

Highlights of Scottish Government's Strategic Research Programme 2011-16



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Introduction

The environment, food and rural economy research showcased in this Report was carried out as part of the Scottish Government's 2011-16 Strategic Research Programme (SRP). The aim of the programme is to build a platform of knowledge to strengthen Scottish Government policy and help answer some of the big issues on the policy agenda such as climate change, land use and food security. The Scottish Government has a long tradition of supporting research in these areas, and I am pleased to note that the examples highlighted in this Report focus on where our investment has made a difference to policy, industry and Scottish citizens.

To achieve maximum impact it is vital that we get the research findings to people who can use them. I strongly support creating further value and opportunity from the programme by sharing this knowledge in ways that resonate with audiences across Scotland. This will ensure that findings can be deployed where they will make the most difference. I therefore welcome that future outputs of Scottish Government investment in this area will be supported by a new Knowledge Exchange initiative, [SEFARI](#) – the Scottish Environment, Food and Agriculture Research Institutes – whose remit is to improve the flow of research findings and expertise. In my role as Cabinet Secretary for Environment, Climate Change and Land Reform I understand how important it is to take a holistic view of complex issues. SEFARI will interpret the numerous connections, constraints and opportunities of the research carried out in the SRP, enabling research findings to be fully utilised by Scottish Government policy teams, industry and the Scottish public. I wish SEFARI every success.

Roseanna Cunningham

Cabinet Secretary for Environment, Climate Change and Land Reform





Introduction

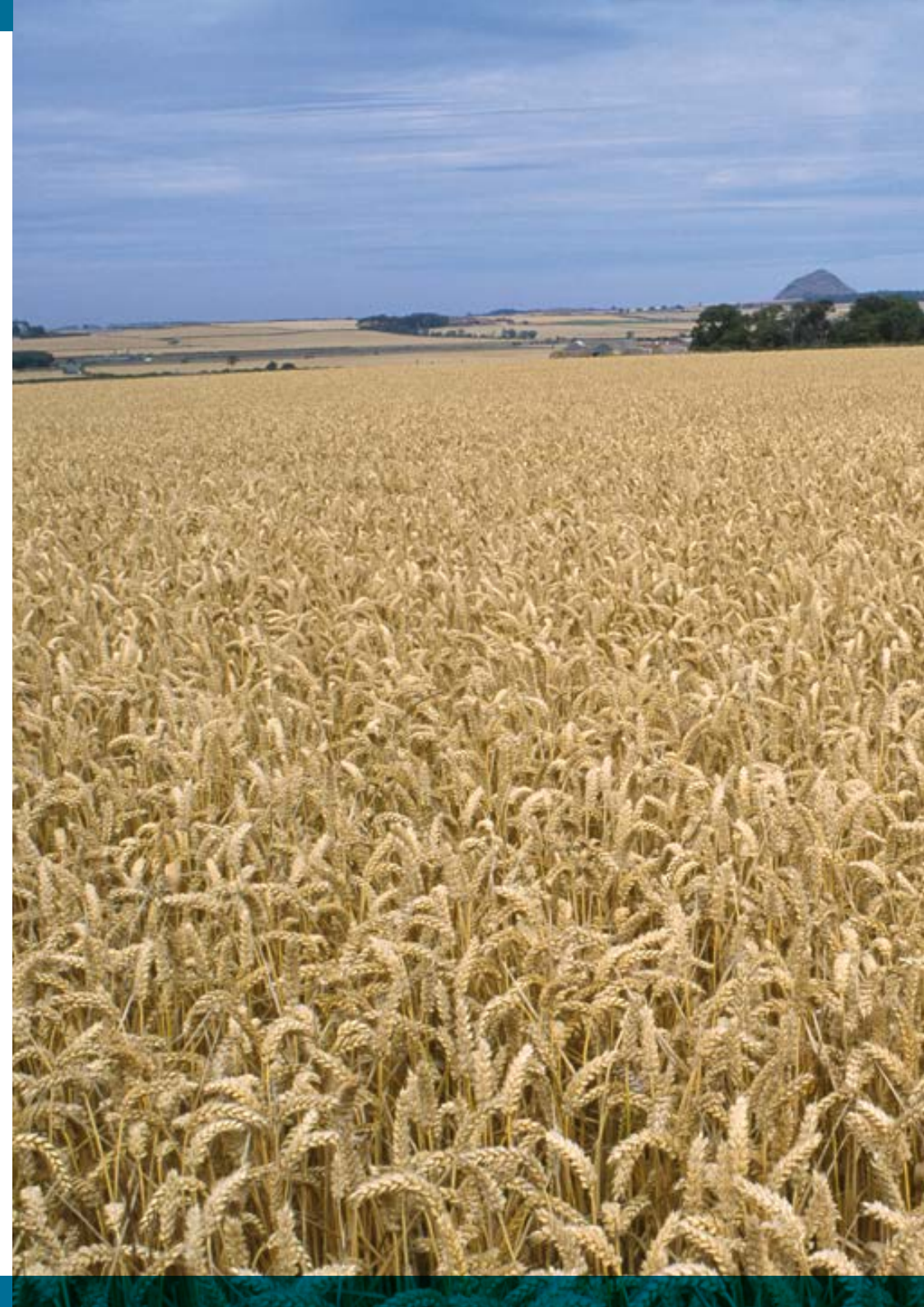


The Scottish Government has provided long-term support to land-based science and has a strong focus on using this scientific evidence to support policy. It has contributed towards valuable research platforms, a world-class skills base and critical long-term data, all available to inform policy decisions. The research in this report highlights outcomes as diverse as: reducing the impact of flooding, new approaches to reduce the Greenhouse Gas (GHG) emissions of peatlands, novel methods to monitor Scottish biodiversity, improved breeding of crops and livestock, improved management and control of crop and livestock diseases, and reducing the fat, sugar and salt content of foods. The range and impact of this investment was increased through successful leveraging of funding from a range of other UK and EU funders, and collaborations with research institutes in countries as diverse as China and Malawi.

The programme is truly interdisciplinary in nature, with numerous links between animal and crop sciences, environment, food and drink, and rural communities research. The investment in this science underpins the development and delivery of Scotland's Economic Strategy, and its four I's of investing, innovation, inclusive growth and internationalisation. It also contributes towards Scottish Government's national outcomes such as: reducing our local and global environmental impact; living longer, healthier lives; having strong, resilient and supportive communities; valuing our built and natural environment; and protecting and enhancing the environment for future generations.

Professor Louise Heathwaite

Chief Scientific Adviser Rural Affairs, Food and the Environment





Overview of Strategic Research Programme

The Scottish Government is an important, and long standing, funder of science in the areas of rural affairs, environment and food. From 2011-16 a significant five-year SRP was funded through the Rural and Environment Science and Analytical Services division (RESAS). More than £50 million was invested each year to support a broad suite of research. This report covers a selection of the key achievements that were realised throughout the 2011-16 SRP.

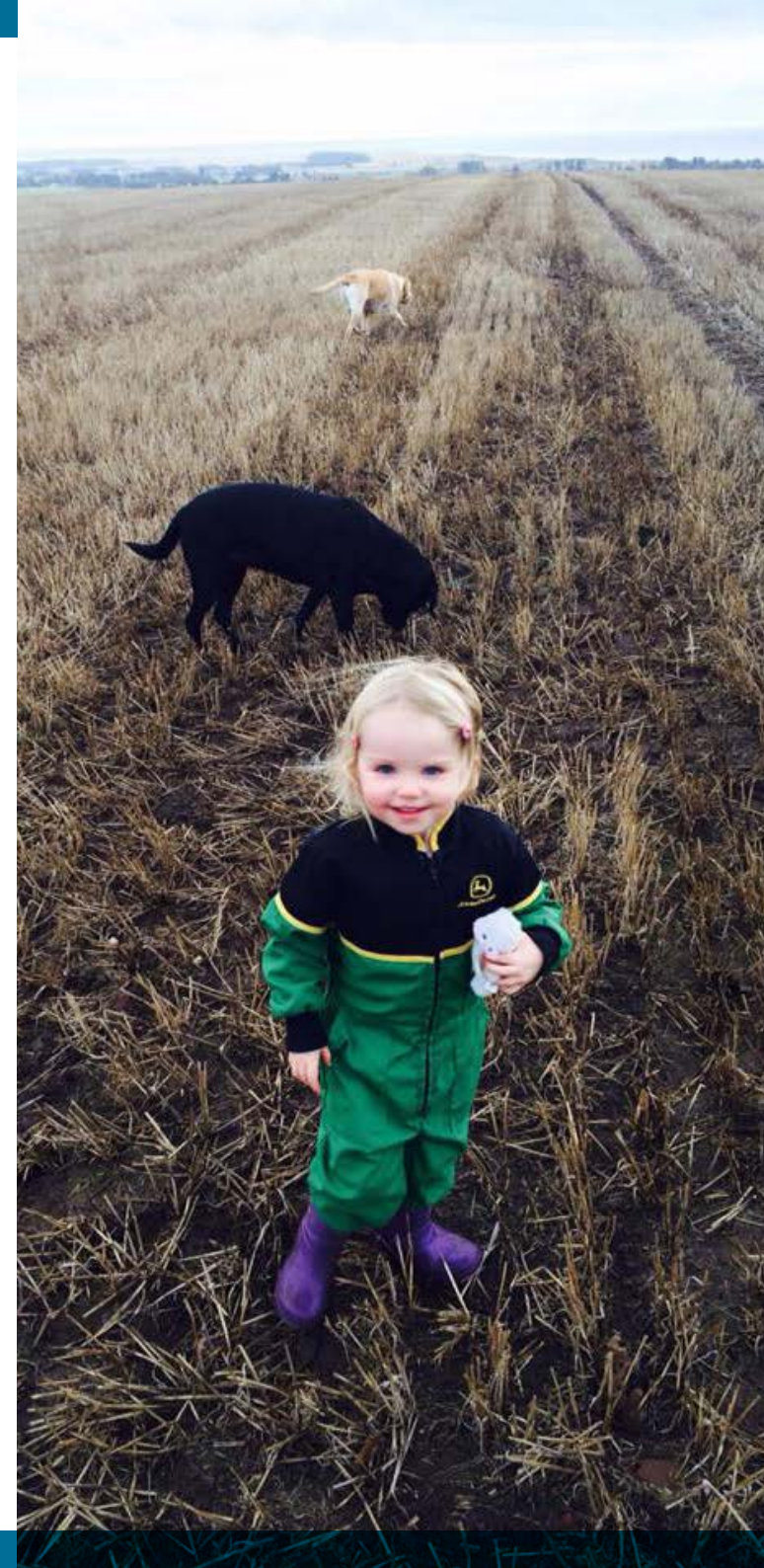
Objectives of Strategic Research Programme

The Scottish Government's continuing investment in environment, rural affairs and food research provides a foundation for the sustainable use of our natural resources, the productivity and profitability of our agricultural sector and rural businesses, the prevention and effective management and control of animal and plant diseases, and our ability to respond effectively to global challenges such as food security and climate change. The funding also helps maintain Scottish-based scientific capability of international standing and the associated infrastructure.

The strategic research supported working towards the following priorities:

- developing the rural economy;
- supporting agriculture to deliver public benefits;
- building up a world-class food and drink industry;
- empowering rural communities;
- making best use of Scotland's natural assets; and
- tackling climate change.

SRP research addresses current and emerging challenges to meet short- and medium-term policy needs. This funding can also establish and support longer-term strategic research to understand change over time and enhance resilience to future threats. We also strive to enhance productivity and economic growth, maintain critical infrastructure and research assets, while developing future research capacity and capability.





Strategic Priorities

The research contributes to the development and delivery of rural affairs, food and environmental policy and the achievement of the Scottish Government's single purpose of 'Sustainable Economic Development' as set out in the [National Performance Framework](#) and [Scotland's Economic Strategy](#).

Scotland's Economic Strategy focuses on the two mutually supportive goals of increasing competitiveness and tackling inequality, with four priorities in which the Scottish Government's actions can make a substantial difference:

Investing, Innovation, Inclusive Growth and Internationalisation. Examples of where the SRP contributes to these four priorities are:

- Investing in research that provides Scotland with the skills and knowledge that it needs to grow in a global economy.
- Taking a leading role in developing a national strategy for rural and environmental research.
- Helping to create a more equal society by widening access to the knowledge created by our investment in research across Scotland.
- Supporting the development of international connections and collaborations that promote Scotland.

Research also supports a Greener, Smarter and Wealthier Scotland, and contributes toward the achievement of a number of national outcomes, including:

- We value and enjoy our built and natural environment and protect it and enhance it for future generations.
- We reduce the local and global environmental impact of our consumption and production.
- We are better educated, more skilled and more successful, renowned for our research and innovation.



Rural Affairs, Food and Environment Research in Context

Rural affairs, food and environment are vital areas for Scotland, with related policies and activities affecting many aspects of life across Scotland, for example:

- Rural Scotland extends over 95% of the land area of Scotland and is home to 18% of the Scottish population.
- Between 2014 and 2020, £1.2 billion will be invested in farming, forestry, crofting and rural development through Scotland's Rural Development Programme.
- Scotland has a diverse and distinctive range of landscapes that are a significant part of the country's natural and cultural heritage, and which make an important and positive contribution to the economic, cultural and social wellbeing of the nation.
- Food and drink is Scotland's fastest growing industry, with food and drink exports valued at £5.5 billion in 2016.
- Scottish Government policies are leading in both local and global efforts to tackle climate change, and by moving towards a circular economy, encouraging waste to be viewed as a resource, rather than a problem.



Main Research Providers

The majority of the Strategic Research Programme (SRP) is primarily carried out by six Research Institutes. These are:

- **James Hutton Institute** (Hutton): carries out research associated with crops, soils, land use, people and the environment. The research aims to make major contributions to the understanding of key global issues, such as food, energy and environmental security.
- **Scotland's Rural College** (SRUC): supports land-based industries and communities with research focusing on sustainable agriculture, animal health and welfare, food chains, economics and the environment.
- **Moredun Research Institute** (MRI): investigates livestock diseases, including the development of diagnostic tests and vaccines. Scientists work with farmers and vets to improve animal health and wellbeing and to support sustainable agriculture.
- **Rowett Institute** (RI): carries out research into how nutrition can prevent disease, improve human and animal health, and enhance the quality of food production.
- **Biomathematics and Statistics Scotland** (BioSS): undertakes the development and application of mathematical and statistical methods in

agricultural, environmental, food and health research. It is hosted by The James Hutton Institute for the benefit of all the institutes which receive SRP funding.

- **The Royal Botanic Garden Edinburgh** (RBGE): carries out research in international, UK and Scottish plant systematics and conservation.

In addition to funding applied and strategic research at these institutes, the SRP funds the maintenance of critical infrastructure and research assets including facilities, collections and databases. Some of this 'underpinning capacity' funding is highlighted on pages 20-23.

During 2011-16 three policy-facing **Centres of Expertise** (CoEs) were funded, covering climate change, animal disease and water, and two industry-facing **Strategic Partnerships** (SPs) focussed on animal science and food and drink.

The key achievements of the CoEs and SPs are explored in pages 29-36.

Approximately **450 Full Time Equivalent (FTE) staff** were employed each year in the SRP. This includes staff in the research institutes and at universities, and is composed of natural scientists, social scientists, economists, and technical and support staff.



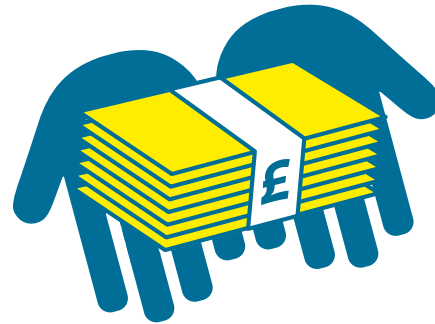


Leverage

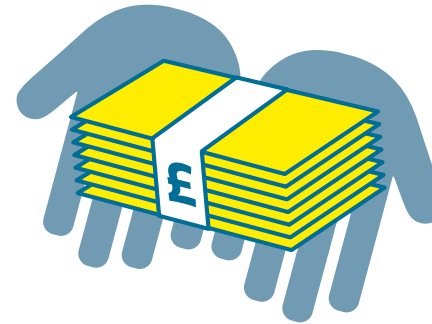
For every £1 the Scottish Government has provided, the SRP leveraged in 60p from external sources, including Research Councils, Levy Boards and industrial collaborations. Between 2011-16 the funding received by programme researchers from Research Councils has more than doubled from £2.1 million to £5.2 million.

When public sources of funding are removed the SRP leveraged £13.3m in 2015-16 from private sources, or roughly 27p for every £1. This compares well to UK science as a whole, where for every £1 of public investment in research 29p of private funding of Higher Education Institutions (HEI) research is leveraged¹.

Scottish Government



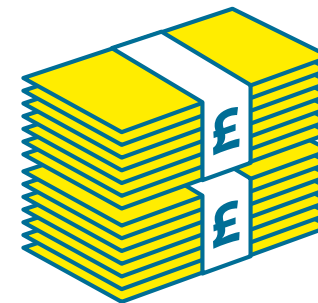
external sources



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¹ ECONOMIC INSIGHT. (2015) What is the relationship between public and private investment in science, research and innovation? A report commissioned by BIS. [Online] Available from: www.gov.uk/government/uploads/system/uploads/attachment_data/file/438763/bis-15-340-relationship-between-public-and-private-investment-in-R-D.pdf



Ecosystem Services

Scotland supports a wide array of habitats and species and it is estimated that 90,000 species occur in Scotland's land and sea. Scotland's biodiversity, together with its geodiversity (the variety of rocks, soils and landforms), provide essential functions – the 'ecosystem services' that provide essential resources for human society. These largely unseen processes make the world habitable and productive, for example, soil formation, nutrient cycling, climate and disease regulation, carbon cycling, pollination, flood regulation and water purification. Ecosystem Services research focussed on the identification, quantification and valuation of Scotland's environmental assets (our natural capital), biodiversity and ecosystem services.





Ecosystem Services

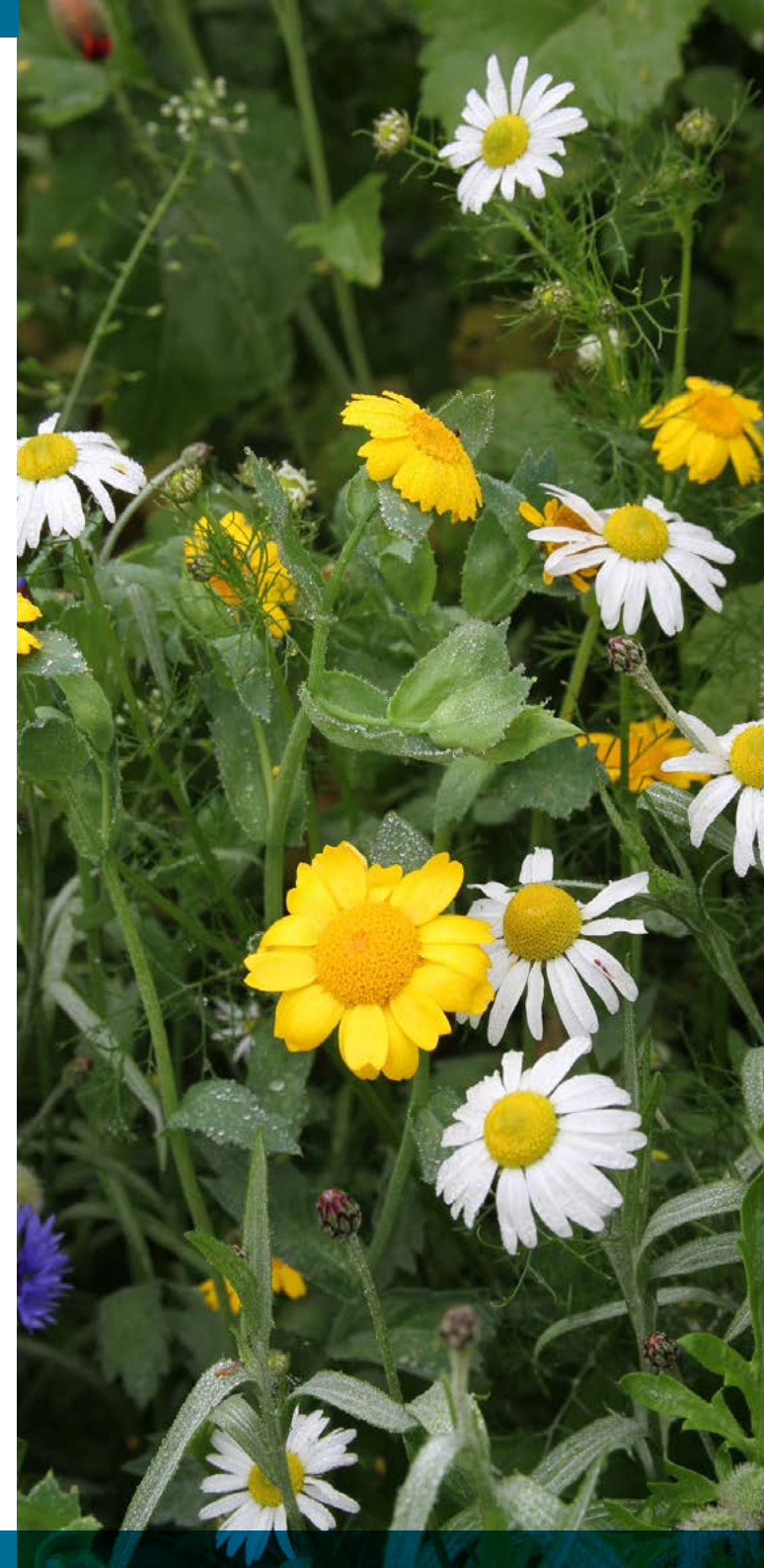
Developing the Science of Ecosystems Services

An Ecosystems Approach is a set of principles that can be applied to any plan or decision that may positively or negatively affect the environment, whether directly or indirectly. It is about making sure that we recognise and sustain the benefits provided by the environment whilst delivering other economic and social goals. Scottish environmental agencies, such as Scottish Environment Protection Agency (SEPA) and Scottish Natural Heritage (SNH) now have a statutory purpose to contribute to sustainable economic growth. Using an ecosystem approach SRP researchers have supported these agencies in fulfilling this statutory purpose; for example, in working with SNH to refine the Natural Capital Asset Index. SRP researchers have also supported the Natural Capital Initiative and the Scottish Forum for Natural Capital which works with businesses to recognise our dependence on Natural Capital. The ECom (Ecosystem Services Community Scotland), Valuing Nature Network and the Ecosystems

Knowledge Network have also received significant input from SRP researchers. Working through these networks has helped to mainstream the concepts of ecosystem services, natural capital and taking a participatory and holistic approach to managing our ecosystems, which are at the heart of Scotland's Land Use Strategy (2011-16; 2016-21).

Scottish Biodiversity Strategy

The 2020 Challenge for Scotland's Biodiversity is an ambitious strategy to protect and restore Scotland's biodiversity. SRP researchers have contributed to the Scottish Biodiversity Strategy (SBS), primarily through providing science advice and support. They have contributed to developing approaches for biodiversity monitoring and ecosystem health indicators, in particular on cultural services. This has helped support and strengthen the links between the evidence and the SBS, as well as enhancing knowledge exchange across the SBS partnership, ensuring progress is being made towards delivering the 2020 Challenge.





Water and Renewable Energy

Scotland has a high-quality water environment which is important for Scotland's economy, health, social wellbeing and the environment. Water plays a prominent role in the success of many sectors of the economy, such as tourism and food and drink manufacturing.

Renewable sources of energy can provide a sustainable means of generating the energy we need. Scotland has huge potential for renewable energy generation due to its geology and climate. Renewables are the single largest contributor to electricity generation in Scotland, accounting in 2015 for over 50%. Research funded by the SRP helps to ensure that water and renewable energy resources are utilised sustainably to bring the greatest benefits to Scotland.

Water Quality - NVZ reviews

Nitrate Vulnerable Zones (NVZs) are areas where the concentrations of nitrate in water exceed, or are likely to exceed, acceptable levels. The source of nitrates in water is primarily from agricultural fertilisers, so legally binding rules are put in place in NVZs to reduce nitrate loss from agricultural land. SEPA led a 2013 Nitrates Directive Review to develop a new methodology to designate NVZs. SRP researchers modelled nitrate loadings to groundwater,

which were used as one strand of evidence in the review. As a result of this review NVZs were revised in 2015, resulting in 2,700 km² of land being declassified. While the total area of Scotland designated as in an NVZ has reduced, NVZ measures remain targeted where they can have most impact.

Flood Risk Management

Approximately 79,000 homes are at risk of flooding in Scotland. Adopting a whole catchment approach and utilising Natural Flood Management (NFM) methods can bring about effective flood management while also delivering multiple benefits to the environment, society and the economy. To understand how to best deliver NFM measures, which slow and store the water, SRP researchers worked closely with SEPA and formed research platforms e.g. at Bowmont Water and Dee catchments. Experiments have been run to understand how NFM may change catchment processes, and workshops and advice provided for practitioners on how best to place NFM measures. [Webpages](#) were developed to provide live data feeds for a number of rivers. In the Tarland catchment this data is used by the Local Authority to trigger automated flood alert texts to the public. Researchers also sit on a number of flooding policy working groups, advising the Scottish Government on the role of NFM.





Land Use

Scotland has a rich and varied environment and a range of land uses to match, supporting a range of agriculture, recreation and development activities. Deciding best use of the land can be challenging as different uses may not always be compatible with one another. However, not all are mutually exclusive and, increasingly, multiple benefits from land are being sought - when the land is managed to maximise the benefits it provides from more than one standpoint.

Land use research demonstrates how Scotland's environment might respond to changes in climate and land use, and has informed the Scottish Government Land Use Strategy (LUS), through its work on greenhouse gas (GHG) emissions from livestock and arable farming systems, peatland restoration and the Scottish Soil Framework.

Peatland Condition and GHG Abatement Potential

Peatlands cover nearly a quarter of Scotland and contain over half of the total carbon in Scottish soils. However, the condition of much of this is degraded or eroded. Better models of the condition of peatland across Scotland have been developed, alongside tools to prioritise sites to be targeted for restoration. While undamaged peatlands can store GHGs, degraded areas will release these gases. SRP researchers have shown that restoring peatland will result in carbon savings, particularly from sites with high emissions. Restoration could therefore aid the land use sector in reducing its GHG emissions alongside numerous biodiversity and other ecosystem service benefits. Analysis of GHG emissions from peatlands has also provided up-to-date approximation of the total emissions from peatlands across Scotland. This has enabled the UK and Scottish Governments to adopt the future use of country-specific calculations in the UK National GHG Inventory. Calculations estimate that by 2050, peatland restoration would significantly contribute to reducing Scotland's contribution to GHG emissions.





Land Use

Legume Research

129,000 tonnes of nitrogen fertilisers are added to Scottish soils every year. Growing legume crops such as peas, beans and clovers can naturally increase soil nitrogen, preventing the need to use chemical fertilisers, resulting in reduced costs for farmers and reduced GHG emissions. However, many such legume crops can have low or inconsistent yields. Rhizobia are soil bacteria that work with legumes to fix nitrogen. SRP research, in collaboration with industry, is developing a service which will deliver rhizobia for a wide range of soil types. This aims to provide consistent increases to legume crop yield. Trials have shown rhizobial inoculation can increase yields by up to 20%, with associated increases in soil quality and a reduction in the need for inorganic nitrogen fertilisers.





Economic Adaptation

Rural Scotland comprises 95% of the land area and 18% of the Scottish population. Rural businesses face unique challenges, and to remain resilient Scotland's rural economy must be able to adapt to changing circumstances. The economy includes traditional land-based industries, but also the wider rural economy such as tourism and recreation. Common Agricultural Policy reform, adaptations to minimise the risks from climate change and the options for transitioning to a low carbon rural economy were all explored by Economic Adaptation researchers.

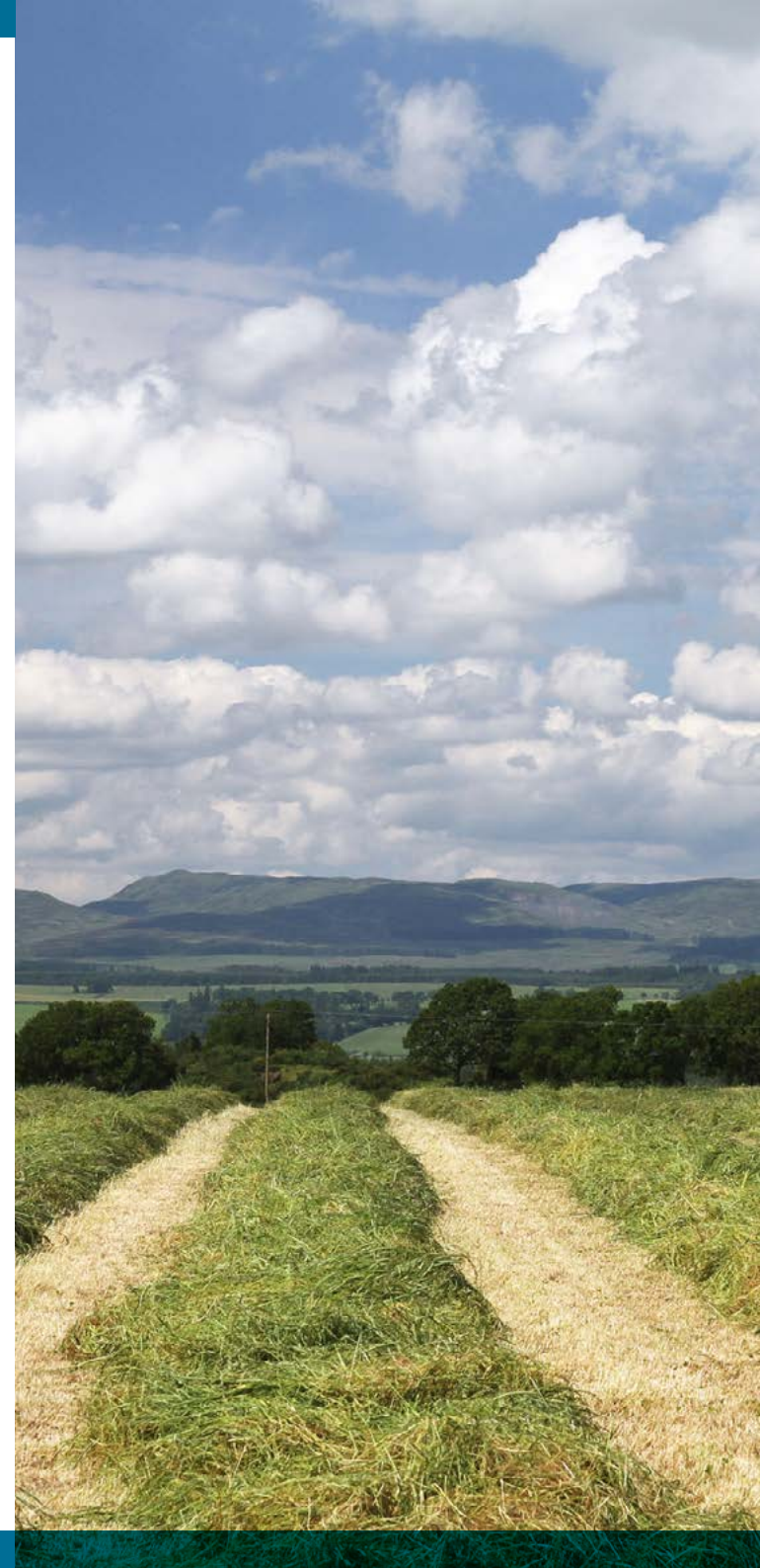
Common Agricultural Policy (CAP) reform

The CAP reforms for 2014-20 have significantly changed how the £580 million annual CAP budget is deployed, including introductions of Greening Payments and schemes for beef, sheep and new entrants. SRP researchers provided support to policy throughout these reforms. A range of potential CAP options and approaches were considered and analysed, and illustrations of their potential effects were presented to policy teams. These were influential in shaping final policy decisions on the reformed CAP. Stakeholder engagement was also central to this process, and ensured

consensus on regionalisation and an understanding of the impact of the reforms. A CAP Payment Calculator and a Greening Calculator enabled the farming industry to better understand the impacts of CAP reform on their businesses.

Sustainable Intensification

Studies of dairy farm data by SRP researchers have developed indicators to show how alternative feeding systems and health variables can effect environmental efficiency. Forage-based feeding systems were sometimes the most efficient, however, low-forage systems were less variable from year to year. Animal health variables were also found to have a significant impact on environmental efficiency. As a result of this data, pollution control strategies have been developed and the cost of GHG mitigation strategies have been examined. These have been communicated to farmers through the Dairy Research and Innovation Centre, the Farming for a Better Climate initiative and via farm consultancies.





Food

The food and drink industry is a major contributor to Scotland's economy, accounting for one in five manufacturing jobs. Scotland aims to build a 'Good Food Nation' where people benefit from and take pride and pleasure in the food they produce, buy, serve and eat.

Food research was focussed on improving the efficiency, resilience and sustainability of food production in Scotland. This included tools to enable crop and livestock breeding for improved nutritional qualities and for increased resilience to climate change.

Plant Genome Breakthroughs

Mapping a plant's genome can make the slow process of conventionally breeding new plant varieties much quicker, which can lead to breakthroughs in improving yield, quality, nutritional value, enhancing resistance to pests and diseases and to stresses caused by climate change. SRP researchers have made major contributions to long-term international collaborative efforts to map the genome of several plant varieties, and have led the UK teams in these efforts. These include the potato, barley and tomato genome.

For example, SRP researchers have analysed

and begun mapping potato genes with resistance to late blight, potato cyst nematodes, viruses and temperature stress, which may enable future varieties to be bred with resistance to these diseases and to environmental threats.

New Crop Varieties

New crop varieties can improve product quality and yield, and are essential in the face of changing climates, disease threats, consumer preferences and market needs. SRP researchers have a strong track record of delivering new cultivars of potatoes and soft fruit. Recent research in conjunction with commercial partners has discovered a range of molecular markers for disease resistance and quality traits in potato which has led to the release of new cultivars 'Mistay', 'Wizard', 'Vales Emerald' and 'Harlequin'. New soft fruit cultivars were also released: 'Ben Lawers' is a blackcurrant variety with enhanced quality and environmental resilience and was released through the breeding programme's sponsor, LR Suntory; while 'Glen Dee' is a raspberry cultivar which combines late-season production with improved fruit quality. Other raspberry lines currently under commercial trial are showing resistance to raspberry root rot - the most economically damaging disease affecting Scottish raspberry cultivation.





Food

Genetic Improvement in Cattle

SRP researchers, with co-funding from industry partners, have developed genetic tools which have led to improved estimated breeding values (EBVs) of cattle. EBVs are an estimate of the genetic potential of an animal, half of which will be passed on to its offspring. Research with beef cattle has included incorporating industry data to routine genetic evaluations, which is expected to increase EBV accuracy by 15%, potentially resulting in a £100 million benefit for the beef sector. In the dairy sector a number of genetic improvement tools, including indicating the level of Tuberculosis (TB) resistance, have been estimated to bring economic benefits of £634 million over a five-year period and reduced GHG emissions per breeding animal by 1.4% (in CO₂ equivalents) per annum.

Understanding the Dairy Industry

The dairy sector is vital to Scotland's farming and food sectors and to the wider rural economy. Scotland's 900 dairy farms and 2,000 processing employees generate well over £400 million or 15% of all farming output. Greater understanding of the resilience of the dairy sector was enabled by SRP research, which analysed Scottish production and milk utilisation data, investigated milk prices and scrutinised agreements between producers and buyers, all of which fed into the Scottish Dairy Sector Strategy 'Ambition 2025'. Separate analyses looked at methods to boost the dairy sectors efficiency and competitiveness, and also reviewed UK consumer trends on dairy products. This research aided the formulation of the findings of the Scottish Dairy Sector Review in 2012.





Health and Welfare

Farming contributes £3.3 billion worth of output to the Scottish economy and underpins the £14 billion Scottish food and drink sector. Maintaining the high standards of plant and animal health in Scotland whilst reducing losses due to disease makes an essential contribution to productivity. Scotland has high health status for both animals and plants, with our cattle being declared officially TB free, and our seed potatoes free of several serious diseases including brown rot and ring rot. However, there are many threats from new pests and diseases, which could cause serious damage to our livestock and crops, and significant costs to our industry were they to cause a serious outbreak, and this research aims to mitigate that risk. The focus of Health and Welfare research is to reduce the burden of disease, secure a safe supply of high-quality food and to improve efficiency while managing environmental impacts and animal welfare.

Potato Late Blight

Potato is an important crop for Scotland, and we have a reputation for producing high-quality seed potatoes. The potentially devastating impact of potato late blight (*Phytophthora infestans*), which contributed to the Irish potato famine in the 19th Century, to both crops and global food security keeps its management high on the potato industry's list of priorities. SRP research has contributed towards improved integrated pest and disease management of late blight by growers. By studying and understanding the pathogen population and its characteristics, research was able to inform better disease control and to improve late blight disease forecasting.





Health and Welfare

Bovine Viral Diarrhoea

Bovine viral diarrhoea (BVD) is a common contagious disease of cattle which has high economic and welfare costs, causing abortion, infertility, failure to thrive and even death. The Scottish Government is supporting an ambitious industry-led scheme to eradicate it from Scotland. SRP research has been central in supporting this scheme, including research on national herd prevalence, economics and knowledge exchange. In addition, an online BVD database, designed for official and industry use, was delivered in collaboration with commercial BVD scheme providers. Researchers collaborated on qualitative risk assessments for herd level re-infection and on a meta-analysis of international BVD prevalence and risk. Statistical tools were also developed to differentiate herd exposure routes. Good progress is being made by the scheme, with 90% of breeding herds recording a negative BVD status as of January 2017.

Sharing Knowledge for Improved Animal Health

Effective knowledge exchange with target audiences is essential to maximise research impact. An example of this is where SRP researchers led Paraban and Paraban Reloaded projects, providing collaborative knowledge exchange based around a group of 'Champion' farms to demonstrate best practice for control of Johne's disease in Scottish cattle. Johne's disease is an infectious wasting condition of cattle and other ruminants, closely related to tuberculosis. Analyses of 'Champion' farm data demonstrated that for problem Johne's disease herds, successful management programmes need to be customised to each farm business. The two Paraban projects reached over 1,000 farmers through a series of open days and workshops, 99% of whom declared that they would act upon the recommendations made in the workshops.





Diet and Health

In Scotland, eating habits are the second major cause, after smoking, of poor health. The national diet contributes to a range of serious illnesses, which include coronary heart disease, certain cancers, strokes, osteoporosis and diabetes. In order to understand what constitutes a healthy diet, we must understand the food we eat and how this affects our health and wellbeing.

Diet and Health research concentrates on how to encourage the adoption of healthy, sustainable diets as well as how to improve the health benefits of food through production and processing.

Reformulating Foods for Increased Sustainability

Increasing world population and demand for food is leading to increased costs for basic ingredients, which could potentially impact on food quality and cost to the consumer. SRP research has shown how sustainable alternatives for key ingredients such as protein could be sustainably grown in Scotland and has shown, through human intervention studies, that the nutritional quality is at least as good as the traditional ingredients they replace. This research has also shown that in some cases the overall nutritional quality can be improved as a result of the presence of additional nutritional components. For example, yogurts are being reformulated with underutilised fruits such as Salal Berries (*Gaultheria shallon*). As part of the programme

SRP researchers developed a range of new and reformulated food products which were showcased to farmers, manufacturers and potential consumers.

Reducing Waste, Improving Health and Creating Better Foods

The Scottish fruit and vegetable industry annually produces significant quantities of 'second grade' produce that cannot be sold to traditional outlets as it is damaged or is near the end of its useful shelf life. This currently has little value and much of this goes into waste streams. Reformulation of yogurt with beta-glucan from spent brewer's yeast and bread with broad bean hull (both are waste products of food processing) is currently being developed. SRP research has shown how value can be retained and how a useful food ingredient can be produced that has multiple benefits. Research has shown that by freeze drying a range of useful freeze-dried ingredients can be produced. These have practical uses as substitutes for fresh produce in foods where inclusion would be challenging. In addition, research has shown that these have significant economic and health impacts. In many cases they can be used as alternatives to traditional colours and synthetic antioxidants improving the overall health qualities of the product, meeting the increasing demand for regulators and consumers for 'clean label' and 'natural', and contributing to maintaining or increasing shelf life.





Rural Communities

Rural communities throughout Scotland form a vital part of Scotland's heritage, identity and economy. They are home to almost one-fifth of our population and contribute greatly to the Scottish economy. In 2014 the Rural Parliament was established. This sets out the priorities of rural communities, and aims to create a more empowered, connected and sustainable rural Scotland.

Rural Communities research helps policy makers to understand the unique needs of rural communities and enables their voices to be heard. It has contributed the Land Reform Review Group, One Million Acre Target short life group, the Cross Party Group on Rural Policy and the Technical Advisory Group on Energy and Climate Change.

Mapping Rural Socio-Economic Performance

In order to have detailed and up-to-date information on the performance of rural areas in Scotland, a socio-economic performance index was developed by SRP researchers. The index combines 20 indicators into a performance score for approximately 2,000 rural or small town data zones in Scotland. This has highlighted considerable variation in performance across Scotland, and can

therefore provide evidence to support decisions on where to target funding. It has been used to allocate 2014-20 Scottish LEADER funding to Local Action Groups. It has also been used by NHS Highland, Church of Scotland, and Highland LEADER.

Access to Outdoor Recreation for Older People

Official statistics show that adults aged over 65 are less likely than other adults to engage in outdoor recreation on a regular basis. Whilst the benefits of outdoor recreation is understood, there is less understanding of the barriers that discourage or prevent older people from participating. SRP researchers examined these barriers and found them to be multiple and inter-related; they include: poor health, lack of social connections, vulnerability, lack of motivation, safety and weather. Ideas to assist greater use of the outdoors amongst older people need to consider the interactions between these factors. Some interventions are "Green prescribing" by doctors, and walking groups, which together may overcome social and motivational barriers. This research is now informing the Scottish Government's Land Use Strategy and Physical Activity Implementation Plan and supports the development of a 'Natural Health Service', which is being led by SNH.





Underpinning Capacity

Investment is also made to support a number of services and collections at the Main Research Providers. This reflects a priority of supporting nationally important capability and resource and ensures the maintenance and accessibility of important data and collections. The skills and capacity at the Main Research Providers are also being supported through the development of new areas of science and leveraging of other funding. Some examples of where this underpinning capacity funding is directed are highlighted below.

Soil Mapping and SE Web

Soils and soil health is of major economic and environmental importance to Scotland. Soils underpin food production, can protect water supplies and make our ecosystems more resilient to environmental change. The James Hutton Institute maintains a large collection of soil data which has been collected across Scotland since 1930, which includes national mapping of Scotland's soils. To increase access to the data over 900 maps have been digitised, at scales ranging from 1:500 to 1:250,000. In addition to the national soil map of Scotland, these maps include a land capability map for agriculture, carbon and peatland maps and land capability for forestry. These digital maps are available through the [Scotland's soils](#) webpages, part of Scotland's Environment website, [SE Web](#).

This resource has led to the publication of many papers and datasets, including contributions to National Biodiversity Network/Atlas of Living Scotland. Advice has also been supplied to a range of end users such as: Royal Society for Protection of Birds (RSPB), SEPA, Scottish Water (SW), and various universities, consultants and estate agents.

Pest and Pathogen Collections

MoreDun Research Institute maintains a large collection of pests and microorganisms which cause disease (pathogens), which can be used to better understand the pests and diseases which affect livestock. These collections can be used as a basis for developing tests to diagnose disease, as well as working towards vaccines and alternative control strategies against entrenched livestock diseases. The collections include: bacteria such *Chlamydia abortus*, which can cause abortions; *Campylobacter jejuni* a major cause of food poisoning; parasitic worms such as *Haemonchus*, *Teladorsagia* and liver fluke; and single-celled parasites such as *Cryptosporidium parvum* and *Toxoplasma gondii*. Collections of *Toxoplasma gondii* have been used to develop genotyping tools to help identify the genetic diversity of pathogens in wildlife, food animals and human populations to help understand disease transmission routes and risks to veterinary and public health.





Underpinning Capacity

Commonwealth Potato Collection

The contribution of Scotland's potato crop to our economy is significant: in 2015 the estimated value of the Scottish crop was £167 million. Despite being one of the world's most important food crops the potato remains one of the most vulnerable to disease and changing environmental conditions. The Commonwealth Potato Collection (CPC) is a potato genebank held in trust by The James Hutton Institute. The collection comprises around 1,500 accessions representing over 86 wild and cultivated potato species. Each accession traces back to a handful of berries or tubers from potato plants in South or Central America, gathered from the wild or obtained from a grower at a market. The purpose of the CPC collection and subsequent duplications is to safeguard genetic diversity and make it available to researchers and breeders. In 2017 seeds from the CPC were lodged at the Svalbard Global Seed Vault, which were the first deposits of materials originating from a UK institute. This assures the availability of the CPC against natural or human-caused disasters.





Policy and Practice

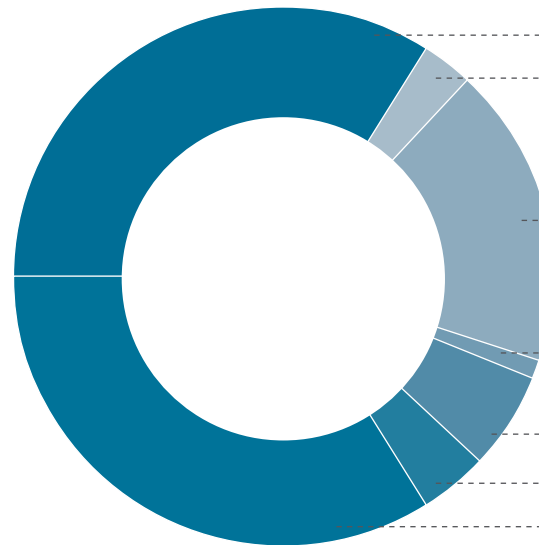
Scottish Government-funded research contributes to shaping policy by providing a knowledge and evidence base to help inform decisions. Much of the funded research is longer term and strategic, rather than directed to immediate policy needs. However, the expertise and capacity available also means that policy makers can seek advice as and when they need it.

904
policy briefings were produced by SRP researchers during 2011-16.

24%
increased in responsive outputs since the start of the programme

Responsive outputs now make up **80%** of all policy outputs

37% of policy requests came from the Scottish Government, and 18% from the UK Government or Government agencies.

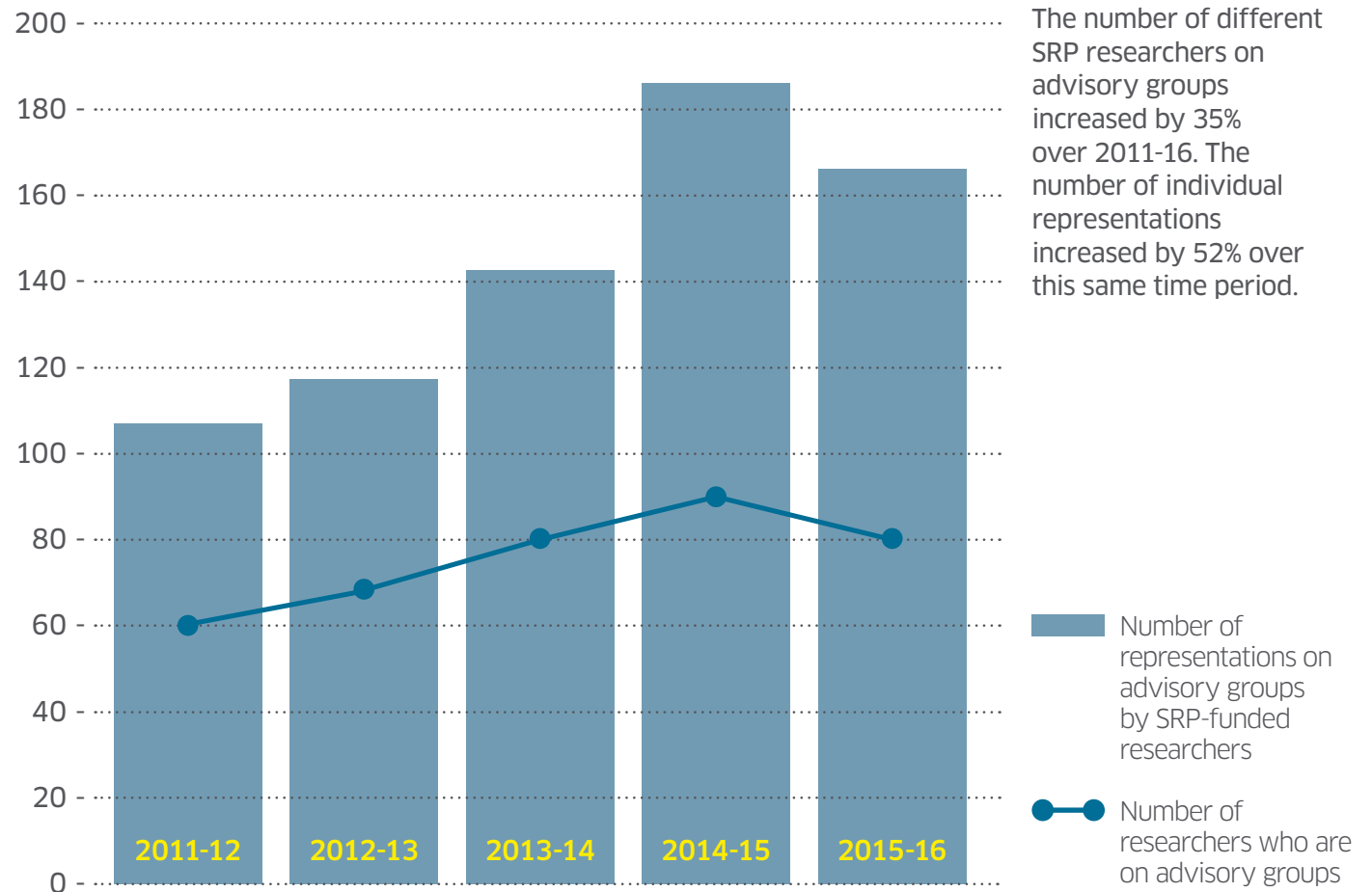


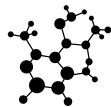
- Scottish Government 34%
- SG agencies 3%
- UK Government or Government Agency 18%
- Local Authority 1%
- EU or International 6%
- Other 4%
- Proactive 34%



Policy and Practice

As well as producing briefs and reports to support policy development, a number of SRP researchers sat on committees or were members of advisory groups which can also provide an opportunity to challenge and influence thinking. By 2015-16, there were over 150 representations on government or agency advisory groups by 80 SRP-funded researchers. These include representations at Scottish Government, UK Government, EU and UN levels, and comprise a diverse range such as: IPCC (Intergovernmental Panel on Climate Change) working groups, EU European Innovation Partnership focus groups, European Food Safety Authority working groups, the UK Government's Department for Environment, Food and Rural Affairs (DEFRA) Antimicrobial Resistance coordination group, DEFRA UK Plant Health Forum, the Scottish Food Commission and Scottish Natural Heritage's (SNH) Science Advisory Committee.





Research Collaborations

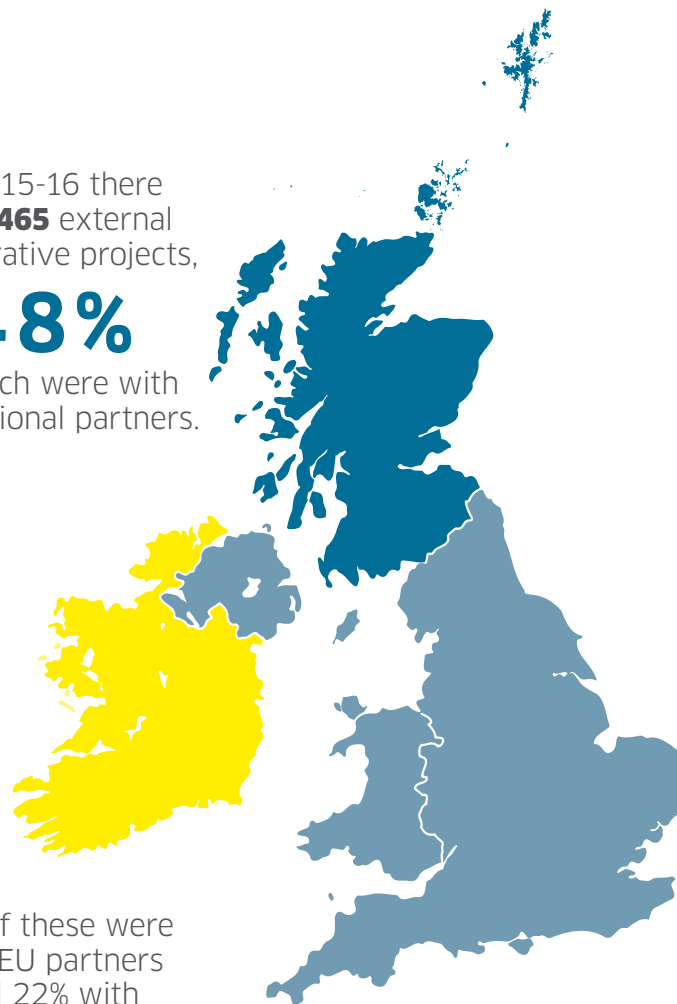
Local, national and international collaborations are critical to the success of SRP research, ensuring the most appropriate and up-to-date methods are used, and that the findings of research are utilised as widely as possible and have maximum impact. Collaborating with international partners ensures cutting edge research is carried out which will extend the benefits of SRP funding beyond Scotland, and helps promote Scotland as a research destination to the international science community. We strongly encourage Scottish, UK and International collaborations.

In 2015-16 there were **465** external collaborative projects,

48%

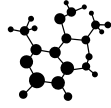
of which were with international partners.

32% of these were with EU partners and 22% with international partners beyond the EU.



EU 32%

REST OF THE WORLD 22%



Research Collaborations

Highly Cited Papers and Researchers

Two SRP-funded researchers (Professors Philip White, Plant and Animal Sciences and Harry Flint, Microbiology) were listed in the Clarivate Analytics list of highly cited researchers for 2016.

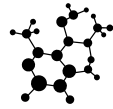
Between 2011-15 **65** highly cited papers were published by SRP-funded researchers. Highly cited papers are defined as a paper which received enough citations to place it in the top 1% of its academic field based on a highly cited threshold for the field and publication year.

The highly cited papers cover a wide range of programme research including: plant and cattle genetics, gut microbiology, soil science, plant pathology, food production and knowledge exchange. They are featured in a wide range of high-impact journals including *Science*, *Nature*, *Ecology Letters*, *Gut*, *Plant Cell* and *Genome Biology*.

DNA Barcoding Vegetation

DNA barcoding is a technique that uses short sections of DNA to identify an organism. This speeds up the process of cataloguing life on earth, and also has applications in forensics, conservation, disease control and ecosystem monitoring. This research is led across the globe by the [International Barcode of Life Project](#) (IBoL), which involves collaborators from 26 countries, including Canada, China, France, Germany and, within the UK, more than 25 different research groups. RBGE researchers, partly supported by SRP funding, are leading in this research. Professor Pete Hollingsworth of RBGE chaired the Scientific Steering Committee of IBoL, is on IBoL's International Scientific Cooperation Committee and is chair of IBoL's Plant Working Group. Within Scotland this has led to the testing of new techniques which have helped to resolve cryptogam (such as mosses and lichens) diversity, leading to the discovery of new native species. Molecular data from DNA projects has also contributed to international efforts to understand global diversity of fungi, and has been used to clarify taxonomic problems affecting designation of Schedule 8 species in the Wildlife and Countryside Act (1981), on behalf of Scottish Natural Heritage.





Research Collaborations

Chinese Collaborations

Strong links and strategic collaborations have been developed with China over the course of the 2011-16 programme. Formal links have been agreed between both James Hutton Institute and Scotland's Rural College with a number of Chinese research organisations, including the Chinese Academy of Agricultural Sciences and Zhejiang Agriculture and Forestry University. Collaborations include training workshops, run jointly with the Centre for Ecology and Hydrology, an Engineering and Physical Sciences Research Council (EPSRC)-funded project and workshops at Universities of Hohai and Zhengzhou to share knowledge on flood risk management and hydropower; a workshop and a peer reviewed publication with the China Agricultural University of Beijing on the potential for intercropping to deliver improved yields and a Visiting Professorship to the Institute of Urban Environment in Xiamen and Ningbo. SRP researchers are also participants in two Newton Fund projects between UK and Chinese scientists, focussing on sustainable intensification of agriculture in China through increased use of organic fertilisers, and improving nitrogen use efficiency and pollution reduction in both China and Europe. SRP researchers also assist in maintaining the Lijiang Field Station which is one of the centres of the Flora of China Project, a major collaborative project to produce an English language revision of the original Chinese text.

Strengthening Links With Malawi

Scotland has many long-standing links with Malawi and the Scottish Government has been funding projects there since 2005. Projects incorporating the skills of SRP-funded researchers have helped to strengthen the links between Scotland and Malawi. These include a project funded by the Scottish Government's Climate Justice Fund, and led by Voluntary Service Overseas, which supported sustainable, effective and equitable water management in Malawi. Researchers from the James Hutton Institute spent a month in Malawi facilitating and participating in workshops with district officials and communities, helping ensure community voices are heard and supporting them to proactively plan for the future. Economic and Social Research Council (ESRC) and Department for International Development (DFID) have also awarded funding to SRUC to examine the role of the dairy sector in Malawi, with the aim of raising the efficiency and sustainability of the sector. Key to the success of the project was the multidisciplinary interaction of SRUC and Malawian researchers, from Lilongwe University of Agriculture and Natural Resources, and the African Institute of Corporate Citizenship. The milk supply chain in Malawi and the barriers to achieving maximum throughput were explored, with a number of techniques for assessing supply chain efficiency, developed through research in the SRP, were applied in the project.





Industrial Collaborations

Collaborating with industry can stimulate innovation, widen the impact of research investment, lead to enhanced 'on the ground' impacts for businesses and individuals, and increase economic resilience in agricultural industries, the environment and within rural communities. Many of the examples throughout this report have involved collaboration with industry. Several innovative collaborations with industry partners are explored below.

GT Biologics/4D Pharma

GT Biologics Ltd was a Rowett Institute spin out company established to develop new therapeutics based on the use of live bacteria. In 2012 the company secured equity investment from Aquarius Equity Partners and was subsequently partially acquired by **4D Pharma Plc**. 4D Pharma has raised over £70 million to fund the product portfolio of the group of companies to build a pharmaceutical company focussed on developing therapeutics from the human gut microbiome. The GT Biologics element of the company has now been renamed as **4D Pharma Research** with its base remaining in Aberdeen on the Foresterhill campus of the University of Aberdeen. The work force has continued to grow and the company is actively recruiting research-based positions. The initial portfolio focussed on the research around the gut bacteria (*Roseburia hominis* and *Bacteroides thetaiotaomicron*) has been expanded to develop a proprietary technology platform which performs high-throughput screening of novel live biotherapeutic candidates to rationally identify bacteria with potential therapeutic efficacy across multiple disease areas.

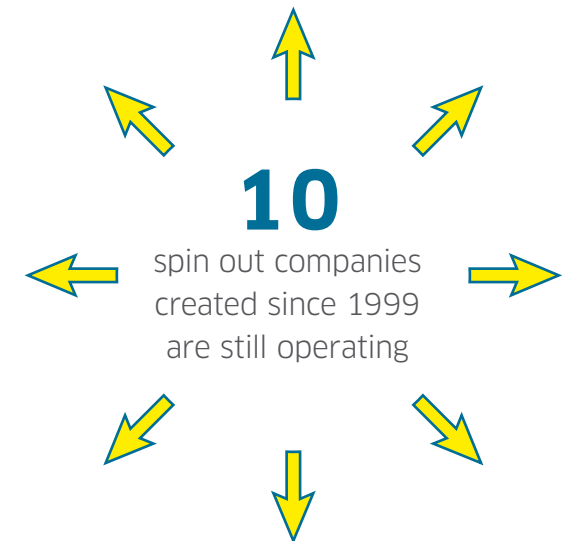


170

patents were granted between 2011-16, with

45%

being licensed.





Industrial Collaborations

LEAF Sustainability Metrics

LEAF (Linking Environment And Farming) is the leading UK organisation delivering more sustainable food and farming. 25% of UK fruit and vegetables are grown on LEAF marque accredited businesses. Research in the programme developed sustainability metrics for use by LEAF in their Sustainable Farming Review. This is a management tool which helps farmers to work more sustainably. It has been applied across hundreds of UK farms and is becoming the industry standard, with implications for soil, carbon, water and other natural asset management on farms.

Sustainable Hydropower

Scotland has the ambitious target of generating all electricity from renewable resources by 2020. Hydropower plays a key role in Scotland's renewable energy contributions, generating 12% of Scotland's electricity. In order to meet the 2020 targets it is likely that more renewable energy schemes will need to be developed, with huge potential now being realised for small-scale schemes. Programme researchers investigated how future water flow scenarios may affect Scotland's hydropower generation potential, and how large-scale hydroelectric power schemes affect the water environment and its delivery of other ecosystem services. The work was designed and carried out in collaboration with both hydropower operators and public bodies to support sustainable hydropower development with low environmental impact.





Industrial Collaborations

Ground-breaking Worm Vaccine

Parasitic worms can have serious effects on livestock health, welfare and production. Worms can be controlled by drugs, however, resistance to wormers is widespread and reduced productivity due to gut-dwelling parasites is estimated to cost the UK sheep industry over £80 million per year. Barbervax® is the first vaccine in the world against a gut-dwelling parasitic worm of sheep, Barber's pole worm (*Haemonchus contortus*).

This worm is the most important roundworm parasite of sheep and goats worldwide (currently it is only a sporadic problem for farmers in the UK, although this is likely to increase due to our warmer and wetter climate favouring survival of the parasite). Following many years of research in Scotland Barbervax® is now on sale in Australia. Results to date are excellent in terms of vaccine uptake and efficacy. Comments from Australian farmers include: "Just awesome results. We are very happy with your vaccine and have been telling anyone who will listen to us about it." "It's a terrific breakthrough for our industry." The vaccine has now been registered as Wirevax(r) in South Africa and an equivalent cattle parasite vaccine is being trialled in South America.

SRP-funded researchers are now extending their expertise gained on the development of Barbervax® to a vaccine against the major gut worm parasite in Scotland, *Teladorsagia circumcincta*. Patents have been filed for this vaccine, although its likely deployment may be a few years away. Vaccines represent a significant breakthrough in the control of parasitic worms in livestock around the world as there are growing reports of significant resistance to the drugs currently used as frontline treatments.





Industrial Collaborations

GHG Emissions from Livestock

Agriculture contributes around 22.8% of Scotland's total GHG emissions. Parasitic worms and flukes which cause several endemic diseases of livestock, such as liver fluke, cost the industry c. £84 million per year and result in a significant increase in GHG emissions. Studies demonstrated that parasitised lambs produce 10% more GHGs than uninfected or effectively treated lambs. This research highlights that disease management can have an impact in addressing agricultural GHG emissions. This information has been communicated to the farming industry at a range of events.

Common Interest Groups for Food and Drink SMEs

Small and medium enterprises (SMEs) dominate Scotland's food and drink sector. Many of these lack the capacity to individually engage with research. Interface Food and Drink, Scotland Food and Drink and the Food and Drink Federation have set up a number of Common Interest Groups, bringing together groups of companies to share information and identify areas of common opportunity. SRP-funded researchers have provided advice and information to these groups, enabling research outputs to be applied by industry. Fifteen have now been set up, including the Scottish Rapeseed Oil Group, who were advised on sustainable and efficient approaches to strain selection, crop production and product quality. In the Reformulation Group several companies are being advised on the use of alternative ingredients to replace sugar, fat and salt whilst maintaining structure and improving health qualities. The Scottish Venison Partnership and Scottish Venison Producers Group have been provided with research data on husbandry, optimal diet and disease management while they work towards increasing the market share of wild and farmed venison.





Strategic Partnerships

During the 2011-16 programme, funding was available specifically to lever knowledge from the SRP into joint projects with industrial collaborators. The majority of this funding was directed into two “industry facing” SPs in key sectors viewed to have high growth potential: animal science and food and drink science. These initiatives aimed to strengthen the flow of knowledge from basic through applied research to meet longer-term industry needs and to enhance the commercial exploitation of the science base. Much of this work has now been mainstreamed into the current research programme.

Strategic Partnership on Animal Science Excellence (SPASE)

[SPASE](#) was set up to improve the exploitation of research and contribute to innovation and economic growth in the livestock and animal health sectors. This partnership enabled new animal science partnerships to establish and flourish. Throughout the five years of funding there was an expanding collaborator base, and acquisition of significant added-value research funding; for example, two large BBSRC projects, and grants with Food Standards Agency and DEFRA.

SPASE scientists engaged with representatives from across the livestock industry and with policy professionals. Highlights included interactions with food standard agencies regarding diagnosis of zoonotic pathogens and the design of tests for ‘real time’ diagnosis during disease outbreaks; the Mothers Matter campaign, to provide accessible messages to industry about the potential impacts of early life experiences for livestock health, welfare and productivity; and engagement with both land managers and water industry to prevent contamination of the public water supply with *Cryptosporidium*. Commercial uptake was demonstrated through animal health industry funding to test bacterial vaccine candidates. Cross-disciplinary interactions thrived, particularly in the application of novel modelling approaches to understanding disease transmission and control.

SPASE also established science in new areas: for example, in development of novel models for analysing data, in using state-of-the-art technologies to define pathogen virulence or in typing field-derived pathogens to provide insights into how they are spread.



SPs were involved in over **75** external collaborations from 2011-16.

SPFDS 40 and SPASE 36, including BBSRC projects, international collaborations, EU projects and FSA projects.



Strategic Partnerships

Strategic Partnership on Food & Drink Science (SPFDS)

SPFDS was set up to provide scientific evidence on food and drink to inform industry and government, and to promote long-term economic development in the Scottish food and drink sector.

Key to the success of SPFDS has been close collaborative working with other industry-facing initiatives, including Food and Health Innovation Service (FHIS) and Interface Food and Drink (IFD). Partnership with IFD led to the formation of 15 Common Interest Groups including workshops on reformulation for improved health and workshops with Scottish craft brewers which led to the creation of the Scottish Craft Brewers Association.

SPFDS successfully communicated research to the industry, and worked with a wide range of businesses to integrate innovations across the whole Scottish agri-food supply chain, helping to shorten supply chains and retain more value in primary production. Product reformulation was carried out with a range of small businesses, which are often reluctant to engage in Research and Development (R&D). Examples include developing guidance for growing food on

contaminated land; evaluating the impact of *Campylobacter* reduction strategies; sustainable ingredient replacement; introducing health attributes without losing sensory qualities; and reformulation of products for reduced sugar, salt and fat. Work following on from SPFDS research on using diet to adjust the gut microbiome has resulted in major collaborations with multinational companies which supply probiotics.

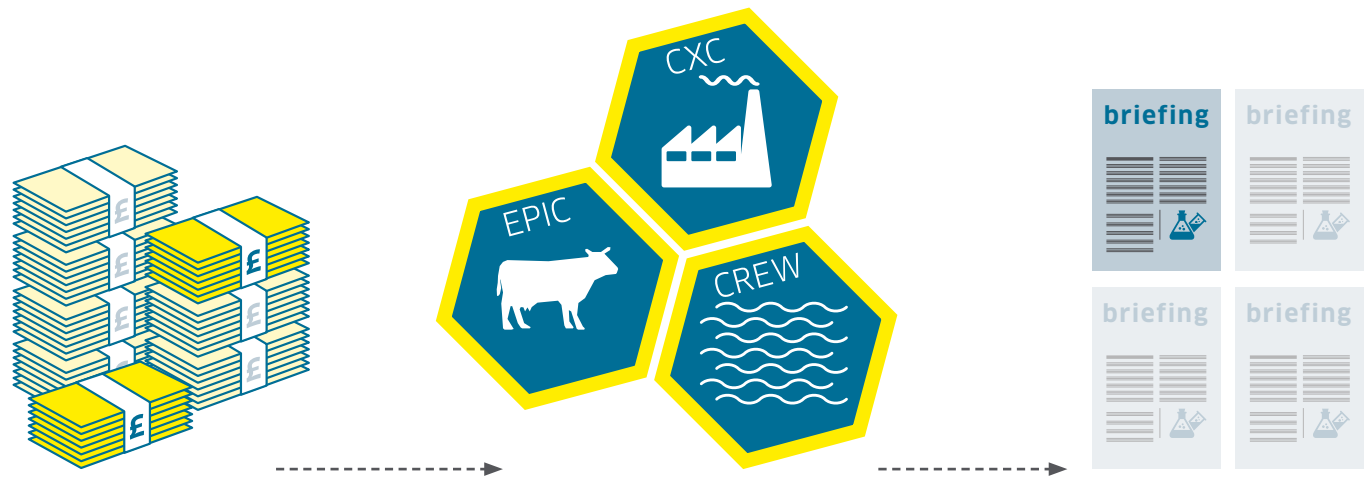
Stakeholder communities and the wider public were engaged using a variety of innovative approaches, including a [Science Bytes](#) series of videos created with FHIS; 'Lunch and Learn' webinars; presentations with chefs; and 'Go with the Grain' a practical recipe book to encourage consumers to eat more oats and barley.



Centres of Expertise

Three CoEs operated throughout the 2011-16 SRP, in areas of high policy importance: water, climate change and animal disease outbreaks. These centres bring together expertise across the publicly funded research sector. Such was the success of the centres they have been recommissioned beyond 2016.

Each CoE aims to provide the best available scientific advice to inform Government policy in an efficient, accessible and streamlined way. The Centres' work aligns to research within the research institutes, is closely linked to the wider policy agenda from Government, and draws widely on resources within universities.



The three CoEs received just over **12%** of the programme funding over 2011-16.

The three Centres of Expertise produced **344 policy briefings** over the course of the 2011-16 SRP.

36% of all policy briefings produced by the programme, reflecting their policy facing remit.

CXC ClimateXChange
EPIC Centre of Expertise on Animal Disease Outbreaks
CREW Centre of Expertise for Waters



Centre of Expertise for Waters (CREW)

Delivers objective and robust evidence and expert opinion to support the development and implementation of water policy in Scotland. CREW informs stakeholders such as Scottish Government, SEPA, Scottish Natural Heritage (SNH) and Scottish Water in their work to develop and implement water policy. Projects range across sustainable rural communities, drinking water, flood risk management, and coastal erosion and river basin management planning. These studies have informed the Flood Risk Management Act (2009); Water Framework Directive; river basin management plans; Water Resources (Scotland) Act (2013); and have contributed towards the Scottish Government's Hydro Nation Agenda.

Water Resources (Scotland) Act (2013)

A report on the Value of Scotland's Water Resources was requested from CREW by policy teams preparing the Water Resources (Scotland) Bill. This led to a successful amendment that contributed to the Act, ensuring that water resources were considered for the full extent of both their monetary and non-monetary value.

Surface Water Flood Forecasting

The impacts of surface water flooding can be severe in urban areas due to the high density of people and the infrastructure that is present. About one third of all flood risk can be attributed to surface water flooding, although accurately forecasting surface water flooding can be challenging. CREW, alongside SEPA and the Met Office, produced the UK's first operational surface water flood risk forecast. A new method was developed to forecast the impacts of flooding in real-time. This was successfully piloted at the 2014 Commonwealth Games in Glasgow, where flood risk was a major concern to strategic operations and where forecasting could be highly beneficial for transport planning and the emergency response community.





Centre of Expertise for Waters (CREW)

Scottish Rural Development Programme (SRDP) Guidance and Options

Water and soil quality options, including water quality, Natural Flood Management and Rural Sustainable Drainage Systems were introduced with the 2014 SRDP. CREW assessed the evidence base for potential options to inform SEPA which options should be funded under SRDP. The options were consulted on the second-stage SRDP consultation and will form part of the second River Basin Management plan. CREW also provided evidence on how the water options could be targeted to deliver most benefit.

Flood Insurance Provision

CREW undertook research on the affordability of flood insurance in flood risk areas in Scotland and the likely impact of the cessation of the Statement of Principles on different socio-economic groups. Subsequently, the report has informed both the Scottish Government and the Scottish Parliament petitions committee in their consideration of a flood insurance problems petition. The work has had impact on Scottish Government correspondence, and the official report and informed government thinking and speeches for a Scottish Parliament Public Petitions Committee debate on flood insurance.





ClimateXChange (CXC)

Provides research, advice and analysis to the Scottish Government as it develops and implements policies on adapting to the changing climate and the transition to a low carbon society. CXC's relevance has been cemented by recent developments: the renewed global commitment made with the Paris Climate Change Agreement generates new challenges for policy and research in Scotland and internationally.

Renewable Energy

A range of studies have informed the Scottish Government in several areas of renewable energy. This includes good practice guidance which has informed public engagement for wind farm developments and a report on "Supporting community investment in commercial energy schemes" which is informing guidance for community groups and developers. Local economic impacts of community energy, and the benefits of expanding community-owned renewables were also highlighted to policy; the associated report was cited in Scottish Government's [Community Energy Policy Statement](#).





ClimateXChange (CXC)

Woodlands

CXC's woodlands research aims to provide evidence to Forestry Commission Scotland (FCS) and other policymakers to make more informed decisions on helping the Scottish Government to meet Scotland's emission reduction targets and improve the resilience of Scotland's forests to climate change. Work includes: a 'Climate Ready Forest network' which has enabled CXC to identify key adaptation issues facing the forest sector and to begin developing solutions; modelling of above and below ground carbon stocks enabling FCS to consider the most appropriate type of tree planting and the implications of new woodlands under different scenarios; and a report exploring the risks of native woodlands from climate change, and how best to manage these risks.

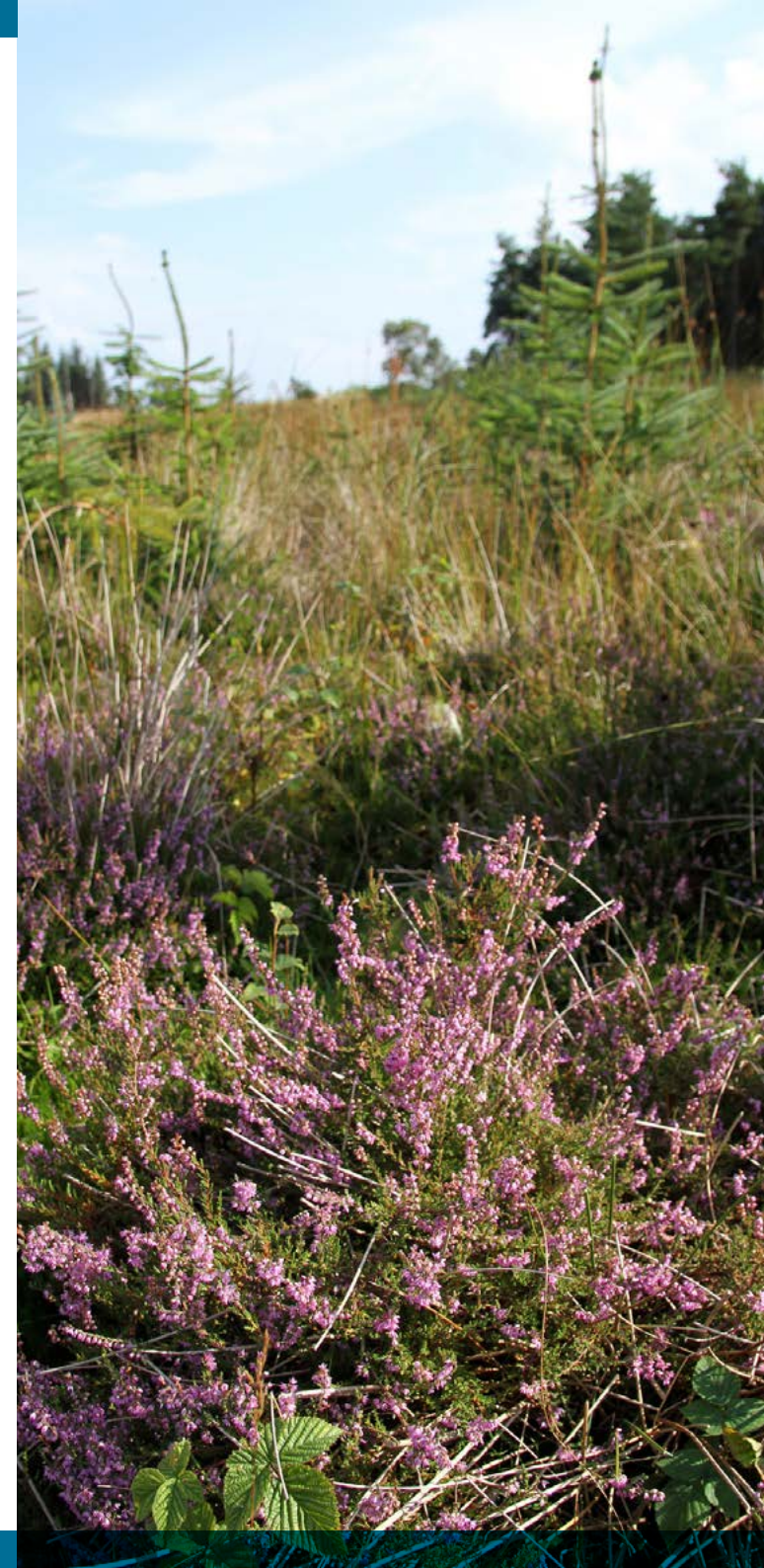
Peatlands

CXC is developing tools for targeted peatland restoration, which will support achieving Scotland's emissions reduction targets, and the aims of the National Peatland Plan and the 2020 Biodiversity Challenge. Workshops identified strategic priorities for research on peatlands which were referenced in the [National Peatland Plan](#). Reports from CXC on the potential GHG abatement benefits from

peatland restoration were evidenced to the Rural Affairs, Climate Change and Environment (RACCE) committee of the Scottish Parliament and informed policy officials preparing the second Report on Proposals and Policies (RPP2).

Adaptation Indicators

CXC has provided input to the development of and monitoring of the Scottish Climate Change Adaptation Programme (SCCAP). CXC developed over 100 climate change adaptation indicators which enable an understanding of how Scotland is adapting to our changing climate and are informing the independent assessment of SCCAP. A number of engagement events have been held to ensure these indicators capture the most useful data and are aligned to policy and practice.





Centre of Expertise on Animal Disease Outbreaks (EPIC)

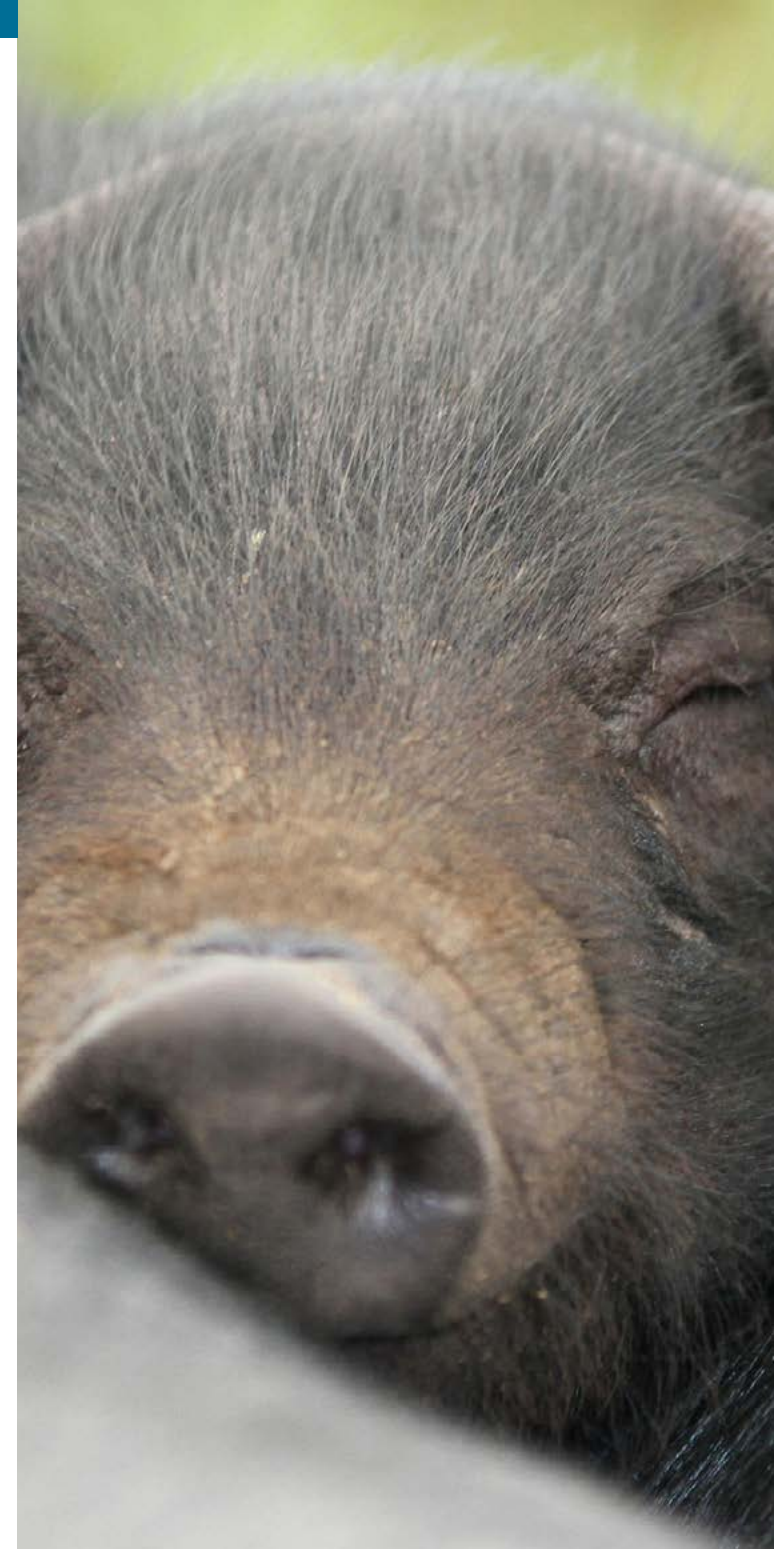
EPIC's mission is 'to best prepare Scotland for the next major animal disease incursion'. To do this EPIC brings together the best available scientific expertise to inform the Scottish Government and the livestock industry on reducing the impact of animal disease outbreaks. EPIC has built a series of tools which model outbreaks and have run simulation exercises to help with coordination and preparedness, in addition to monitoring diseases which may become future threats to Scotland's livestock.

Expertise in Qualitative Veterinary Risk Assessments

Qualitative veterinary risk assessments (VRAs) provide a method of assessing animal health risks on particular topics. EPIC has generated VRAs which have helped inform long-term contingency planning for different exotic diseases. The VRAs have covered: responses to potential Avian Influenza and Classical Swine Fever outbreaks; decisions on animal movement licences and access to the countryside in the event of a Foot and Mouth Disease outbreak; and the retention of single flock tagging versus the double Electronic Identification (EID) tagging which highlighted that retaining the single tags would increase risk.

Exercise Walnut – Pig Movements

Exercise Walnut was a disease simulation exercise undertaken in 2013 to test the UK's preparedness for an outbreak of classical swine fever (CSF). The operation involved the Animal and Plant Health Agency (APHA, previously the Animal Health and Veterinary Laboratories Agency, AHVLA), DEFRA, the Scottish Government, Welsh Government and Department of Agriculture and Rural Development. EPIC researchers participated in the exercise, and during the 'live play' section were asked to interrogate pig movement and demography databases to enable understanding of disease transmission routes and to identify control options. A subsequent report prepared by EPIC assessing the impact of implementing a movement ban during a CSF outbreak has led to findings valuable to Scottish Government and DEFRA policy teams.





Centre of Expertise on Animal Disease Outbreaks (EPIC)

Sheep Scab Control

A collaboration between Scotland's Sheep Scab Action group, SRP researchers and EPIC scientists helped to instigate a local eradication campaign on the island of Mull in 2013. An optimal testing schedule for applying the sheep scab diagnostic blood test was devised. The majority of flocks were demonstrated to be free from the disease. The same schedule was used to test breeding tups in 2015, resulting in sheep scab being detected in a defined area, showing the value in this approach to disease monitoring.

Avian Influenza

There have been a number of cases of Avian Influenza confirmed in both domestic and wild birds in the UK, including two instances in Scotland. Communication by Scottish Government, to industry and other partners, was supported by EPIC scientists. In addition to assisting the Scottish response, EPIC scientists were invited to join meetings of the National Epidemiology Emergency Group. EPIC's work contributed to Scottish Government understanding of the Scottish commercial poultry sector, susceptibility of the industry to exotic disease and the value of existing data on forensic contact tracing, enabling policy-makers to make more informed decisions.





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