two key problems are first, that it is difficult to run randomised controlled experiments for many ecological problems; and second, that

local conditions mean that experiments elsewhere may not really apply to your site. Professor Sutherland will describe the strengths and limitations of the current approaches and suggest an alternative solution.

*Event open to all and free to attend: registration required at [www.rse.org.uk/event/policy-making-uncertain-environments/](http://www.rse.org.uk/event/policy-making-uncertain-environments/)*



THE FLOW COUNTRY of northern Scotland is one of the largest and least damaged peatland areas in the UK, if not Europe. This huge blanket bog – a candidate World Heritage Site – was extensively damaged in the 1980s by the planting of non-native conifer plantations. It is now widely recognised that many of these plantations, especially those on the deepest peat, should never have been planted.

The Flow Country holds the largest RSPB reserve in the UK: the 21,000 ha Forsinard Flows National Nature Reserve. A major part of the work of the reserve is removing inappropriate forestry plantations, in order to restore these areas as blanket bog. More than 2,000 ha of such peatland restoration is under way at present.

Restoring former forestry plantations as blanket bog can throw up novel challenges. Restoration is a long-term process, and the rate of progress and ultimate outcome are often uncertain. Consequently, habitat trajectories of restoration areas should be carefully monitored and evaluated. This information can then help guide management choices at similar restoration areas.

Since the late 1990s, restoration areas on RSPB Forsinard reserve have had periodic monitoring of biodiversity recovery, led by RSPB science and reserves staff. Initially, this focused on vegetation recovery. But lately, monitoring has become more detailed,

## Peat restoration in the Flow Country: towards a better evidence base

Mark Hancock, Danni Klein and Neil Cowie of the RSPB Centre for Conservation Science describe their research at Forsinard



Restored peatland at Forsinard Flows

including hydrological measures and a wider suite of biodiversity measures (invertebrates, birds).

More recently, the growth in interest in peatlands as carbon stores and sinks has given a major impetus to research into how restoration might support these functions. Here, the expertise lies with universities and research institutes. At its Forsinard reserve, RSPB increasingly hosts and supports visiting researchers who are helping understand how restoration

affects the climate change mitigation function of the peatlands.

Key partners currently working on the reserve include the University of the Highlands and Islands (through the Thurso-based Environmental Research Institute), the universities of Stirling and St Andrews, and research institutes such as the James Hutton Institute, CEH and Forest Research, all linked via the wider Flow Country Research Hub, coordinated by ERI-UHI.

The scale of research activity in the Flow Country has been given a boost by the recent completion of a new field centre at Forsinard, funded by the multi-partner Flows to the Future project, with support from the Heritage Lottery Fund. With accommodation for visiting groups and long-term volunteers, a laboratory and education room, the new centre brings a step change in the quality of the research and education infrastructure in this remote area. This will really help put Forsinard and the wider Flow Country on the map, as a key site for developing the evidence base to support peatland restoration.

## Scottish-Norwegian model for climate impacts on grassland

GRASS SPECIES DIFFER strongly in their tolerance of winter conditions, writes Marcel van Oijen of the Centre for Ecology and Hydrology. Timothy grass survives winter frost better than ryegrasses, and is therefore widely grown in Scandinavia and Canada as cattle feed. But frost damage may, surprisingly, increase with global warming. This is because warm spells in winter undo the hardening process of the plants. The degree of hardening is measured as LT50, the temperature lethal to 50 per cent of tillers. Experiments in Norway show that LT50 can decrease from about -6C every summer to lower than -20C in winter.

LT50 is one of the many variables that are simulated by the dynamic grassland model BASGRA, developed by CEH and its Norwegian counterpart NIBIO. A full model description has just been published [Ecol. Modell. 335 (2016): 1-15], and model plus user



guide can be freely downloaded at <https://zenodo.org/record/27867>.

The model is used to predict the impacts of climate, soil and management on the productivity of grassland in the warm months and its survival in winter. The capacity to simulate the sward year-round is rare

in grassland models, most of which simulate the growing season only. Winter processes proved challenging to simulate, as the dynamics of the snow pack and of soil frost needed to be modelled, and plant response to those conditions. Essential to model development were field and greenhouse experiments carried out across Norway over the past two decades. Plant physiology was studied in great detail, and this knowledge was built into the model.

Currently, CEH and NIBIO are using the model in ideotype design – identification for plant breeders of the optimum combination of plant traits. An open-access paper on this work [Euphytica 207 (2016): 627-643] shows an inevitable trade-off between maximum yield and yield stability.

For more information, please contact Marcel van Oijen, [mvano@ceh.ac.uk](mailto:mvano@ceh.ac.uk)

Members' reports

James Hutton Institute; BioSS and Scottish Natural Heritage

## PotatoSize: an app for estimating the size of potato crops

FUNDED BY THE Genomia fund and jointly developed by the James Hutton Institute and Agrovista, the innovative PotatoSize app provides a cheap and rapid solution for farmers to count and measure a potato crop sample by using cutting-edge image analysis techniques. It is designed to enable farmers to decide when to halt crop growth which, until now, has required the expensive and time-consuming practice of digging up a sample of the crop, passing it through multiple sieves and counting each size fraction.

Instructions are provided to guide the preparation of a sample, taking the photograph of the sample necessary for the app, and the form of the results returned. The user is also required to provide information such as the length of the sample dig, row spacing and the



weight of the crop sample. The analysis, which takes two to three minutes, provides a count of potatoes within each five-millimetre size range, and an estimate of the yield in tonnes

per hectare within these size ranges. The project team estimate that the user saves approximately £14 in costs of labour and equipment for each £1 invested in use of the app.

The App is available for iOS and compatible with iPhone and iPad. It can be downloaded for free from the App Store. An Android version is planned for release early in 2017, together with updates to the iOS version which will improve the image analysis capabilities. These upgrades are scheduled to be in time for the 2017 growing season.

PotatoSize can be downloaded from <https://itunes.apple.com/gb/app/potato-size/id1140453642>. Contact Dr Matt Aitkenhead, James Hutton Institute, [matt.aitkenhead@hutton.ac.uk](mailto:matt.aitkenhead@hutton.ac.uk)

## Improving the evidence base for making informed decisions about red deer management

A collaboration between BioSS and Scottish Natural Heritage aims to improve the gathering and analysis of data on red deer populations

THE MANAGEMENT OF red deer in Scotland, including the setting of local densities that management should aim to achieve, has long been a source of debate between many interested parties with different perspectives and objectives, and the level of debate has intensified recently. Responsibility for advising government on red-deer management was passed to Scottish Natural Heritage (SNH) in 2010 with the cessation of the Deer Commission for Scotland (DCS). Since then, SNH has acted as custodian for data held by DCS which relates to open hill land lying within 44 upland Deer Management Groups (DMGs) covering nearly 40 per cent of the land area of Scotland. The inherited data set has been augmented annually through further surveys of selected DMGs within this area and collation of data on culling reported by individual estates.

James Hutton Institute (JHI) and Biomathematics and Statistics Scotland (BioSS) have been working with SNH to analyse and interpret the existing data and to inform future data collection strategies. Much pre-processing has been required to



enable the creation of a count data set at the level of Deer Management Units (usually representing single estates), enabling a fuller analysis of the data than has been possible previously. Modelling this derived data set has revealed a diversity of trends at the DMG level that in combination produce a broad national pattern of increasing density from the 1960s to 2000, followed by approximate levelling off. We are exploring the extent to which a number of drivers can explain this.

Above left and right: red deer in Glenshee



PHOTOGRAPHS: JUSTIN IRVINE

We have also been developing an approach to the analysis of the SNH site condition monitoring data from protected areas which treats the response variable (feature condition eg of habitat type or assemblage of species) as ordinal (ordered categorical, on a four-point scale). Again, the objective is to extract maximum information from these data, and in particular to examine evidence for the impact of different herbivore densities (eg domestic sheep and deer densities) on site condition. This is a good example of two research bodies working with a government agency to advise on a core aspect of environmental policy and practice.



SCIENTISTS AND INDUSTRY leaders are embarking on a new project to build an artificial salmon gut with a view to better understanding fish digestion. This information will arm the fish-farming industry with a sustainable response to increasing global demand for high-quality farmed fish.

Led by scientists at the University of Glasgow, the three-year project, SalmoSim, will work in collaboration with The Marine Institute and University College Cork (Ireland), Nofima (Norway), Alltech and Marine Harvest. Its aim is to better understand the link between gut microbiota – the bacteria that colonise the intestine – and digestion processes in salmon. Gut microbiota are known to play a vital role in digestion and nutrient absorption across a wide variety of different organisms. Understanding how these microbes can facilitate the efficient absorption of novel feeds in salmon is of vital importance.

Salmon farming is of increasing significance, both in terms of economics and food sustainability. In Scotland, Atlantic salmon is now the number one food export. Nearly 180,000 tonnes of farmed Atlantic salmon was produced in 2014 alone and the sector provides employment for an estimated 7,000 people. Scottish Government and industry leaders anticipate as much as a 30 per cent increase in production by 2020.

As with all industries, sustainable salmon farming must be accompanied

## SalmoSim: project to build an artificial fish gut is launched

University of Glasgow project aims to better understand the role of gut microbiota



PHOTOGRAPH: WIKIMEDIA COMMONS

Right: Atlantic salmon in Norway

by scientific innovation if it is to succeed. One of the major challenges over the next decade will be a reduction in wild feedstock availability. Less wild fish as feedstock will cause a drop in the levels of omega-3 fatty acids found in salmon and a drop in the marketable quality of the fish.

Dr Martin Llewellyn, from the University of Glasgow's School of Life Sciences, said: 'The experimental gut system, once established, will represent a powerful tool for carrying out basic and applied research into

fish digestion. We're really excited that it will be based here at Glasgow.'

The initial project will run for just over three years but the tool that will result should be a valuable test-bed for novel feeds and feed formulations for many years to come, safeguarding the sustainability and quality of Scottish farmed Atlantic salmon.

For more information contact Elizabeth McMeekin in the University of Glasgow communications office, [elizabeth.mcmeekin@glasgow.ac.uk](mailto:elizabeth.mcmeekin@glasgow.ac.uk)

## International students show the future of aquaculture

AN INTERNATIONAL GROUP of students have embarked on a prestigious masters degree at the Scottish Association for Marine Science (SAMS UHI) in Oban.

The 25 students represent 19 countries, including New Zealand, Jamaica, Peru, Brazil, Pakistan, China, Colombia and the USA, and are taking part in the two-year ACES programme, an Erasmus Mundus Joint Masters Degree (EMJMD) in Aquaculture, Environment and Society (ACES) awarded jointly by the University of the Highlands and Islands and University of Crete. Based in and around Oban for an initial six months, they will continue their studies in Crete in February 2017 and then move on to Nantes, before spending the final six months of the course at one of the three partner organisations. The academic course will cover industry-relevant aspects of



aquaculture, such as environmental issues, governance, technology, life cycles and feed production.

ACES students arrive at Oban

Dr Elizabeth Cottier-Cook, course leader and a senior researcher at SAMS, said: 'The ACES programme provides fully funded scholarships for EU and non-EU students in a bid to

attract the very best aquaculture students from around the world. It also allows the students to share their experiences of that industry from nation to nation. This helps us build on the academic elements of the course and encourages a curiosity about links between academia and industry.'

Marine Harvest sponsors a scholarship for one EU-based student, who will go on to complete their studies with the company. Steve Bracken, its business support manager, said: 'Courses like EMJMD ACES are an important vector to bridge the gap between education, research and development, and applied industry techniques and knowledge.'

Applications are being taken for the for the third ACES cohort (academic year 2017/18). To apply, or to find out more information visit [www.emm-aces.org](http://www.emm-aces.org)

Members' reports

Moredun Research Institute; SRUC

PHOTOGRAPH: ISTOCK.COM



Maasai herdsman with cattle

naturally infects most sheep; and alcelaphine herpesvirus 1 (AIHV-1), which is found in wildebeest. No treatment or commercial vaccine is available for MCF and avoidance is currently the only strategy that provides some protection.

Vaccine research at Moredun Research Institute (MRI) has focused on AIHV-1 because this can be grown in culture. However, attempts by several groups to produce a vaccine for MCF produced variable results until trials at MRI of a live attenuated strain of AIHV-1 showed significant protection of cattle from challenge with fatal wildebeest-associated MCF.

Since 2010, small-scale field trials of this attenuated MCF vaccine have been conducted in Tanzania and in Kenya by researchers from MRI in collaboration with colleagues in the Universities of Nottingham and Glasgow, and the International Livestock Research Institute, with funding from BBSRC, DFID, the Scottish Government and GALVmed. The trials used natural challenge by exposure to calving wildebeest and showed that the vaccine protected cattle from infection and from disease.

Thus, the vaccine appears to protect cattle from wildebeest-associated MCF and further work is planned to optimise the vaccine and measure its effectiveness in larger trials.

For more information contact [george.russell@moredun.ac.uk](mailto:george.russell@moredun.ac.uk)

## Protecting cattle from malignant catarrhal fever in sub-Saharan Africa

George Russell reports on work at Moredun Research Institute to produce a vaccine for a disease for which there is currently no treatment

WILDEBEEST-ASSOCIATED malignant catarrhal fever (MCF) is a significant challenge for livestock keepers in sub-Saharan Africa. As the wildebeest migration reaches the short-grass plains of Northern Tanzania for calving, Maasai herdsmen move their cattle to poorer upland grazing, risking other

diseases such as trypanosomiasis and East Coast Fever (ECF), to avoid MCF. Despite this strategy, MCF is still considered one of the top five disease threats for cattle in this region.

MCF is a fatal disease of cattle caused by herpesviruses including ovine herpesvirus 2 (OvHV-2), which

## Report says Brexit fears may lead farmers to retire early

ONE IN FIVE Scottish farmers and crofters may retire early due to fears over Brexit, according to a survey by Scotland's Rural College (SRUC). More than half of those surveyed said Brexit increases business uncertainty, which may lead to lower on-farm investment and negative effects on the wider rural economy. The findings appeared in 'Rural Scotland in Focus 2016', the fourth edition of the biennial report produced by SRUC's Rural Policy Centre.

Steven Thomson, senior agricultural economist with SRUC and contributing author, said: 'Brexit is clearly causing uncertainty and some farmers have told us that means they are thinking of retiring earlier than planned. Scottish agriculture is used to change, but our report shows how vital support still is to the industry. Under Brexit, we don't know what will replace

the CAP, but assume there will be budgetary pressures – meaning innovation and new approaches will be key to making farming more resilient.

'Being traditionally unsupported by the CAP, soft-fruit growers, pig producers and others have shown the way. It is no coincidence they tend to be run by a younger generation, ready and able to grab opportunities, adopting new technologies and research ideas.'

The authors argue, however, that we need to look beyond agriculture. 'With Brexit we need to understand the characteristics, needs, and contributions of all of Scotland's businesses more than ever.' They stress that a lack of evidence and knowledge has fed false assumptions that the rural economy only means agriculture, and that cities are the only

engines for growth. Yet the success of businesses involved in various service-related activities, for example, challenges these assumptions.

The report also called for the creation of a Scottish rural strategy. Professor Sarah Skerratt, editor of the report, said: 'Rural communities and businesses are resourceful, innovative and cooperative. These are qualities everyone involved in the rural economy must adopt. But to be effective that must be within a coherent, overarching strategy, taking account of the possible conflicts and properly monitored so it can be adapted based on real evidence. That way we can have a greener, smarter and more prosperous Scotland.'



The report is available to read and download: [www.sruc.ac.uk/RSiF2016](http://www.sruc.ac.uk/RSiF2016)

SCRR event • Friday February 24, 2017 at 1pm • Salisbury Suite, Our Dynamic Earth

## STEM Strategy seminar at Our Dynamic Earth

AN SCRR SEMINAR around the Scottish Government's Draft STEM Strategy will be held on Friday, February 24, 2017 at 13.00 in the Salisbury Suite of Our Dynamic Earth to provide a forum to increase awareness of the strategy and to discuss issues raised by it; to learn more of the challenges facing teachers in bringing real world science issues into the classroom; and to see examples of initiatives currently being delivered.

All members of SCRR are concerned with demonstrating the impact of their research, a key part of which is engagement with schools and wider communities in which they live and work. This seminar will help us all to understand current developments and consider strategies and actions for co-ordinated engagement.

Contact Willie Donachie, SCRR's secretary/treasurer (see back page) for further information.



## Genomia Fund – an experiment in seed venture capital for the biosciences in Scotland

Keith Winton, chair of the Genomia fund, describes the origins and objectives of the fund, and looks back at some of its successes

A CONSTANT COMPLAINT heard in the last quarter of the 20th century was that while Britain seemed to punch above its weight as far as scientific and technical research developments were concerned, the commercial rewards were often generated beyond its shores – penicillin being an oft-quoted example.

There was also an emerging perception that the UK economy could be benefiting substantially if universities and research institutes could be better supported in their commercialisation efforts. The then Department of Trade and Industry (DTI) was persuaded to support schemes which, amongst other things, allowed universities and public-sector research institutes to establish their own seed capital venture funds.

The Genomia Fund was launched in 2004 and over two rounds of funding from the DTI and from the European Regional Development Fund successfully secured funding totalling £4.85M. Its primary target was a group of public sector research establishments (PSREs) mostly based in Scotland and mostly members of the Scottish Consortium for Rural Research, whose research interests lay in the biosciences sector – animal, plant, forestry, marine and environment. Fortunately, Genomia was free of shareholder pressure to



Over the past decade, Genomia has considered 275 proposals and has supported just over a third of them, committing more than £4.6 million

make substantial returns to its funders, which was just as well, because research in the US has shown that such early-stage seed funds seldom even recovered their investment funds. Ideally, the model was that Genomia would become an 'evergreen' fund, with any returns which did materialise being invested in new opportunities.

Over the past decade, Genomia has considered 275 proposals and has supported just over a third of them, committing more than £4.6M. Either alongside Genomia's initial investment, or through follow-on third party investment further down the development track, something close to £18M has been secured for continuing development of projects that Genomia has pump-primed. The variety of opportunities brought to the fund has been quite astounding and highlights

Above left: Keith Winton, chair of the Genomia fund

just how complex and wide ranging is the Scottish scientific landscape. Admittedly, relatively few projects might realistically be considered to have good prospects of making financial returns; but on the other hand, if we had a high proportion of such projects, it could be argued that we had not taken sufficient risk of the type we had been expected to take, based on the original objectives of plugging the funding chasm between research results and proof of commercial opportunity. It was never intended that we undertake the depth of due diligence that conventional venture capitalists would pursue. Often, gut feel was seen as good a measure as any at such early stage, there being little or no market data on which to base decisions – especially given that, in some cases, the market may not yet exist!

Amongst successful projects supported is the PotatoSize app, described in this issue. A joint venture between the James Hutton Institute and a commercial company, this utilises the research expertise of the JHI scientists and the business acuity of the commercial partner.

Genomia does not operate in a market sector with fast returns. The time scale from lab to market is unlikely to be less than a decade and could be twice that. So, to be still operating, and able to make investments some 13 years after the Fund was established must be seen as a success at some level.

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## Events

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

Please see the website for announcements.

### PEOPLE AT SCRR

Scientific Director:  
Prof Stuart Monro  
[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)

### CONTACT SCRR

SCRR, 18 Hoghill Court, East Calder,  
West Lothian EH53 0QA  
01506 880929 or 07990 595217

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