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Scottish Consortium
for Rural Research

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DAVE DUNFORD VIA WIKIMEDIA COMMONS



It's always good to talk research

Prof Sarah Skerratt, Scientific Director of SCRR, explains that our mission is to share knowledge for the public good

'IT'S GOOD to talk!' was the theme of a successful advertising campaign from three decades ago, which turned around the fortunes of a national telecoms company. The campaign focused not on the technology of phones and networks, but on the power of communication to generate deeper relationships. The message still holds true 30 years later, perhaps even more so in 2019 when digital interaction is increasingly all-pervasive.

This edition of our newsletter celebrates the persistence and power of face-to-face meetings, while acknowledging the challenges posed by our carbon footprints when we travel. We remain compelled to engage with one another, as social animals, as humans – as researchers. There is so much merit in eye contact, in non-verbal signals, reactions, curious looks and smiles. There are those chance conversations over coffee or lunch, serendipitous moments that can generate impactful outputs. The examples of such face-

to-face connections highlighted in this edition include SCRR's own mini-conference (or 'Gathering') in Inverness in mid-November 2019. We focused on bringing together Early Career Researchers working on a breadth of rural issues, creating the opportunity to share their embryonic research ideas with each other and with those outwith the academic community, in an informal setting.

We're also aware of the growth in virtual conferences, online sessions and webinars enabling participation and engagement from across Scotland, the UK and internationally, enabling the co-creation of new ideas that would not be possible otherwise. Although such virtual conferences miss the informal interactions between sessions, they do enable a meeting of minds and people without the environmental impacts of travel.

This newsletter itself is another form of connection; a few steps removed in its immediacy, but nonetheless enabling links to be created between an author

Telephone boxes are going out of fashion, but communication is still crucial

and reader, an idea and a further spark of an idea. Again, the technology of the medium is not the focus; it's the outcome of a shared idea that matters.

As SCRR, our reason for being is to share rural research knowledge for public good. We do this through communicating with one another, and with wider society. The message 'It's good to talk' is therefore as relevant for us now as 30 years ago, and is likely to remain so for another few decades, as we move science forward through our shared endeavour.

This issue in places

The Cairngorms is the site of an experiment that uses Arctic technology to predict flooding – **page 2**

Grangemouth is home to the deepest 'buried valley' so far discovered in Scotland – **page 2**

New South Wales is the location for a study of oysters and ocean acidification – **page 4**

The Isle of Rum is where red deer have been giving birth earlier in spring, in response to climate change – **page 6**

The Bass Rock is the setting for a study of how gannets learn about feeding grounds – **page 8**

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 are on the back page.

Members' reports

SAMS, BGS

PICTURES: SCOTTISH ASSOCIATION FOR MARINE SCIENCE



The team from SAMS deploys a SIMBA unit in the Cairngorms

Snow sampling technology could help predict flood risk

A novel use for technology usually deployed in the Arctic is being explored by the Scottish Association for Marine Science

TECHNOLOGY DESIGNED by the Oban-based Scottish Association for Marine Science (SAMS) that could provide early warning for floods has been deployed in the Scottish Highlands. The device, known as SIMBA (Sea Ice Mass Balance Array), was originally developed to analyse sea-ice in Arctic regions but SAMS is exploring the potential for the technology to be used closer to home.

SAMS has been working in a multi-agency co-operation comprising of the Scottish Avalanche Information Service (SAIS), the Scottish Environmental Protection Agency (SEPA) and the University of Dundee to test the application of this technology in monitoring snowpacks forming on the Cairngorm mountains.

The equipment remotely gathers data in snow accumulation zones at around 1,000m altitude, primarily measuring ground, snow and air temperature profiles, snow accumulation and melt rates and total depth. It can give readings 24 hours a day during storms and dangerous snowpack conditions when these sites are often not accessible safely by avalanche forecasters.

The deployment this winter in Glen Feshie will test the ability of the equipment to detect and monitor snow melt, providing data that can help



scientists understand the contribution of snow melt in floods and that will ultimately enhance flood prediction models in Scotland.

Trials are already under way on Cairngorm itself, with the assistance of Cairngorm Mountain Resort and the RSPB, to use SIMBA technology to complement other traditional snow analysis techniques and observations conducted by SAIS, to assess avalanche risk. The testing will continue throughout the winter and extend to several other Scottish mountain areas.

For more information please contact Euan Paterson, euán.paterson@sams.ac.uk

SIMBA units are more commonly used in the Arctic to measure sea ice thickness and melt rate

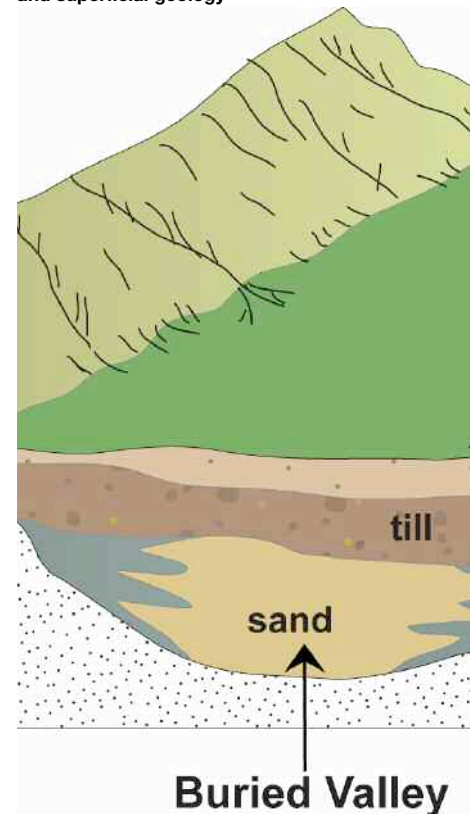
Ancient valleys that lie buried under Scotland

Known since the 1950s, these hidden features have now been mapped by the British Geological Survey

WE OFTEN SEE Scotland's landscape as something that is as literally 'as old the hills'. However, the positions of valleys have changed over time, which can lead to the phenomenon of ancient buried valleys, where the depth and orientation of a valley underground has no relation to the river that now flows over it. Buried valleys cause problems for hydrologists, civil engineers, planners and construction companies.

The British Geological Survey has reported enigmatic features all over the Midland Valley of Scotland since the 1950s, but because they are buried, they could not be mapped. This all changed with the move to digitally capture millions of borehole records

A stylised example of a buried valley, showing bedrock and superficial geology



held by the survey in a digital database. Using the database to look at the position of bedrock buried under unconsolidated sediments, it is now possible to map these features for the first time.

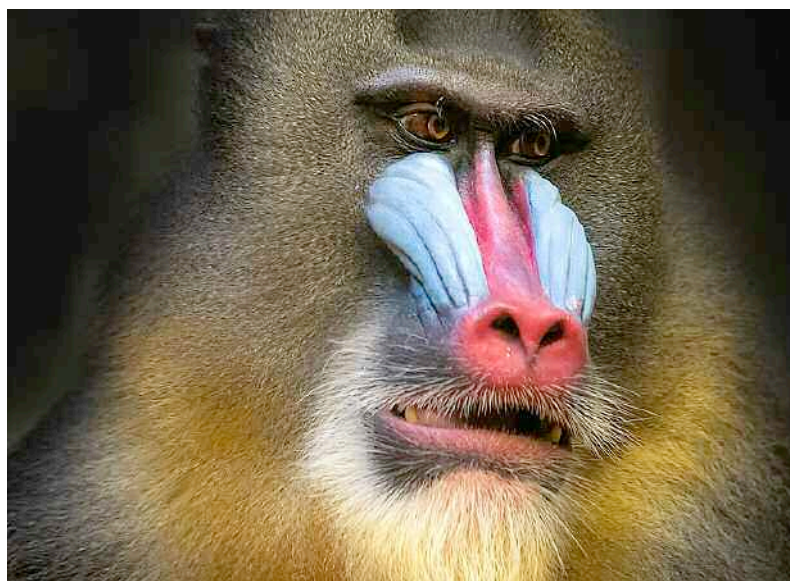
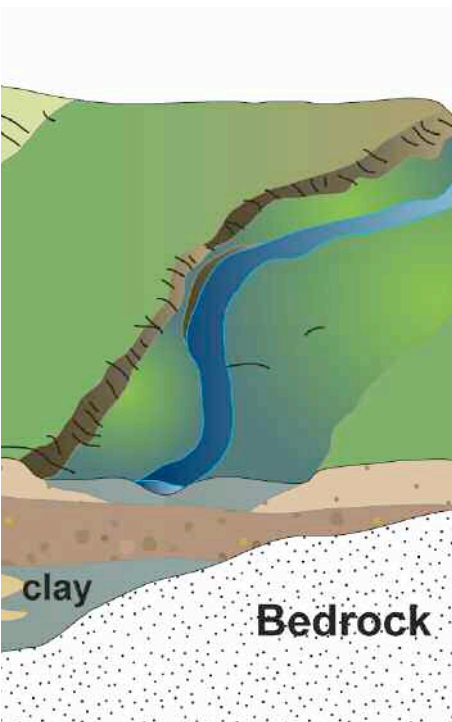
Eighteen Buried Valleys have been identified in central Scotland. The deepest system, under Grangemouth, is more than 162m deep. Other, shallower features have been identified under Perth, beneath the River Kelvin, around Ayr and south of the Ochils.

The valleys mostly date from the last ice age, which ended around 11,500 years ago. They are ancient drainage networks from rivers and glaciers that over the years have become partly or completely buried by more recent sediments.

In Cardiff, the BGS has had a successful project in partnership with Cardiff City exploiting shallow geothermal heat from a buried valley system. The work on buried valleys will allow us to start to identify if there is a similar potential in Scotland.

Buried Valleys in central Scotland:
<https://doi.org/10.1111/bor.12364>

For more information, please contact enquiries@bgs.ac.uk



Banked species: mandrill in a zoo collection

PICTURE: WILLIAM WARBY VIA WIKIMEDIA COMMONS

CryoArks: establishing a UK-wide zoological biobank

A new consortium involving National Museums Scotland aims to create a unique resource for conservation management and biological research

A UK-WIDE COLLABORATION aims to create the UK's first comprehensive zoological biobank for research and conservation. The initiative, funded by the Biotechnology and Biological Sciences Research Council (BBSRC), is a consortium of museums, zoos, academic institutions and existing biobanks.

Biobanks are curated collections of biological samples (such as tissue, blood, serum, DNA, gametes and cell lines) that are collected, preserved and maintained along with their associated data, following international standards and guidelines. Biological samples from wild and zoo animals are valuable sources of genetic material, providing a wealth of information that can support conservation management as well as fundamental biological research.

CryoArks is a partnership project that aims to bring together millions of biological samples held in disconnected collections across zoos, museums and academic collections into a publicly visible and accessible biobank. As a CryoArks partner, National Museums Scotland is helping to establish the physical infrastructure and protocols required to biobank genetic material at -80C.

CryoArks partners offer physical storage (at both -196C and -80C), a searchable database, on-site

assistance in archiving sample material and advice on embedding biobank sample collection during routine veterinary care and fieldwork. In conjunction with the Royal Zoological

'Biological samples from wild and zoo animals are valuable sources of genetic material, providing a wealth of information that can support conservation management as well as fundamental biological research'

Society of Scotland, National Museums Scotland's Biobank is promoting the benefits and needs of zoological biobanking in the UK to a wide range of audiences across the research and public sectors.

Samples donated to the National Museums Scotland Biobank will be available through the CryoArks initiative. In donating samples, contributors are enhancing the durability, sustainability and availability of their frozen biological material. Partners include Cardiff University, University of Nottingham, Natural History Museum, RZSS and the University of Edinburgh.

Details of the National Museums Scotland Biobank are at www.nms.ac.uk/collections-research/collections-departments/natural-sciences/biobank/ and for more about CryoArks, visit www.cryoarks.org

Members' reports

University of Stirling, SAMS

Farmed oysters able to protect themselves from ocean acidification

Field research in New South Wales by the University of Stirling shows that targeted breeding can produce resilience in an important food species

THE ONGOING INCREASE in the acidity of the world's oceans hampers some organisms, such as oysters, from producing and maintaining their shells. However, a team led by Dr Susan Fitzer of the Institute of Aquaculture (IoA) at the University of Stirling has studied Sydney rock oysters in New South Wales, Australia, and found that resilient strains of this oyster – generated through targeted breeding – can cope better with more acidic seawater conditions.

A major problem in oyster aquaculture is coastal acidification and in many regions around the globe this is damaging the ability of oysters to grow properly. Such changes in shell growth mechanisms are likely to have implications in the future: for example, it may see the production of smaller oysters with thinner shells, leaving them prone to fracture and at risk of shell damage during culture and harvesting. The researchers have shown for the first



time that oysters selectively bred for fast growth and disease-resistance can alter their mechanisms of shell biomineralisation, promoting resilience to acidification.

Sydney rock oysters ready to be eaten

Commercial shellfish aquaculture is vulnerable to the impacts of ocean acidification, caused by increasing carbon dioxide absorption by the ocean, and coastal acidification, driven by land runoff and rising sea levels.

Working with New South Wales Department of Primary Industries, the University of Sydney and the Scottish Universities Environment Research Centre, the team characterised the crystallography and carbon uptake in the shells of the Sydney Rock Oyster (*Saccostrea glomerata*) farmed in habitats affected by acidification from land runoff.

The scientists looked at oysters from families selectively bred for fast growth or disease resistance to in comparison to wild oysters.

The researchers were able to show that selective breeding in oysters is likely to be an important global mitigation strategy for sustainable shellfish aquaculture to withstand future climate-driven change to habitat acidification.

The Natural Environment Research Council and the New South Wales Environment Trust supported this work. The paper is published in the journal *Global Change Biology*.

For more information please contact Dr Susan Fitzer, susan.fitzer@stir.ac.uk

PICTURE: AUSTRALIAN ACADEMY OF SCIENCE

Evidence prompts UN rethink on global seaweed policy

Work by the Scottish Association for Marine Science highlights key challenges for a growing industry

AN AUDIENCE OF United Nations delegates attending the FAO Sub-Committee on Aquaculture in Trondheim in August 2019 called for more work to be done to understand the global seaweed industry, after hearing from Scottish Association for Marine Science (SAMS) scientist Professor Elizabeth Cottier-Cook and five other international experts.

The industry was valued at around US\$12 billion in 2017 and supports millions of families worldwide. Seaweed production grew globally from 13.5 million tonnes in 1995 to 30 million tonnes in 2016; as a food, seaweed is a source of nutrients, vitamins and Omega-3 fatty acids but it is also used globally in the food processing industry as a thickening agent.

Prof Cottier-Cook, who leads the Global Challenges Research Fund

(GCRF) 'Global Seaweed STAR' research project, told delegates at the meeting how this rapidly expanding industry faces a number of key challenges including disease and pest outbreaks, which can lead to whole farms being shut down.

She said governments from around the world had to consider how best to safeguard the industry.

Following the presentation, key messages from the expert panel included a call for the seaweed industry to be scaled up, both at the national and local farm level, alongside initiatives to address the lack of specific policies and guidelines for seaweed biosecurity.

Global Seaweed STAR is a four-year programme funded by UK Research and Innovation (UKRI) to improve the sustainability of the global seaweed industry. Work undertaken by

Below: delegates at the UN FAO meeting in Trondheim

the project was presented at the event and the team hopes to work with the FAO to develop a biosecurity action plan for this industry.

To find out more about the UKRI-funded GlobalSeaweedSTAR project, visit www.globalseaweed.org





The trouble with trees: are there really benefits to afforestation?

A collaboration involving Royal Botanical Garden Edinburgh is casting doubt on one of the main methods to combat climate change in Africa

HAILED AS A resolution in the fight to reduce greenhouse gases (GHGs) and global warming, tree-planting programmes have been seen as a major player in conservation, but new research questions the viability and validity of large-scale afforestation.

While restoration of recently deforested areas has been acknowledged as an important factor in helping to reduce further increases in GHGs, the significance of planting vast areas that have never been forest has not been well scrutinised. An article published in *Trends in Ecology and Evolution* examines the possibility that plans for large-scale tree planting, far from offering hope, are a distraction from the urgent problem of reducing use of fossil fuels and transforming energy systems.

Against a backdrop of growing scientific skepticism over the contribution of afforestation, a group of researchers – William Bond from the University of Cape Town; Nicola Stevens and Guy Midgley, from Stellenbosch University; and Caroline Lehmann of the Royal Botanic Garden Edinburgh – have been examining the

Savanna is one of the landscape types that is vulnerable to forest plantation

supposed benefits and potential losses of mass tree planting. Their focus is the ambitious AFR100 plan to plant 100 million hectares of trees in Africa by 2030.

This vast area – more than four times the size of Britain – is the subject of a pledge by 28 African countries signing up to AFR100, to afforest an explicit target area. Mozambique, for example, has committed to 'restoration' of a million hectares; South Africa to 3.6 million; Kenya to 5.1 million; Cameroon to 12 million; and Nigeria to 32 per cent.

But Bond and colleagues argue that the programme will not contribute significantly to GHG reduction, that the funding is a small fraction of that really required to stem CO₂ increases, and that African countries are locking themselves into a novel land use for decades without considering the costs to their own future.

If Africa reached its target of 100 million hectares afforested, the reduction in the annual increase of atmospheric CO₂ would be less than 3 per cent per year, they calculate. Africa was targeted for afforestation

because the continent's considerable grasslands and savannas – with climates that can support forests – were wrongly considered to have been deforested in colonial times.

The researchers have concluded that the conversion of these grassy landscapes to plantations of eucalypts and pines could condemn citizens in these countries to a century or more of plantation forestry. That means suppressing plantation fires, felling trees and storing the carbon produced, and replanting every decade or two for the foreseeable future. Furthermore, there is not even scientific agreement on whether plantations will warm or cool the planet. Trees have darker canopies than grassy vegetation, absorbing more sunlight and heating the land surface – a problem not yet included in the calculations of afforestation advocates.

In Africa, vast new forests will be at the expense of food crops, livestock farming and conservation of Africa's rich diversity of savanna animals and plants. It will also reduce the dry season flow of streams and rivers.

'The rush to implement AFR100 has left little time for sober evaluation of the multiple costs and benefits to countries that have promised large chunks of their land to afforestation,' said Caroline Lehmann. 'For tree planting to be positive it needs to be the right trees in the right places.'

For further information, please contact Shauna Hay, s.hay@rbge.org.uk

Members' reports

RSPB, University of Edinburgh

PICTURE: ANDY HAY, RSPB



A new study examines populations of 525 bird species, including the wood warbler

Birds benefiting from climate change may find their boost short-lived

Jenna Huber of the Royal Society for the Protection of Birds reports on new research that overturns previous findings of a climate change bonus for some bird populations

THE CLIMATE CRISIS has had a profound impact on bird populations in Europe and the US, scientists say. Climate change is a major global threat to humanity and to nature. It threatens to undermine our water and food supplies; it is fuelling extreme weather; and some large cities are predicted to disappear under rising sea levels.

So conservationists were flummoxed by studies showing that climate change is having a stronger effect upon species that benefit from it, compared to those that suffer negative impacts. Could this possibly be true? Or were those studies flawed? The authors of a new major study, recently published in the journal *Climatic Change*, investigated 525 bird species over 30 years and across two continents in an attempt to find out.

The researchers thought there might be several explanations for the surprising findings. There could be a time-lag in the response of populations to climate change, creating an 'extinction debt'. Also, studies covered timespans too short to pick up on shrinking habitat ranges; and tended to focus on changes in range rather than changes in numbers.

The new report has indeed turned those earlier findings on their heads. It found no evidence that climate change

has a more profound effect upon birds that should cope well with it, compared to those that might struggle. Climate change is causing widespread population change in birds.

The researchers called for further research into the long-term consequences of climate change on wildlife to be commissioned urgently, as precious wildlife is already struggling to cope with habitat destruction, farming practices, pollution, harmful fishing and invasive non-native species introduced into fragile eco-systems. The climate crisis and biodiversity crisis are two sides of the same coin and need to be tackled together.

Recently, another landmark paper in the journal *Science* suggested the loss of nearly three billion birds in North America over the last 50 years, although linked to a range of factors, such as habitat loss and intensive agriculture, were all exacerbated by climate change. This new study, led by the RSPB, goes even further and argues climate change may be a major driver of population change in birds, aggravated by other factors.

For more information please contact Prof. Richard Gregory, richard.gregory@rspb.org.uk

Evolving deer give birth earlier as climate warms

A project on the Isle of Rum involving genetic changes are playing out among the red deer population

RED DEER on a Scottish island are providing scientists with some of the first evidence that wild animals are evolving to give birth earlier in the year as the climate warms.

Genetic changes to red deer on the Isle of Rum – located off the west coast of Scotland – have played a key role in a rapid shift in birth dates in recent years. Previous studies have shown that the deer have been giving birth earlier since the 1980s at a rate of about three days per decade, partly due to the effects of warmer temperatures on the deer's behaviour and physiology.

A team involving Edinburgh scientists has revealed that genetic changes caused by natural selection are also involved. The study provides a rare example of evolution happening quickly enough to be detected over only a few decades – a rare case where evolution has been documented in action, showing that it may help populations adapt to climate warming. The team made the discovery using

Red deer hinds have been giving birth earlier each spring



Birth earlier as

at the University of Edinburgh
are playing their part in a rapid response

field records and genetic data collected on Rum over a 45-year period since 1972. Female red deer give birth to a single calf each year, and those that reproduce earlier in the year have more offspring over their lifetime, researchers say. Their findings show that this is partly because of an association between the genes that make hinds give birth earlier and higher overall reproductive success. As a result, genes for breeding earlier have become more common in the Rum deer population over time.

Scottish Natural Heritage manages the Isle of Rum National Nature Reserve. The research, published in the journal *PLOS Biology*, involved scientists from the Australian National University and the universities of St Andrews and Cambridge. It was funded by the Natural Environment Research Council.

For more information please contact Prof Josephine Pemberton, j.pemberton@ed.ac.uk



PICTURE: SHARP PHOTOGRAPHY VIA WIKIMEDIA COMMONS



PICTURE: FRANOIS FRANKLIN VIA WIKIMEDIA COMMONS

Woodland birds such as the blue tit are breeding earlier in the year

Warmer nights prompt woodland birds to lay eggs earlier in spring

Further research at the University of Edinburgh has found that night-time temperatures are the trigger behind another phenomenon associated with climate change

RESEARCHERS AT the University of Edinburgh have shown that rising night-time temperatures are causing woodland birds to build nests and lay eggs earlier in springtime.

With climate change continuing to cause temperatures to rise, the breeding patterns of birds such as blue tits are being altered as evenings in spring get warmer.

Previous research has shown that warmer springs have led birds to begin breeding earlier. However, until now, scientists had not identified the key factors that cause this behaviour.

The team of biologists from the University of Edinburgh analysed data from 40 Scottish sites over a five-year period. They found that birds decide when to reproduce based on night-time temperatures in springtime. Their findings suggest that colder temperatures may act as a constraint that delays the processes of building nests and laying eggs.

Blue tits were also found to lay eggs sooner if birch trees come into leaf earlier. This is some of the first evidence that birds use trees as a cue for timing breeding. Blue tits may use birch trees as a signal because they come into leaf earlier than other species.

Using data gained from two national citizen science projects,

researchers found that night-time temperature and birch leafing have very similar effects on the breeding behaviour of woodland birds across the UK.

The study, published in *Proceedings of the Royal Society B*, was funded by the Natural Environment Research Council. It also involved researchers from the Woodland Trust,

‘Previous research has shown that warmer springs have led birds to begin breeding earlier. However, until now, scientists had not identified the key factors that cause this behaviour’

British Trust for Ornithology, University of Exeter, and Royal Society for the Protection of Birds.

However, birds may not be responding fast enough to warmer spring temperatures. The early arrival of spring is also causing the peak in caterpillar numbers to occur earlier in the year and chicks can hatch after the period when caterpillars, their main food source, are most plentiful.

For more information please contact Dr Jack Shutt, Jack.Shutt@ed.ac.uk

Members' reports

University of Glasgow, Heriot-Watt University

Gannets learn to hunt by following their elders

Dr Ewan Wakefield from the University of Glasgow's Institute of Biodiversity, Animal Health and Comparative Medicine describes recent research findings on gannet behaviour

GANNETS, THE LARGEST seabirds in the North Atlantic, can travel hundreds of miles from their homes just to catch food for their chicks. However, with around a million square miles of ocean to choose from, it has always been a mystery how they decide where is best to search for fish.

New research led by the University of Glasgow and published in the *Journal of Avian Biology* offers fresh insights into why these iconic seabirds choose to hunt the way they do.

Scientists recorded thousands of gannets commuting to and from the Bass Rock, in the outer reaches of the Firth of Forth in Eastern Scotland. The Bass Rock houses the world's largest northern gannet colony, with an estimated 75,300 breeding pairs. The researchers were able to show that the more experienced adult birds were often found at the front of commuting flocks, with younger birds following behind.

The research offers a more detailed insight into how and why gannets search for food in the way they do.



With such a large expanse of ocean to choose from it has always been a mystery as to how they know where fish are most likely to be found.

By demonstrating that young gannets follow more experienced adults, the researchers have shown that knowledge about the best feeding grounds may be passed down from generation to generation. The team of

researchers modelled how frequently the gannets travelled in flocks, the sizes of those flocks and the positions of young and adult birds.

Many birds travel in flocks, including geese, swans and cranes. Birds do this for a number of reasons, including to reduce aerodynamic drag and therefore save energy. In addition, travelling in a group can improve hunting efficiency and navigational accuracy, and help avoid predators. The findings in this research demonstrate that travelling in flocks may also facilitate social learning. The ability to tap into this communal wisdom may also go some way to explaining why gannets and other seabirds breed in such huge colonies.

The work was funded by the UK Natural Environmental Research Council, the University of Glasgow and the German Academic Exchange Service.

For more information, please contact Dr Ewan Wakefield, Ewan.Wakefield@glasgow.ac.uk

PICTURE: IRISH WILDLIFE TRUST VIA WIKIMEDIA COMMONS

'Significant donation' to preserve historic Lyell work

Heriot-Watt University has contributed to the effort to keep an invaluable research resource in the UK

NOTEBOOKS BELONGING TO one of Charles Darwin's mentors are to be publicly accessible for the first time, following a successful fundraising campaign. A collection of work notebooks penned by the renowned geologist Charles Lyell has been secured through the National Heritage Memorial Fund, headed by the University of Edinburgh's Centre for Research Collections.

Supporters across the country, including Heriot-Watt University, have raised almost £1 million to purchase the unique works and ensure the public can enjoy them, the notebooks having previously been in private ownership.

Lyell's work has been credited with helping Charles Darwin's framework of evolutionary theory, as well as articulating the importance of 'deep' geological time when most thought the



A study by Lyell of chalk flint

age of the Earth was limited to a few thousand years. It also cited threats to biodiversity and climate change.

Professor John Underhill, the Chair of Exploration Geoscience in the School of Energy, Geoscience, Infrastructure and Society, helped secure the £10,000

that Heriot-Watt pledged to ensure they remained in the UK. He said: 'The notebooks are hugely important as a historical record of Lyell and Darwin's journey of scientific discovery. Charles Lyell was truly ahead of his time, beginning a discourse that is as relevant today as it was two centuries ago.'

In all, 294 notebooks were bought. The University of Edinburgh's Centre for Research Collections will work with Heriot-Watt and the Lyell Centre, a collaboration between Heriot-Watt and the British Geological Survey named to commemorate Sir Charles Lyell's link to the university. The aim is to create an 'ambitious access project' that will allow the material to be viewed in the coming months.

Please contact Prof John R Underhill, J.R.Underhill@hw.ac.uk

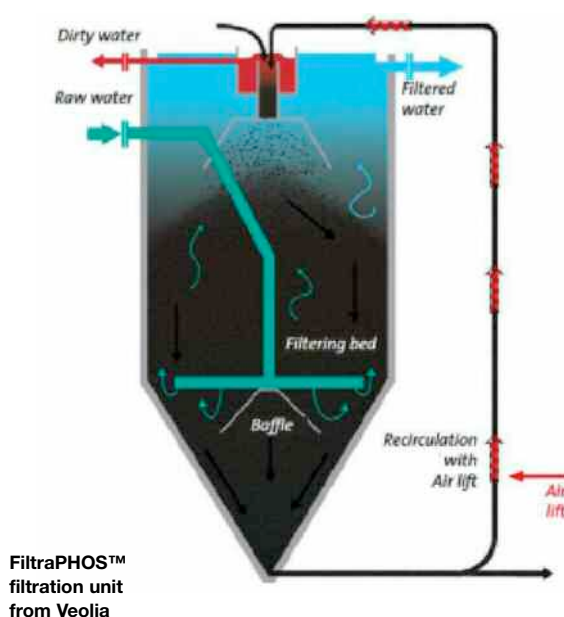
PICTURE: PROF JOHN R UNDERHILL

Filtering phosphorous from wastewater using natural waste materials to create fertiliser

Sabi Pap from the North Highland College UHI reports on a method for removing excess macroelements that can yield a very useful product

PHOSPHOROUS IS AN essential macroelement, but too much phosphate in aquatic ecosystems can lead to a deterioration in water quality and eutrophication. Phosphorous (P) removal and recovery from wastewater, through its adsorption onto natural waste material, may provide a beneficial solution. Ideally, this would be a low-cost solution that would create a P-rich material (low in other adsorbed contaminants) for direct use in agriculture as a fertiliser.

The Environmental Research Institute (ERI), as a partner in the EU Phos4You project, is now working on small-scale solutions for remote, rural areas and islands. In partnership with Veolia, we are testing a unit named FiltraPHOS™ for use on small discharges (such as septic tanks) to help reduce diffuse phosphorous pollution. FiltraPHOS™ employs



enhanced gravitational filtration through a granular medium with continuous self-backwashing. Local resources are used as the adsorption media.

After filtration, the adsorbent material containing the recovered P can hopefully be applied directly to the land in a granular-powder soil conditioner and fertiliser that is also rich in other beneficial components, such as CaCO₃.

A chitosan-calcium-rich adsorbent produced from crab carapace will be tested first. Carapace from the edible or brown crab (*Cancer pagurus*), a waste by-product from the seafood industry, is generated in millions of tonnes annually in Scotland and large quantities are simply discarded to landfill, so a feasible approach may be to turn this solid waste into a high-value-added agricultural product.

Another significant ERI contribution to this project will involve the quality assessment of the new fertiliser materials. This will ascertain if other, and in some instances, potentially undesirable organic/inorganic contaminants are also present in any new products. If this is the case, ERI will work to verify if crops could take up such contaminants,

For more information please contact: szabolcs.pap@uhi.ac.uk, mark.taggart@uhi.ac.uk or barbara.bremner@uhi.ac.uk

PICTURE: © VEOLIA

Mapping global biodiversity change

An international collaboration involving the University of St Andrews is clarifying a complicated picture

NEW INTERNATIONAL RESEARCH reveals different rates of biodiversity change across the globe. The research – led by scientists from St Andrews, the University of Edinburgh, the German Centre for Integrative Biodiversity Research (iDiv) and Martin Luther University Halle-Wittenberg – was published in *Science* and focused on mapping biodiversity change in marine and land environments.

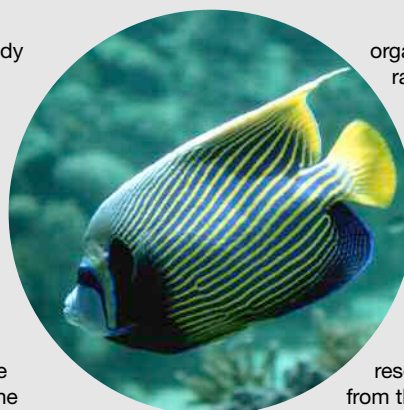
The findings reveal negative and positive changes in ecosystems across the world, and that changes in marine systems outpace those on land, with loss of biodiversity most prevalent in the tropics.

At the sDiv synthesis centre of Germany's iDiv, a group of researchers from leading universities across Europe, the USA and Canada aimed to reach a consensus about variation in

biodiversity change. The study reveals that on average the numbers of species that live in each place are not changing, but regions are gaining or losing species.

The international team of scientists examined longitudinal variation in species richness and composition by piecing together and mapping more than 50,000 biodiversity time series from studies across the planet using the biodiversity database BioTIME, hosted at the University of St Andrews. This established clear geographic variation in biodiversity change.

Scientists were then able to dissect variation in biodiversity trends to identify the places and the types of



The habitats worst hit are marine ones in the tropics

organisms changing most rapidly. Detecting geographic variation in biodiversity trends will not only improve understanding of how global biodiversity is changing, but also inform conservation priorities by identifying which regions to protect and which regions to help recover.

According to lead researcher Dr Maria Dornelas, from the School of Biology at the University of St Andrews, the study shows that while biodiversity is changing everywhere, we are not losing biodiversity everywhere; some places are recovering and adapting.

Please contact Dr Maria Dornelas, maadd@st-andrews.ac.uk

PICTURE: ROBERT KEERTON, CSIRO VIA WIKIMEDIA COMMONS

News from SCRR

SCRR Mini-Conference: November 13th 2019, An Lochran, Inverness

Rural science for public good: sharing our best ideas

ACROSS THE BREADTH of Scotland, there are many researchers examining different aspects of the 'rural' from multiple perspectives – geography, geology, sociology, ecology, animal health, anthropology = and from the very micro through to the macro.

In November 2019, SCRR held a Mini-Conference at An Lochran, Inverness entitled 'Rural science for public good: sharing our best ideas'.

We focused on early career researchers (ECRs). It was a poster-based mini-conference: the full list of posters appears below. Researchers had the opportunity to discuss their ideas with scientists in the research community of SCRR member organisations and with people from charities, private sector and development organisations, colleges and local government. The focus was

There were joint winning posters, by Rodney Lovie (below) and Celia Delugin (opposite page)

on networking as equals, sharing ideas and fostering new connections.

Professor Sarah Skerratt, scientific director of SCRR (and director of policy engagement at Scotland's Rural College) welcomed everyone to the conference and her passion for ensuring that research evidence impacts positively on policy and on people's livelihoods in rural areas was clearly demonstrated. She hoped all present shared her enthusiasm to find out more about the great rural research taking place across Scotland.

There was also a video-recorded interview between Sarah and Professor Jonathan Seckl, Chairman of the SCRR Board, in which Prof Seckl encouraged ECRs to take full advantage of the opportunities offered by the SCRR and be curious about all aspects of rural research.

In the competition for the best poster which was voted on by all the attendees there were joint winners, Celia Delugin and Rod Lovie, both from the University of the Highlands and Islands. Their posters are reproduced below. Celia Delugin also won the Scholar Award and was instrumental in working with the ECRs and co-organising the conference, along with extensive support from Catriona Clark of SRUC.

The video conversation between Prof Sarah Skerratt and Prof Jonathan Seckl is at vimeo.com/373156854

List of Presenters, with Poster Titles and Further Information

1. Alasdair Bachell (UHI Perth) –
The potential for the refurbishment of historic hydro sites in the Highlands & Islands region with a view to re-use such sites for hydro power generation for the benefit of local communities

2. Ailsa Clark (Inspire Alba) –
Social Enterprises in rural Scotland

3. Jonathan Hopkins (JHI) –
Place-based approached to rural development in Scotland

4. Rodney Lovie (UHI Perth) –
Using the A9 dualling between Perth and Inverness as a case study to:

A "Corporate Memory" of Place...

How is change influenced by landscape perceptions?

Introduction

Perceptions of landscape are an interaction between the individual and their place, community, and past. Therefore "any landscape is composed not only of what lies before our eyes but what lies within our heads" (Meinig 1979 p.34). The A9 dualling project between Perth and Inverness is the setting for research into how community perception of place and landscape can influence planned change.

The research aims to:

- Establish how community perceptions of landscape can be gathered and how these meanings react to future change;
- Determine how to improve the inclusion of community landscape perceptions in the statutory planning process.

Research Overview

The research was participative and started from the position that community perceptions of landscape are not wholly taken into consideration by the planning process.

Community groups and planning professionals were interviewed before a photo elicitation project was used to gather information on landscape meanings. A workshop based on the *Landscape and Visual Impact Assessment (LIVA)* process then explored how meanings and change interact. Finally, planning professionals explored how this could be integrated into the planning process.

Results

Correspondence analysis showed how transport elements were associated with *Past* meanings. This shows they contribute towards the creation of place from a historical or heritage perspective, rather than only from a modern or functional context.

Heatmaps of ascribed meanings showed how *Community* and *Negative* landscapes were clustered close together. This could help identify the locations where different types of landscape change could be more appropriate.

Land meanings were ranked of highest significance by the community, this could be to prevent any change.

Older respondents saw *Personal* meanings as internalised and so not susceptible to external change.

Conclusions

Although landscape perceptions are subjective, they contain collective elements which can be used to assist planning future change.

Planning professionals see as beneficial the inclusion of landscape perceptions, if underpinned by a valid and robust elicitation method. This information would benefit early development planning, such as *Local Place Plans*, which then strategically inform the later stages of development management.

However, the 'earlier is better' approach also has challenges. If communities need to provide their views on less tangible elements of landscape before any development is proposed, it may be difficult for them to determine possible impacts of landscape change.

Reference:
Meinig, D. W., 1979. The beholding eye. In: *Views of the same scene* ed. Meinig, D. W. 50-61. The Interpretation of Chelmsley Johnsons. New York: Oxford University Press.
Additional quotes from survey respondents.

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Twitter: [theAGuy](https://twitter.com/theAGuy)

(1) Establish how community perceptions of landscape can be ascertained and how these meanings would react to future change;
 (2) Determine how to improve the inclusion of these community landscape perceptions in the statutory planning process

5. Ellie MacLennan (SRUC) – The Scottish Entanglement Alliance (SEA, www.scottishentanglement.org) is a two-year EMFF-funded collaboration between six organisations dedicated to promoting and protecting Scotland’s wildlife, heritage and sustainable marine industries: Entanglement in fishing gear

6. Aaron Reeves (SRUC Inverness) – Gill health in Scottish farmed salmon: to identify actions and measures that can be used to prevent or reduce gill disease in farmed salmon

7. Rita Ribeiro (OuE & SRUC) – Improve the knowledge of tick and disease risk distribution in Scotland


8. Leonie Schulz (UHI Perth) – The future spatial conflicts between designated conservation areas and the outdoor tourism/recreation (OTR) industry in the Western part of the Cairngorms National Park

9. Kate Stephen (SRUC) – Motivations for and experiences of disease control on Scottish beef farms

10. Belinda Vigors (SRUC) – Livestock farmers’ perspectives of positive animal welfare and how their current husbandry practices relate to scientific perspectives of positive animal welfare

11. Ruth Wilson (JHI) – Islands Revival project: The purpose of this project was to collate and communicate evidence and practice from across the islands relating to green shoots of demographic recovery; to facilitate in-depth discourse about island repopulation; and to make recommendations as to how policy can best support such developments

12. Celia Delugin (UHI) – The project involves an integrated consideration of the potential for developing ecotourism in support of the conservation of the biological communities of Scotland’s freshwater lochs, with a focus on the fish biodiversity. The work focuses on three case studies of potential freshwater ecotourism destinations known for the uniqueness of their aquatic systems and biological




Celia Delugin | Celia.delugin.ic@uhi.ac.uk | [@celia_delugin](https://twitter.com/@celia_delugin)

University of the Highlands and Islands (UHI) Cairn Robin Lochs
Waters and Lochs Institute (University of the Highlands and Islands Business College)

INTRODUCTION AND AIM

Scotland’s >28,000 lochs play an important role in supporting traditional tourism. They provide critical habitats and support for freshwater biodiversity, but are experiencing declines in biodiversity which are often going unnoticed by the general public. Developing **freshwater-focused ecotourism** as a **conservation tool** can help to both raise biodiversity awareness, help conservation and deliver long-term, sustainable benefits to local communities. The project involves an integrated consideration of the potential for developing ecotourism based on the biological communities of Scotland’s lochs.


Focus on 3 case studies: Loch Ness (●), Loch Maree (●) and Loch Rannoch (●).



Methodology


Mixed methods approach with **quantitative** and **qualitative** data collection.

- Exploration of what is known and unknown about freshwater biodiversity in Scottish lochs
- Defining the scope and approaches that might be taken in Scotland to freshwater biodiversity capital.
- Engagement with stakeholders to explore the existing ecotourism sector and how it might be encouraged to encompass freshwater biodiversity.



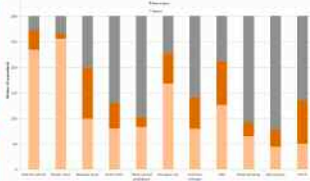
PRELIMINARY RESULTS – Visitor survey

- Visitors associate ecotourism with the **natural** aspect (nature, environment, wildlife). Only a small number mention the **social** and **economical** aspect (Fig.1).
- Most visitors engage in **fast tourism** (day visit onsite, travel by car or coach tours). More visitors engage in **slow tourism** at Loch Rannoch.
- Engagement in activities with different levels of immersion: sightseeing/walking, boating, swimming, diving. Most visitors have a low level of immersion (Fig.2).
- Low interest for fish and invertebrates compared to mammals and birds viewed as more charismatic (Fig.3).



Knowledge and connection with freshwater fish in Scotland:

- No statistical differences in knowledge between the 3 case study areas.
- Gap of knowledge for native species (e.g. Arctic charr, sticklebacks, brook and sea lampreys) and misconception for non-native species (e.g.: rainbow trout and pike).
- Atlantic salmon and brown trout are the most known native species (Fig.4).



CONCLUSION

In all case study areas, nature, scenery and landscape is a very important aspect of tourism visits. However, this attraction seem to stay “above the surface”; there is low interest and a lack of knowledge of freshwater fish (interest and knowledge higher for visitors engaging in fishing) and a lack of connection with “hidden” and non-charismatic biodiversity. In order to overcome this, visitors have expressed their interest in diverse activities, and suggestions are very contrasting between the three case study areas, due to the different context in which each loch is set.

Next steps of the research project include data analysis of the interviews (with tourism and conservation bodies) and data collection for the focus groups (with representatives of the local communities).

References

- The International Ecotourism Society (2015) [online]. Available from <http://www.ecotourism.org>
- Kriger, O. 2005. The role of ecotourism in conservation: panacea or Pandora’s box? *Biodiversity & Conservation*, 14:3.

diversity: Loch Ness, Loch Maree and Loch Rannoch

13. Ejaz Hussain (UoE) – In order to increase crop yield in understorey crops or in a intercropping system, we need to dissect a better understanding of how plants adjust their developmental program in responses to environmental cues, including light, which has a particularly prominent role

14. Ashleigh Weeden (SRUC) – If innovation agendas fail to account for diverse notions of rurality and the

full spectrum of what happens in rural places, they will fail to address broader issues in rural community development and fail to leverage place-based assets that are critical to rural community development. This doctoral research will produce a comparative case study investigation into the complex relationships at play in place-based rural innovation systems.

15. Sue Rawcliffe (Inspire Alba) – Rural Social Enterprise Hub: What are the key drivers that nurture and support flourishing rural social enterprises?

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SCRR member organisations

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Scottish Association for Marine Science, Oban.	www.sams.ac.uk
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Events

www.scrr.ac.uk/events

Challenging Upland Futures

Perth Theatre, 1-2 September 2020

Aim: To integrate knowledge and understanding on the uplands of Scotland, and to agree priority actions to help ensure that our uplands deliver the widest possible range of benefits. Participants: the wide diversity of stakeholders living in, and concerned with, the uplands of Scotland.

For more information contact Professor Martin Price, Martin.Price.perth@uhi.ac.uk

Please see our website for more events.

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