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Scottish Government
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Spotlight
on Strategic Research 2020-21

The Scottish Government's Strategic Research Programme for environment, land use, agriculture, food and rural communities (SRP) is delivered by the Scottish Environment, Food and Agriculture Research Institutes (SEFARI). The SRP is the mid to long-term research component of the Scottish Government's Strategic Research Portfolio. In addition to the SRP, the Portfolio includes the underpinning of SEFARI national capability resources and, in partnership between SEFARI, Scottish Universities and Agencies, the policy facing Centres of Expertise.

This report provides selected highlights from research and Knowledge Exchange (KE) during 2020-21, which reflect the strengths and benefits of long-term strategic funding from the Scottish Government. The SRP is delivering integrated, interdisciplinary research that creates significant innovation and practice change, while also underpinning expertise to support advice for policy and practice. Central to this is SEFARI's enduring relationships with policy, agency, business and civic society across Scotland, UK and globally. SEFARI Gateway is the Centre for Knowledge Exchange and Innovation for the Portfolio. Gateway works to enhance access to, and extend the reach of the individual, and interdisciplinary expertise and innovation from this publicly funded research as enshrined under the ethos of delivering "leading ideas for better lives".

SEFARI is recognised across Scotland's policy, business, enterprise and public landscape for authoritative, evidence led, and independent research for the environment, food, agriculture, land sectors and rural communities. SEFARI, through the Strategic Research Portfolio and its wider research as underpinned by the Portfolio, supports policy priorities and delivers innovation and practice change contributing to Scotland's National Outcomes and the United Nations Sustainable Development Goals (SDGs).

SEFARI

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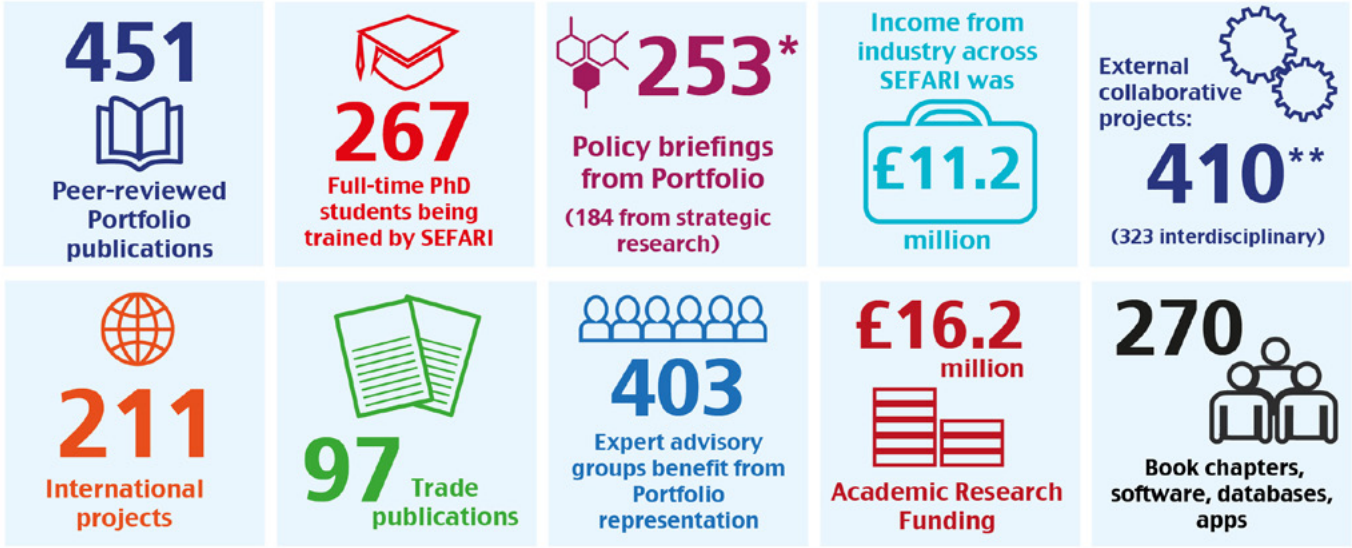
A year in numbers: new findings, innovations, leverage, advice, training and partnerships



* Outputs from across the Strategic Research Portfolio as fully funded or underpinned by strategic funding

** Collaborative projects that involve SRP related research with non-Portfolio organisations

UN Climate Change Conference-COP26

The work outlined in this report has been achieved within a world still dominated by COVID-19 which has seen the core resources and expertise within SEFARI assisting in Scotland's pandemic response and recovery. However, the UN Climate Change Conference of the Parties (COP26) has provided a crucial global reminder and a heightened emphasis to the present, intense damage and future threats of the climate and nature crises. There is an urgent need to accelerate climate action at pace and scale. SEFARI research and KE is responding to this need, delivering extensive engagement with national and international communities before, during and after COP26 to inform research and forge partnerships for delivering climate action.

Engagement with rural and island communities on their needs for a Just Transition to net zero as part of Scottish Government's COP26 programme

Working with the True Animal Protein Price Coalition as part of the EU COP26 Programme, on the dichotomy of local versus global effectiveness of carbon pricing in agriculture's route to net zero

Showcasing SEFARI innovation in environmental, agriculture, land use and food research as part of a UK Department for International Trade presentation on innovation for global climate action at the UK COP26 Presidency Pavilion

Working with the Centres of Expertise to define strategies and best practice in addressing the climate emergency in Scotland

Engaging indigenous communities on climate action needs

Demonstrating sustainable innovation for Scotland's Food and Drink Sector during COP26

Working with the EU SHERPA project at the COP26 Green Zone on the role of agriculture, rural communities and social innovation for a Just Transition to climate neutrality

The TB Macaulay Lecture explored the pace and scale for global climate action and the impact of climate emergency on youth, gender and equality

New online platforms to engage the public with SEFARI's climate research

Working with the Plant Health Centre and Centre of Expertise for Animal Disease Outbreaks highlighting the threat of vector borne diseases for animal, plant and human health in the face of climate change

Supporting international engagement on peatlands research at COP26

Working with the Centre of Expertise on Climate Change to engage early career researchers and students on best practice for knowledge exchange in climate-policy

Knowledge Exchange for Sustainable Development Goals

The impact of strategic research is amplified through Gateway's bespoke knowledge partnerships.

Just Transition for Net Zero

Facilitated land user engagement and undertook an analysis of international just transitions that directly informed Scotland's Just Transition Commission Final Report and recommendations.

Nature-based Solutions

Working with Nature Scot, assessed Nature Based Solutions (NBS) Frameworks, leading to recommendations on approach to NBS planning and evaluation, supported by a road map to assist end users (e.g. land managers, local authorities) in the application of NBS in Scotland.

Livestock Health and Greenhouse Gas (GHG) Reduction

A newly convened multi-sector, industry advisory group to support livestock farming in reduction of GHG emissions through combating the burden of endemic disease.

Woodland Creation Strategy

A new SEFARI report and workshop series with Loch Lomond and Trossachs National Park Authority has identified drivers for land manager decision-making and opportunities for addressing constraints to woodland creation.

Food Innovation Clusters

A SEFARI report developed in response to the Scottish Government's Arctic Policy Framework has assessed regional food innovation clustering strategies and opportunities for economic resilience with Scotland's remote and rural communities. The work provided an opportunity to learn from best practice e.g. for growing regional trade and inter-community cooperation.

Regional Approaches to Net Zero in Agriculture, Food and Drink

In collaboration with Opportunity North East, a KE-Fellowship has been established to identify the gap between the current carbon footprint of the North East food and drink sector versus the target footprint required to meet national targets and identifying solutions towards achieving Net Zero.

Advice on Data Use for Enhancing Land Based Policy and Decision Making

Provided insight and analysis to Scottish Government on how spatial data can inform and support policy for land use and agriculture.

Supporting Environmental Standards Scotland

Provision of advice on developing an approach to monitoring environmental standards compliance with, and effectiveness of, environmental law in Scotland.

New Opportunities from Agricultural By-Products

Identification of opportunities for by- and co-product use from agricultural production within North East Scotland as part of the bio-circular economy.

Agritech, Animal Health and Aquaculture

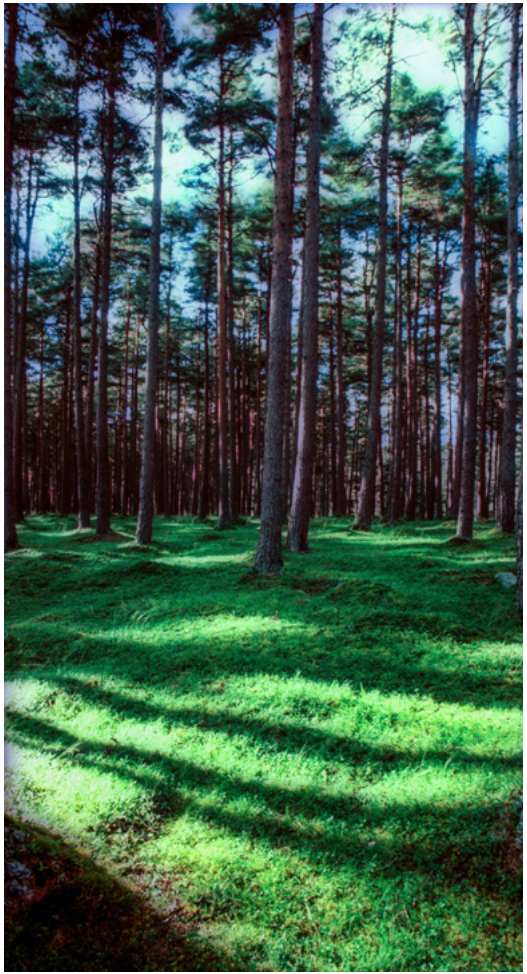
Provision of a combined inventory of Scotland's innovative Agritech, Animal Health and Aquaculture capacity to support national and international science and business collaboration for this sector.

Land Acquisition for Carbon-the Risks and Opportunities

A SEFARI multi-stakeholder specialist advisory group is developing evidence led recommendations on the opportunities and risks from large-scale land acquisition for carbon sequestration.

SEFARI Virtual Farms Tour Online

A new online platform is engaging the public, farmers and land managers providing access to strategic research conducted through SEFARI farms. The SEFARI farms represent one of SEFARI's national capabilities as supported by Scottish Government underpinning capacity funding.



SEFARI Climate Action Online

A new online platform is engaging the public with progress on SEFARI's Scotland-wide climate research.

New School Resources

SEFARI's online educational resources are continually expanded by strategic research findings to incorporate new opportunities for learning both in and out of school.

Sustainable Transport on Route to Net Zero

A new KE Fellowship with Loch Lomond & Trossachs National Park Authority is assessing engagement strategies for improving sustainable transport within the National Park.

Community Just Transitions

Continuing online engagement with rural and island communities following the SEFARI rural communities Just Transitions debate at COP26.

Scientific Excellence

The Strategic Research Programme is shaping national and international research perspectives.

The UK Food System and Implications of COVID-19

SEFARI researchers, with collaborators at Cranfield University and Chatham House, provided crucial fore-sighting for UK food and nutrition security. This was framed by the cascading risks from the COVID-19 pandemic and from the persistent major challenges from the climate emergency and biodiversity crisis.

Mapping Net Carbon Storage from Woodland Expansion

Using unique data sets for climate, soil and land use; SEFARI researchers mapped above and below ground carbon storage for eleven Forestry Management Alternatives for new woodlands on all non-forested land in Scotland. This revealed that area-based targets can underplay the climate benefits of new woodlands, raising implications for woodland creation policy and climate change mitigation strategies.

Climate Change and Mountain Hare Camouflage

SEFARI scientists, in collaboration with colleagues in the USA, found little evidence of change (over 60 years) in the seasonal coat colour of mountain hares to align with shorter snow seasons, thereby creating a mismatch in their seasonal camouflage. The results reveal significant implications for wildlife adaptation in the face of man-made climate change.

Guiding Forest Planning Under Climate Change

SEFARI scientists modelled conditions under which forest expansion and management can create micro-climates that support the diversity of globally-rare Scottish rainforest and offset the negative effects of increasing summer dryness projected through to the 2080s. The research identified an urgent need for targeted spatial planning of reforestation to reduce threats to species from climate change.

Managing Land and Water for Multiple Benefits

A review by SEFARI explains how targeted management on the placement, physical properties, and vegetation of land adjacent to water courses and between farmed land (riparian buffer strips) can be improved to deliver multiple benefits to mitigate against the effects of climate change, provide an improved habitat for biodiversity, and create natural flood management.

Further Evidence of Health Benefit from Soft Fruits

SEFARI research has demonstrated how specific components of soft fruit inhibit a protein which regulates insulin signalling, identifying a potential for soft fruit extracts to be used in the management of type 2 diabetes.

Consumer Views on Food Attributes and Labels

SEFARI research has identified a public willingness to pay premiums for certain combinations of food attributes e.g. in the UK demand for beef mince with low fat content when also labelled as organic or having low greenhouse gas emissions. The work makes a significant contribution to understanding how beneficial climate or health behaviours might be influenced by labelling.

Advances in Nutrient Reformulation and Impacts on Health

SEFARI researchers, in seeking to enhance the nutritional health properties of yoghurt, have been able to encapsulate vitamin E in yoghurt-based beverage emulsions - a process suitable for adoption by the dairy industry.

Policy and Practice

The Strategic Research Programme provides research to support key areas of policy and practice across the Scottish Government and its agencies.

Diagnosing COVID-19

The expertise of SEFARI scientists, and the infrastructure supported by Scottish Government Underpinning Capacity funding of SEFARI national capabilities, provided support to the NHS in Scotland in their COVID-19 testing programme for SARS-CoV-2 and to pilot a study looking at pooling of test samples to increase efficiency of testing regimes. The latter was based on experience gathered from strategic research conducted for the Scottish Bovine Viral Diarrhoea Virus (BVDV) eradication campaign.

Hills, Uplands and Crofting

SEFARI has contributed expertise to the Scottish Government Hill, Upland and Crofting Group, with recommendations for reducing greenhouse gas emissions, enhancing biodiversity, whilst continuing to produce high quality food.

Arable Climate Change Group

SEFARI contributed to the Scottish Government Arable Climate Change Group, and its recommendations on the roles that Scotland's arable sector can play in contributing to long-term climate change mitigation and transition to Net Zero.

Suckler Beef Climate Group

SEFARI researchers informed the reporting by the Scottish Government formed Suckler Beef Climate Group Programme Board on the structure and efficiency of the Scottish beef herd, accreditation and advisory support, and support payments.

Advice to Scottish Land Commission on Regional Land Use Partnerships

Work from across the SRP on land management, land use and environmental governance was used to provide the Scottish Land Commission with an evidence base for their advice to Scottish Government Ministers on rolling-out Regional Land Use Partnerships. The resulting report was welcomed as an important contribution to the subsequent report to Ministers, providing a strong evidence base for the proposals, and highlighted previously unconsidered issues and pitfalls to avoid.

Peatlands and Payments

From newly derived geospatial data on land use, land ownership, and peatlands using the classifications developed for the UK Greenhouse Gas Inventory, SEFARI expertise has provided Scottish Government with insights into different types of degraded peatland and emissions in relation to agricultural practices and agricultural support payments. The findings informed options for the Scottish Government Climate Change Plan Update.

National Islands Plan

SEFARI researchers prepared the summary of the Scottish Government's National Islands Plan. An additional visual summary of the results is now available as well as an online results explorer. Islands groups that were developed by researchers during the survey are now being engaged by the Scottish Government (e.g. in the consultation on an Islands Bond) and are also being used by the National Registry of Scotland's small area population estimations.

Innovation and Improved Practices for Sustainable Economic Development

A major goal of the Strategic Research Programme is to develop new practices and bring forward innovation that supports sustainable and inclusive economic growth.

Borderlands Inclusive Growth Deal Dairy Nexus

The Borderlands partnership announced investment of up to £8 million into a new Centre of Dairy Innovation at a SEFARI campus. It will draw on SEFARI organisation pedigree in teaching, research and consultancy to support dairy industry skills and careers, encourage KE and create innovative research across the Borderlands region. The work will accelerate research and technology to be applied within dairies and the supply chain. The Nexus will support innovation to de-carbonise the dairy sector and move it towards a circular bio-economy and support significant and inclusive regional growth to underpin rural communities.

Precision Farming of Sheep

Precision Livestock Farming (PLF) can improve efficiency and productivity on-farm and provide early warnings of problems. Uptake in the sheep sector has been slow compared to in the beef and pig sectors. Building on sustained strategic research PLF practices have now been tested on a commercial Quality Meat Scotland monitor farm. Findings reveal a c. 40% reduction in wormer use in sheep flocks, saving money for the farmer and slowing development of resistance to chemical drenches and reliance on chemicals for parasite control, without inducing penalties on animal growth.

Alternative Cropping Systems for Sustainability

Working with Arbikie distillery, and Abertay University, researchers from SEFARI studied ways to use pulses in its supply chain. Arbikie currently has a 15% legume cover on its farm, compared with a national average of 1%, and their climate positive products, with a reduced carbon requirement throughout the life of production on farm, is a world first. This collaboration showcases the importance of adapting the whole farm system and the development of products in tandem.

Delivering Better Barley

As part of an international collaboration, SEFARI identified natural genetic variation that allows barley plants to accumulate high concentrations of sodium without any adverse impacts on plant growth. This finding will significantly advance the development of new varieties for improved yield and resilience. The genetic basis of barley malting quality has also been studied using new approaches that are providing a detailed understanding for genetic improvements in malting quality to support the economically important brewing and distilling industries.

Flood Embankment Lowering and Natural Recovery Helps Restore Natural Connections

A 70m long flood embankment on the upper River Dee in Aberdeenshire was lowered in 2015 to restore habitat and floodplain connectivity. Two years of pre- and three years of post-restoration monitoring by SEFARI have provided evidence that improved river to floodplain connectivity can result from targeted flood embankment lowering and letting the 'river do the work'. Such approaches can improve catchment resilience, and that of land-based businesses to climate change by improving water storage and hence reducing downstream flooding.

Training Local Communities on the Use of Digital Storytelling

SEFARI researchers delivered a week long training programme on digital storytelling to staff and apprentices of Creating Natural Connections, a project of the Cumbernauld Living Landscape partnership involving Scottish Wildlife Trust, North Lanarkshire Council, Sanctuary Scotland and Conservation Volunteers. The training programme enables more participatory, creative methods of evaluating project outcomes through the creation of personal digital stories of change.

Scientific Resilience and Collaboration

Research quality and capability within SEFARI as underpinned by strategic research, attracts extensive national and international collaborations which are supported through competitively won funding, including from UK Research & Innovation and EU Horizon 2020. These add significant value to Scottish Government investment and further the international reputation of Scotland.

Atmospheric Research Observatory Tower

A capital grant of £1m from NERC has been won to construct and run an atmospheric research observatory tower. The new facility, in collaboration with the University of Edinburgh, will facilitate the measurement of greenhouse gas composition, enabling the modelling of changes in carbon sources and sinks in Scotland for supporting response to the climate emergency. The facility will also be used as a teaching resource.

Controlled Environment Agriculture (CEA) Vertical Farming (VF)

Innovate UK awards worth £1.57M have been won for developing CEA and VF, including in hydroponic systems, to improve crop production through utilisation of captured carbon (Hydrobubbles; £0.25M); in development of plant varieties best suited for "high health" CEA/VF (CHOPS; £0.82M), and for control architectures for CEA/VF systems and extending their use to new areas, such as micro-algae and insect protein production (PROLEAFS; £0.5M).

Microbiome Modulating Therapeutics

SEFARI's international expertise in microbiome research has secured a grant of £316K from Innovate UK for a translational project supporting product development within the microbiome therapeutic company, EnteroBiotix.

Eco-friendly Solutions for the Integrated Management of Late and Early Blight of Potatoes

A grant was awarded (ECOSOL; €800k) from the EU ERA-NET Co-fund on Sustainable Crop Production, with an aim to identify effective alternatives to conventional pesticides, and to integrate these, with other measures, into practical and effective integrated pest management strategies for late and early blight of potato.

Partnership Through European Union Research Funding

Extensive collaborations have been built from the EU Horizon 2020 Programme and including collaboration with 21 partners investigating policy frameworks to boost resilience and sustainability of mountain areas in the face of climate change (MOVING; €393k).

Delivering SEFARI Expertise Via Global Challenges Research Funding

Reflecting the strength of SEFARI's trans-disciplinarity, funding has continued to be secured for initiatives under the Global Challenges fund. These include (ZIRON Pulse; £1.01M) on the up-scaling the adoption and exploitation of a wide diversity of iron and zinc-rich beans by rural populations in Africa. The project develops new varieties of common bean with high levels of iron and zinc, in collaboration with Kenyan academics, growers, processors and consumers, thereby addressing micro-nutrient deficiencies in rural communities.

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View the full range of Strategic Research progress here