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Scottish Consortium
for Rural Research

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PHOTOGRAPH: ONDREJ RAFAJ VIA UNISPLASH



This issue in carbon

Net zero farming is one of the aims of the £74m agritech hub at Easter Bush, Edinburgh – **page 3**

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Back to the future, part 1

Prof Sarah Skerratt, scientific director of SCRR, on recovery and resilience

WE ARE BEGINNING to emerge from 18 months of enormous impact – as individuals, as research institutions, as a collective under the shared identity of SCRR, as members, associates, interested parties. We have been, and continue to be, profoundly affected by the Covid-19 pandemic. Some have experienced distress and loss; some, isolation and pain; some, setbacks either professional or personal.

Yet we are still imagining, thinking, questioning, researching and querying the world around us – how, why, where, and how it all fits together. We still have the urge to connect with one another, and have been doing so through Zoom, Teams, Skype, phone, with some now taking the first tentative steps back to face-to-face meetings. A new norm beckons, with small celebrations as we see one another in 'full 3D' again, treasuring contact we perhaps previously took for granted.

This Newsletter showcases how we have continued to progress during

the Covid-19 crisis. In May, our annual Peter Wilson Lecture, co-hosted with the Royal Society of Edinburgh, brought together Early Career Researchers from across Scotland to share their work with fellow academics and stakeholders from Scotland, the UK and internationally on the theme of 'Science for Rural Recovery and Resilience'.

Also in these pages, you can read about the diversity of trees, from their role in nurturing African elephants in the Congo Basin through to safeguarding the British oak. You can find out how Scottish-based researchers are leading the way in numerous fields – on action for climate change; improving the welfare of farmed sheep and chickens; finding a balance between agriculture and conservation in Orkney or Gabon. Further investments reported here focus on global work to advance agricultural technology and food security.

We are now planning our online Annual General Meeting (AGM) on Wednesday November 17, which will

Above: looking to the future should involve a 'greener, fairer trajectory' for rural people

also see our third mini-conference for Early Career Researchers, whose productivity has been disproportionately affected by Covid-19. We are therefore looking to our SCRR network to 'pull out all the stops' in supporting our ECRs and make this our best mini-conference to date!

Please enjoy this SCRR Newsletter for Autumn 2021, as we continue to celebrate the research outcomes of this fantastic, diverse and connected network across Scotland.

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.

PHOTOGRAPH: RSE



Event report • RSE / SCRR Peter Wilson Lecture 2021

Rural recovery and resilience

Prof Sarah Skerratt, scientific director of SCRR, looks back at our most significant event of the year, the annual RSE / SCRR Peter Wilson lecture

THE ANNUAL Peter Wilson Lecture is a key event in SCRR's calendar. Run jointly with the Royal Society of Edinburgh (RSE), it is now in its 17th year. It was created in memory of the distinguished agriculturalist, former general secretary of RSE and former Professor of Agriculture and Rural Economy at the University of Edinburgh, Prof Peter Wilson CBE. In the past three years, the format of the event has encompassed a keynote speaker with respondent panel, shifting online in 2020 and 2021.

The theme for the May 2021 event was 'Science for Rural Recovery and Resilience'. The event's keynote speaker, Professor Pete Smith FRSE, University of Aberdeen, challenged us to consider not only the twin crises of the Covid-19 pandemic and climate change, but also the opportunities that may arise from reflecting on how we might 'recover and reboot towards a new, greener, fairer trajectory'. Pete stated that we are all now in 'our decade of action', with opportunities to rethink our food systems, and how we invest in rural – including through making low-carbon jobs attractive.

The 'respondent' was Dr Leslie Mabon, Scottish Association for Marine

Science (SAMS) and Young Academy of Scotland (YAS) member. Leslie began with a key statement about the need to see rural Scotland as a 'lived-in, working, productive environment'. He outlined how climate change transition needs to be fair for rural communities, explaining how there will be 'no shortage of jobs in

a net zero world' but that these jobs must be: high-value, innovative, around knowledge-growth and encourage young people to stay. To enable this, people must be involved in the science, and the science must relate to social policy for affordable housing, roads and digital connectivity.

Panel speakers Prof Lee Innes FRSE (Moredun Research Institute), Prof Lorna Dawson FRSE (James Hutton Institute) and Prof David Raey (University of Edinburgh) then briefly shared their responses and views.

Lee spoke of the world being united in seeking to address the Covid-19 pandemic, fighting an infectious disease through vaccination and other disease control measures. She said this singular focus on 'our shared planet' might help us to be more inclusive when tackling climate change challenges, including in

Scotland ahead of COP26 and our target of net zero by 2045.

Lorna echoed how we are in a time of multiple crises, but that we are also fortunate in having fantastic research institutions in Scotland that are 'near to policy, industry and rural communities'. She described Safari Gateway working together to integrate research for transformational change. Lorna gave examples of research that are co-constructing solutions and reducing jargon around climate change.

David, a 'self-confessed carbon geek', outlined how education, skills and training of the existing and new workforce 'underpins transition to net zero'. He emphasised existing good practice and the need to attract, retain and inspire new entrants to rural careers, including through teaching in schools, careers advice and support for the next generation, for 'rewarding rural work'. Through this, Scotland can show a pathway internationally.

Dr Rebekah Widdowfield of RSE then chaired the debate, with many participants putting questions to the speakers around: encouraging private investors and landowners to engage in nature-based solutions; making sure the public are involved; importing food while offshoring greenhouse gas emissions; whether persuasion is sufficient to amend dietary choices and other climate change behaviours; food waste and food larders; and green jobs for young people.

We were delighted that, as ever, members of Peter Wilson's family were able to join the event, welcomed by Prof Stuart Monro. With high attendance, excellent speakers, energetic and highly relevant discussion, after 17 years the Peter Wilson Lecture continues to attract attention and will certainly generate important debate for many years to come.

For more details of this event including a video report see scrr.ac.uk/events

Profs Stuart Monro, Sarah Skerratt and Pete Smith with Dr Leslie Mabon at the online event



Roslin Institute, University of Edinburgh

£74m agritech hub at Easter Bush

Backing from the UK and Scottish governments aims to advance agricultural technology and food security, in a new joint venture involving Roslin Institute and University of Edinburgh

INVESTMENT OF £74M in a new agritech hub will improve the efficiency and output of agricultural applications, and enhance worldwide food security. The virtual hub will foster collaboration between researchers and companies to contribute to global food systems, work towards net zero carbon in the agritech sector and inform food and environmental policies.

Experts in the hub will use data to develop genetics and health innovations for agricultural science and business, and to build initiatives and novel systems of production, such as robotics. Work in innovative areas such as data-driven breeding and aquaculture will enable data generation and analysis that will improve the agriculture industry worldwide.



The Easter Bush campus, University of Edinburgh

The agritech hub will be nucleated at the Easter Bush campus of the Royal (Dick) School of Veterinary Studies, Europe's largest concentration

of animal science research expertise, where the Roslin Institute is located. It will, however, have reach across the whole University of Edinburgh. Investment comprises £27 million from the UK Government, including £1.3 million from Scottish Government, as part of the Edinburgh and South East Scotland City Region Deal.

The Easter Bush AgriTech Hub will bring together researchers from the University of Edinburgh and other higher education institutions, along with commercial, public and third sector organisations, in collaboration with project partners Midlothian Council. Researchers will work with the Scottish and UK public sector, including the Animal and Plant Agency (APHA), Scottish Government's Animal Health and Welfare Division, UK Department for Environment, Food and Rural Affairs (Defra) and industry, such as the InnovateUK Agri-Tech Centres.

See: www.ed.ac.uk/roslin/news-events/latest-news/ps74m-investment-for-agritech-hub-on-campus

PHOTOGRAPH: CHRIS CLOSE / UNIVERSITY OF EDINBURGH

So long and thanks for all the butties!

Prof Stuart Monro, our former scientific director, pays tribute to Prof Willie Donachie who is now standing down as SCRR's secretary and treasurer



WILLIE DONACHIE, with whom I had the privilege of working at the Scottish Consortium for Rural Research (SCRR), has left

a substantial legacy. He is one of that band of innovative Moredun scientists who have both developed and commercialised vaccines to tackle some of the most prevalent animal diseases – quite a legacy. But more than that, Willie has played an important role in cultivating a collaborative approach across the rural and land-based sciences.

When Willie stepped down from his role as managing director of Moredun Scientific, having previously been deputy director of Moredun Research Institute for 14 years, SCRR was looking for a new Secretary and Treasurer. Willie had already had a long connection with the consortium and a wide interest in all aspects of rural research, and happily stepped up to the mark.



Prof Willie Donachie (right) with profs Stuart Monro and Sarah Skerratt

Shortly before Willie was appointed, we changed the name of the consortium from 'Edinburgh' (ECRR) to SCRR to reflect the now Scotland-wide membership. The challenge I shared with Willie was making this name change a reality. Willie completely revamped the Newsletter, with an edition on the web but retaining a paper copy for widespread distribution, not only to members but also to every MSP and all Scottish MPs as well as the

international consulates in Scotland. We tackled the task of putting newsletters in envelopes in the library at the Moredun Institute, fortified by the excellent bacon butties and coffee from the Moredun canteen!

Getting into the digital age is now something we all are familiar with and expect and thanks to Willie we can now see at a glance what is going on across the consortium. Keeping the website up to date is always a challenge – the bane of Willie's life!

Taking SCRR out and about from its original home at the Bush campus in Edinburgh led to some interesting excursions, not least a meeting organised by Willie at Millport on the Isle of Cumbrae with the Field Studies Council. But physically visiting members' sites does take time out of the busy schedules of members and one of the positive things to have emerged during the pandemic from the Sarah-Willie team has been engagement taking place via the marvel of Zoom, something that I think will remain with us in the future.

So we say farewell to Willie in his current role. I will miss the friendship and camaraderie that Willie engendered and the chat over coffee touching on many issues, and I am greatly appreciative of all he has done for rural science. Good luck and fair winds in the future, Willie!

Consensus breaks out on net-zero farming

Farmers, academics and NGOs find common ground on the usually contentious subject of farming and climate

A PANEL OF farmers, academics and NGO representatives have published a consensus pathway for making Scottish farming climate-compatible. In a debate that has been polarised, Farming for 1.5 Inquiry was able to set out a credible way forward by bringing different perspectives and aspirations around the same table.

Agriculture accounts for 20 percent of Scotland's greenhouse gas emissions. Scottish Government cannot achieve its ambitious climate targets without a transformation in farming. After a two-year inquiry, the Farming for 1.5 panel produced a consensus set of policy recommendations, taking the sector to net zero in 2045.

Farming for 1.5 was established as an independent inquiry in 2019 by NFU Scotland and Nourish Scotland. The panel conducted farm visits and heard evidence from experts on farming practices, environmental impacts and behavioural change.

Key recommendations of the report include:

- whole farm contracts to deliver on farming and nature from 2024;
- reducing total emissions from agriculture while maintaining food production per capita;
- rapid uptake in low methane breeding for cows and sheep.

Nigel Miller, co-chair of the inquiry, said: 'Being part of the 1.5 group has been a fascinating journey which, through integrating food production, biodiversity, the wellbeing of both rural communities and landscape into a net zero solution, has left me optimistic about the future of rural Scotland.'

'The inquiry journey has reached into soil health and sustainable cropping, in some ways revisiting principles which were established in the 18th century with the first agricultural revolution. Cutting edge science, precision techniques and genetics have also been a significant focus. Both approaches will be part of the net zero future.'

'The report, built on consensus, breaks through the tired soundbites that often dominate the climate change



'With COP26 a few weeks away, this report sets out a just transition for farming in Scotland, maintaining livelihoods and food production while transforming the impact of farming on climate and nature. We are only going to get the change we need by working together'

debate and block smart solutions. The transformation pathway mapped out by the group is a holistic plan which balances the three core goals: food, biodiversity and the 2045 net zero target. It delivers for society as a whole but also provides an integrated route for farmers, crofters and land managers to deliver diverse and sometimes conflicting policy priorities.'

Mike Robertson, also co-chair, said: 'This inquiry has brought together a panel with a wealth of

experience and expertise, drawn from farmers, researchers, economists, policy experts, scientists and campaigners. As a result the findings are credible, practical, robust, ambitious but also pragmatic, and there is a strong focus on how this change is delivered and who needs to help bring it about, and not simply on what could be done.'

'I hope this model is one that Scottish Government can draw inspiration from for any future advisory boards and that the findings are taken on fully. Scotland can not achieve its national targets without the full engagement of the agricultural sector, and while that clearly requires change, as it does for every sector, it also requires wider support from government and many others across the industry and society.'



Pete Ritchie, farmer and director of Nourish Scotland, said: 'With COP26 a few weeks away, this report sets out a just transition for farming in Scotland, maintaining livelihoods and food production while transforming the impact of farming on climate and nature. Food production is a major global driver of biodiversity loss and climate change and the world can not achieve the 1.5 degree target unless the way we farm becomes part of the solution.'

'This consensus approach takes time: but we are only going to get the change we need by working together.'

The final report can be downloaded at bit.ly/Farming1point5Report

Above right: a key part of the plan will be rapid uptake of low-methane breeding in sheep and cattle



PHOTOGRAPH: FREDÉRIC CHEVALIER VIA UNSPLASH

Pioneering research to safeguard British oak trees

Forest Research scientists embark on two new research projects on oak health, both funded by the Bacterial Plant Diseases programme

TWO PIONEERING research projects investigating the health of British oak trees have recently been given the go-ahead. The projects, named BACSTOP (www.bacterialplantdiseases.uk/bac-stop.html) and FUTURE OAK (www.future-oak.com), secured significant funding from the Bacterial Plant Diseases Programme (www.bacterialplantdiseases.uk) to further research on acute oak decline (AOD). The projects are also supported by Action Oak (www.actionoak.org).

BACSTOP aims to advance understanding of the role of the bark boring beetle *Agrilus biguttatus* in AOD,

the stress factors which predispose trees to AOD, as well as the attitudes of land managers towards oak and the management of AOD.

The project is led by Dr Sandra Denman at Forest Research and involves a multidisciplinary team from Aberystwyth University, Bangor University, Rothamsted Research and the University of the West of England (UWE).

The project is currently seeking tributes to oak trees and woodlands via its Odes2Oaks competition. Enter via the website at bit.ly/3vCsKTH where you can find out more and get inspired!

Above: oak trees may be predisposed to disease if they are already stressed

FUTURE OAK will investigate the role of beneficial microbes in fighting diseases that affect native oak trees by developing understanding about the microbiome of oak. The aim is to develop biocontrol treatments for the oak microbiome, to promote healthier trees and suppress the symptoms of AOD. The work is led by Prof. James McDonald at Bangor University and is undertaken in collaboration with Aberystwyth University, Forest Research, the Sylva Foundation and Woodland Heritage.

The Bacterial Plant Diseases programme is funded by the Biotechnology and Biological Sciences Research Council (BBSRC), Natural Environment Research Council (NERC), Defra and Scottish Government. The programme coordination team is led by Dr Sarah Green from Forest Research.

For further details, please contact suzanne.peace@forestresearch.gov.uk



PHOTOGRAPH: MARC PELL VIA UNSPLASH

Forest factsheets to inspire action on climate change

A new series of factsheets from Forest Research will give practitioners a summary of research to date and suggest 'actionable insights' that can be used in the management of trees and woodland

FOREST RESEARCH has launched the first in a series of factsheets exploring the relationships between climate change and trees and woodlands. Aimed at practitioners, the factsheets showcase the breadth of research carried out by Forest Research, sometimes over decades, explaining how trees and the climate interact.

The first four factsheets are:

- Climate Change and Forests: How do woodlands and forest affect the climate?
- Climate Change, Flooding and Forests: How can forestry help reduce flooding?
- Peatlands, Forestry and Climate Change: What role can forest-to-bog restoration play?
- Climate Change and Biodiversity: Can biodiversity help our woodlands in a changing climate?

The factsheets also offer actionable insights into how trees and woodlands

can be used to reduce the effects of climate change. Future editions in the series will be published throughout 2021 and in the buildup to the 26th UN Climate Change Conference of the Parties (COP26) which is being held in Glasgow in November 2021. In a separate initiative, recognising its expertise in climate change and the important role of trees and woodlands in addressing the climate emergency, Forest Research was invited by Scotland's Finest Woods Awards (www.sfwa.co.uk/) to provide specialist guidance to develop a new award focused on climate change. The Climate Change Champion Award will form part of the 2021 Scotland's Finest Woods Awards and aims to discover the very best examples of Scottish woodlands which contribute to climate change mitigation and/or adaptation and which share their knowledge and experience of these topics.

For further details, please contact suzanne.peace@forestresearch.gov.uk

A new approach to interpreting long-term change in soil carbon

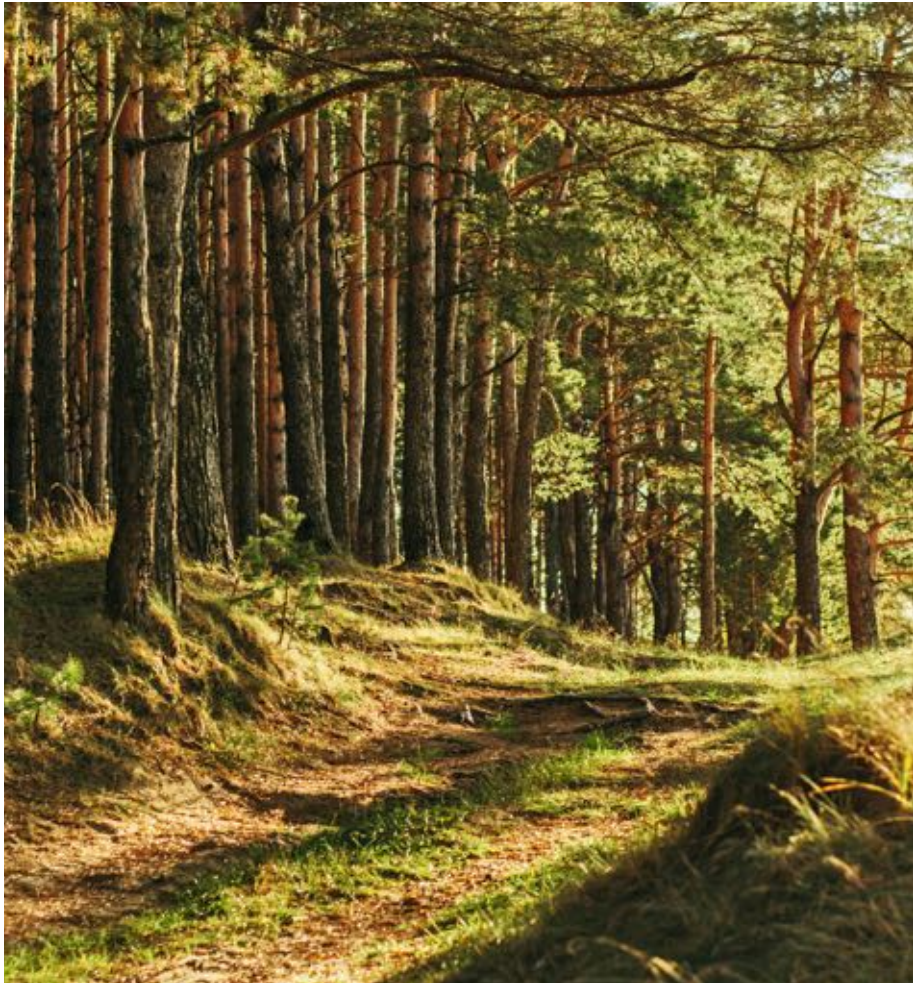
A study by scientists at Forest Research shows differences in carbon pools beneath forest and grassland

RECENTLY PUBLISHED research explores a new approach to interpreting measured changes in soil organic carbon in forest soils. The study, co-authored by researchers at Forest Research and the University of Aberdeen, represents a significant advance on existing methods by using site-specific measurements across a 200-year old pine forest chronosequence in Scotland to evaluate changes in soil organic carbon in both the topsoil and sub-soil at steady state. Simulations indicated that significant accumulation of organic carbon under forest occurs mainly

in the organic horizons, while the deeper sandy mineral soil horizons are likely to become depleted in organic carbon compared to grasslands. An important finding is that afforestation of grasslands will increase overall soil carbon stocks but may deplete the carbon pools in the deeper mineral horizons of podzols.

Raûauskaite, Vangelova, Cornulier, Smith, Randle and Smith (2020) 'A new approach using modelling to interpret measured changes in soil organic carbon in forests: the case of a 200 year pine chronosequence on a podzolic soil in Scotland'. Frontiers of Environmental Science, 16, November 2020. <https://doi.org/10.3389/fenvs.2020.527549>

For further details, please contact suzanne.peace@forestresearch.gov.uk



PHOTOGRAPH: IRINA IRISER VIA UNSPLASH



Churches, congregations, trees and climate change

A new 'citizen science' project developed by Edinburgh Napier University and the Church of Scotland aims to gain a better understanding of carbon storage in trees on church land while, just as importantly, engaging local communities

Above:
a citizen
scientist at
work in a
churchyard

THE EFFORTS OF citizen scientists in identifying and recording the species and approximate diameter of trees on Church of Scotland land have resulted in the establishment of a baseline database in a project developed by the Church of Scotland and Edinburgh Napier University under the leadership of Dr Murdo Macdonald and Dr Kathy Velander, with project co-ordination by Maddy Richards and Victoria Cochrane (MSc students at ENU).

Participants completed questionnaires before and after to evaluate their nature connectedness, participation in environmental education and engagement with their local green spaces.

The 85 participants surveyed 161 Church of Scotland sites which were host to 7,263 trees from 68 genera and 182 species. They discovered differences in community structure and diversity of trees between areas of Scotland. We also learned of the desire for adults to engage with nature and the lack of opportunity to do so in practical, educational ways.

Data from the questionnaires indicated a significant change in nature relatedness before and after the study, supported by participants describing how the project altered their personal

attitudes towards nature and their local trees. We also saw that lockdown due to Covid-19 positively impacted most participants connection to nature.

Participants expressed that taking part in the Our Trees project personally benefited them because they were able to contribute to science, engage with local nature and had fun. Connection to nature has been shown by other researchers to be important for mental health.

As one participant explained: 'The project has enhanced my experience of being connected to nature by encouraging a closer look at trees in my local area. While we were participating in the survey, many people shared good memories about trees and now these memories will live on because the experience has been shared. This shows how a connection to nature benefits our wellbeing.'

It is clear that engagement with environmental education and citizen science projects brings out a sense of community and ownership of local green spaces. It would be beneficial for more citizen science projects to be made available to adults. The analysis of the information gathered is ongoing and the database will be publicly available upon completion.

Members’ reports

Royal Botanic Garden Edinburgh; University of Stirling



Left: African elephants in a wooded setting

Large trees are good for elephants

Conservation of large trees not only helps mitigate against climate change, it also supports indigenous people and iconic African wildlife, according to new research involving Royal Botanic Garden Edinburgh

CONSERVATION OF large trees not only helps mitigate against climate change, it supports indigenous people and iconic African wildlife, according to new research by scientists from Scotland, the USA and Republic of Congo published in the journal *Plants, People, Planet*.

Research based in the Congo’s Nouabalé-Ndoki National Park brings new light to the role large trees play in the global ecosystem. Both larger and more diverse than previously recorded, they are recognised for their efficiency in removing carbon from the atmosphere and supporting local human and animal populations.

Explaining the findings of a paper entitled ‘Large trees in tropical rain forests require big plots’, Dr David Harris of Royal Botanic Garden Edinburgh (RBGE) said: ‘Large trees, towering over the land for generations, have always provoked awe, but there is now a growing awareness of their importance in our future on this planet.

‘Conserving our largest trees helps in the fight against the twin global challenges of climate change and species extinction. Not only do they capture carbon, an important factor in mitigating against rising carbon dioxide levels, but they are also vital to the wellbeing of local people. Almost half of the trees we found provided nutrients, from oil-rich seeds and honey to edible caterpillars and symbiotic fungi.’

Dr Sydney T. Ndolo Ebika, from the Faculty of Sciences and Techniques, Marien Ngouabi University, Brazzaville,

Republic of Congo, is a co-author. He added: ‘The Congo basin is home to large mammals such as forest elephants, western lowland gorillas and chimpanzees. These megafauna rely on the largest trees for food, shelter and protection, so the conservation of these big forest trees is crucial to the survival of these iconic species.’

The study took place in the Nouabalé-Ndoki National Park, part of the Sangha Trinational that was declared a UNESCO Natural World Heritage site in 2012.

While previous research examined trees in plots of only one hectare, this ambitious study widened the scope of the research to 13 plots, each of 10 hectares. The scientists found more than 100 species of tree greater than 80cm in diameter, the most abundant of which was the sapele tree (*Entandrophragma cylindricum*). The sapele, used in global timber markets as an alternative to mahogany, is listed as vulnerable by the International Union for the Conservation of Nature (IUCN).

The global scientific community has started to recognise the importance of big trees in a healthy ecosystem, but there is still much more to learn about their effects on our planet.

For further details, please contact Suzie Huggins at RBGE, 07837 745007 or Shauna Hay, 07824 529028.

‘Large trees in tropical rain forests require big plots’, <https://doi.org/10.1002/ppp3.10194>

‘Gamefied’ research makes clear farmers’ views on conservation

Farmers playing a game on a tablet reveal their attitudes to wildlife in an innovative study from the University of Stirling

FARMERS ARE more likely to protect wildlife on their land if they trust their local communities and government.

These findings emerged from an innovative research project, which involved farmers in Orkney and Gabon playing a game on an electronic tablet, in which they had to choose how to deal with wildlife that would damage their crops – geese in Orkney and elephants in Gabon.

In the game, designed by Stirling researchers Dr Sarobidy Rakotonarivo, now at the Université d’Antananarivo, Madagascar, and Prof Nils Bunnefeld, the farmers had to choose whether to kill the wildlife, scare it away or sacrifice crops to allow the wildlife to co-exist on their land.

Farmers chose not to eradicate wildlife because that wildlife was seen as a part of their lives. The actions of farmers in the game depended on the trust they had in the system, rather than the points – or, in the real world, money – they were offered. Trust and perceptions of fairness were as

important as a reward. The Stirling team was funded by the ConFooBio project of the European Research Council.

The game was played by 260 farmers in Gabon and 84 in Orkney. In Gabon, elephants are protected: killing them is not allowed by law. Where farmers felt they had a say in government policies, and where they lived near a national park and had seen local investment, they showed more tolerance for elephants than farmers who had no say in management or who lived near logging concessions.

In Orkney, where you can apply for a licence to shoot geese, the effect of financial rewards on the pro-conservation behaviour of farmers was greatest when farmers had higher levels of trust in other farmers in their community. Farmers who thought financial compensation was unequally distributed in were less likely to sacrifice crops for geese.

‘It was the interaction with trust and equity issues that showed the biggest shift in behaviour,’ says Professor Bunnefeld. ‘Policy makers tend to focus on investment and financial rewards but this research showed trust in those making decisions, and having a say in policy and management, was as important.’

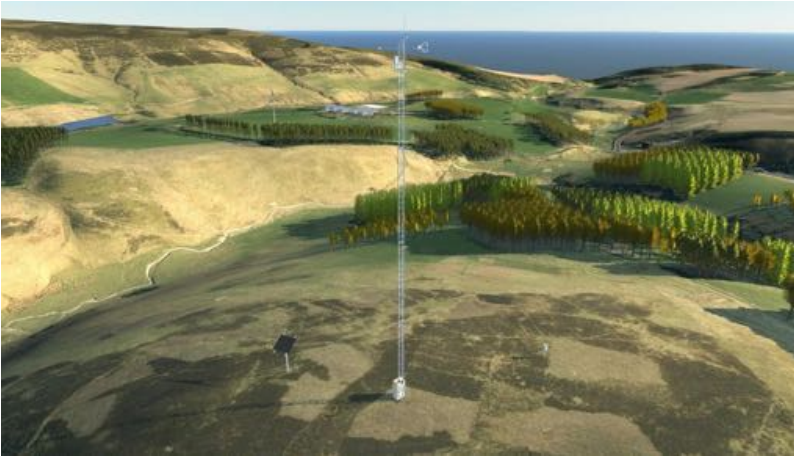
The research was carried out in partnership between the University of Stirling and the Gabon National Parks Agency (ANPN).

The Gabon research is detailed in the paper ‘The role of incentive-based instruments and social equity in conservation conflict interventions’, published in *Ecology and Society*.

The Orkney research is detailed in the paper ‘Experimental evidence for conservation conflict interventions: The importance of financial payments, community trust and equity attitudes’, published in *People and Nature*.



Left: geese frequently cause damage to crops in Orkney



Computer-generated visualisation of 100-metre high meteorological tower

Monitoring and near real-time simulation of carbon and greenhouse gas emissions

A new project from the James Hutton Institute will keep an eye on carbon sequestration in soils, with a separate project to measure the composition of greenhouse gases

TWO NEW PROJECTS and associated investments in scientific infrastructure are being designed to improve monitoring and accessibility to new data on greenhouse gas emissions.

Carbon sequestration in soil is one of the most promising biological negative emission technologies to mitigate climate change. Successful implementation of land-based negative emissions technologies requires continuous monitoring, reporting and verification of soil storage changes and greenhouse gas (GHG) emissions to estimate net carbon sequestration.

However, the variability in soils and greenhouse gas emissions makes it difficult to evaluate results. This challenge is being tackled using digital technology in the development of a system to monitor and understand changes in soil carbon and GHG emissions from agricultural systems.

The £1m project, Dynamic monitoring, reporting and verification for implementing negative emission strategies in managed ecosystems (RETINA) is funded through the NERC programme Constructing a Digital Environment, led by James Hutton Institute with the Centre for Ecology and Hydrology and University of Aberdeen. A network of environmental sensors is being deployed in the field,

data from which is augmented by landscape level sensors, and national scale from satellites, all harmonized to provide data feeds to cloud-based models and visualisations of outputs. This infrastructure is designed to enable near time simulations of changes in carbon and GHG emissions without the need for individual user inputs.

A complementary investment is in a £1m, 100-metre tall tower for measuring the composition of greenhouse gases and enable estimates of greenhouse gas fluxes, deployment of scientific equipment that becomes available in future, and as a teaching resource.

The tower is planned to be sited at one of the James Hutton Institute research farms and to be operational by early 2023.

The infrastructure will enable the objective monitoring of progress towards achieving the UK’s binding ‘net zero’ greenhouse gas emissions targets. The initiative is led jointly by University of Edinburgh and James Hutton Institute, supported with a capital grant from the Natural Environment Research Council (NERC).

For further details, please contact Dr Jagadeesh Yeluripati, Jagadeesh.Yeluripati@hutton.ac.uk

Members' reports

Moredun Research Institute; Roslin Institute

New vaccine for a familiar disease of sheep and red grouse

Research at Moredun backed by the Game and Wildlife Conservation Trust aims to replace a discontinued vaccine from the 1930s



LOUPING ILL is an acute tick-transmitted viral disease affecting the central nervous system to which sheep and red grouse are highly susceptible. Surveillance data for sheep shows that mortality rates in flocks due to louping ill virus (LIV) are between 5-10%. In about half of infected sheep showing

clinical signs of virus infection, the disease will prove fatal. Clinical signs in sheep include muscle tremors and rigidity in the head and neck and they often have a louping gait with both front legs moving together followed by the back legs. Sheep that survive the infection

Above: hill sheep were first to benefit from the 1930s vaccine

gain strong immunity, supporting the feasibility of vaccination as a method of controlling the disease. Moredun Research Institute first developed a highly effective vaccine in the 1930s, which was successfully deployed in hill sheep flocks in areas of high risk. The vaccine was improved in terms of efficacy and safety in the 1970s and was available commercially until 2017 when it was discontinued. To address this important gap in methods to control louping ill, Moredun, together with the Game and Wildlife Conservation Trust, is currently undertaking research to develop a new LIV vaccine with the work generously funded by Scottish estate owners. This new approach uses DNA technology to generate a synthetic form of key viral proteins that are important for immunity to LIV. These proteins are non-infectious and are therefore safer to produce than previous vaccines. Recent pilot studies at Moredun have shown that lambs mount a strong immune response when vaccinated with the prototype vaccine, which is really encouraging and further trials are underway to check the efficacy of the new vaccine.

BONE QUALITY in egg-laying hens benefits from a common feed supplement as well as from traits that help their skeletons store calcium, research shows. The nutritional additive, betaine, could complement programmes to improve bone quality in hens that lay eggs, which are at risk of osteoporosis, scientists concluded. In a separate Roslin study, it was found that selection for hens with an adaption to store calcium that is associated with bone strength, known as mineralisation of medullary bone, could also improve bone quality. The timing of puberty may play a role in bone strength, whereas the amount of eggs a hen produces has no effect on their bone quality, the second study also showed.

Findings from both studies could aid poultry breeders in deciding which animals to breed, researchers say.

Impact of diet

Scientists investigated the effects of a nutritional intervention on chicken bone quality, after previous results suggested it might play a role. Chickens were fed with one of four diets containing different amounts of dietary betaine, from when they were hatched until they stopped laying eggs.

Feed additive builds strong chicken bones

A widely used feed additive in swine, poultry and fish production improves bone strength in laying hens, a study led by scientists from Roslin Institute has shown



Blood and bone samples were collected at different stages. Analyses measured the concentration of a blood component that is inversely linked to bone quality, and bones were examined

Dietary betaine was found to improve bone strength in laying hens

with X-rays and a bending test. Addition of dietary betaine improved bone strength in laying hens, scientists observed. Egg production and quality was excellent throughout the study and were not affected by the dietary treatments. The study was funded by animal nutrition technology company AB Vista and is published in the journal *British Poultry Science*.

Hen bone health

Hens that lay lots of eggs do not experience loss of bone quality, the related study suggested. Scientists examined heritability of bone strength through statistical analyses that accounted for body mass, egg production, and measures of bone strength obtained through a bending test, X-rays and chemical composition. The study, in collaboration with the Swedish University of Agricultural Science, breeding company Lohmann Breeding and the University of Granada, was funded by national funding bodies coordinated through the European Union Animal Health and Welfare ERA-NET scheme. It is published in the journal *Genetics Selection Evolution*.

Members' reports

University of Glasgow; SCRR

'Energy citizens' and the pathway to decarbonisation

The University of Glasgow is part of an international consortium looking at the best ways to engage citizens on sustainability and the climate emergency



Wind turbines off the coast of Cumbria

THE €3.1 MILLION EU Horizon 2020 project Energy Citizens for Inclusive Decarbonisation (ENCLUDE) aims to share new knowledge and motivate the broadest possible population of 'energy citizens' to help the EU to fulfil its promise of a just and inclusive decarbonisation pathway. Energy citizenship refers to people's active participation in working individually or collaboratively for a more sustainable future. In the transformation of the energy system, citizens are becoming increasingly important as engaged, involved and shaping participants. The University of Glasgow will work alongside research partners from Switzerland, the Netherlands, Ireland, Austria, France, Belgium, North Macedonia, Romania, Greece and Canada on the ground-breaking project, which is led by ETH Zurich. The work in Glasgow is led by the University of Glasgow's Professor Gioia Falcone and Dr Anastasia Ioannou, with the support of Glasgow City Council, the United Nations Economic Commission for Europe (UNECE) and Energy Action Scotland. News of the project launch comes ahead of the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow in November 2021.

Professor Falcone, the Rankine Chair of Energy Engineering at the university's James Watt School of Engineering and Associate Director of the Centre for Sustainable Solutions, said the research team at the University of Glasgow would focus on clustering algorithms and data-driven machine learning methods for the identification of strategic groups of citizens – 'clusters for decarbonisation' – at multiple scales of analysis and in different contexts. The transdisciplinary ENCLUDE project will create a typology of the energy citizenship concept for diverse communities of citizens by investigating on-the-ground case studies of existing decarbonisation activities. For the first time, insights about who is affected by energy citizenship and how this concept might affect decarbonisation pathways will be incorporated into agent-based models and integrated assessment models. The research aims to operationalise the energy citizenship concept at multiple scales of policy and decision making. For details of the Horizon 2020 project 'Energy Citizens for Inclusive Decarbonization' see cordis.europa.eu/project/id/101022791

EVENT NEWS

Rural research in Scotland 2021: facing up to the challenges

SCRR's third mini-conference for Early Career Researchers (ECRs) Wednesday November 17, 2021 1pm – 3pm

EVIDENCE SHOWS that Early Career Researchers (ECRs) across Scotland have experienced significantly greater personal and professional challenges due to the Covid-19 pandemic compared with academics who are later in their careers. This is particularly the case for those ECRs who have also experienced disadvantage, poverty and/or identify as BAME, LGBTQI+ and/or who took on additional caring responsibilities during the pandemic. In this third SCRR mini-conference for ECRs, we have therefore decided to focus on the theme of challenges in two ways. First, to create the opportunity for you to share your challenges as ECRs under Covid. Second, to showcase how, in spite of this, you have managed to produce research that seeks solutions to some of our bigger societal challenges – around climate, the economy, and wider sustainability goals, at local, regional, national and international levels. As always within SCRR, we celebrate the diversity of all that falls within 'rural science' and welcome contributions from across all research fields, covering research into land, freshwater, coastal and marine resources, and their uses – including farming, forestry, aquaculture and recreation, as well as all that connects with rural communities. As with previous years, ECRs apply to submit a poster. Successful applicants will receive a certificate to show they presented. There is a prize for the winning poster and the opportunity to apply to be an ECR co-organiser for the conference, for which a certificate will also be given. Let's use this opportunity to celebrate how ECRs have faced up to challenges across Scotland!

Please register your interest via the Events section of our website to make sure you receive further details as soon as they become available: scrr.ac.uk/events/

SCRR member organisations

The University of Edinburgh	www.ed.ac.uk
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Edinburgh Napier University, School of Applied Sciences	www.napier.ac.uk/fhlss/SLSSS
Field Studies Council, Millport	enquiries.sco@field-studies-council.org
Forest Research, Northern Research Station	www.forestry.gov.uk/forestresearch
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National Museums of Scotland	www.nms.ac.uk
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Royal Society for the Protection of Birds - Scotland	www.rspb.org.uk/scotland
Royal Zoological Society of Scotland	www.rzss.org.uk
Science & Advice for Scottish Agriculture	www.sasa.gov.uk
Scotland's Rural College (formerly Scottish Agricultural College)	www.sruc.ac.uk
Scottish Association for Marine Science, Oban	www.sams.ac.uk
Scottish Natural Heritage	www.snh.gov.uk
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University of Glasgow	www.gla.ac.uk
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Stop press!



SCRR is delighted to congratulate one of our founder members, Professor Julie Fitzpatrick OBE, who has just been appointed Chief Scientific Advisor for Scotland.

Events

www.scrr.ac.uk/events

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