Consultation on 2027-32 Environment, Natural Resources and Agriculture (ENRA) Research Strategy

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Scottish Government
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Foreword by the Cabinet Secretary for Rural Affairs, Land Reform and Islands

Scotland's natural environment is at the heart of our national identity, our wellbeing, and our economy. Our landscapes, ecosystems, and natural resources are vital, not only for our prosperity, health and wellbeing, but also for our ability to adapt to the challenges of climate change and biodiversity loss.

Our Environment, Natural Resources and Agriculture research programme plays a pivotal role in shaping evidence-based responses to these challenges. This investment reflects our deep commitment to building climate resilience, restoring ecosystems, increasing biodiversity, and supporting rural livelihoods.

The research funded through this programme is already delivering impact, informing key policy decisions across government, including on priority areas such as climate change, agricultural reform, peatland restoration, and environmental protection. It is also supporting sustainable economic growth in rural and island communities.

This strategy outlines our future research priorities, including climate change mitigation and adaptation, sustainable land use, biodiversity and ecosystem restoration, rural and island economic resilience, plant and animal health, and the management of water resources and flood risk. We are also extending our research into new areas, including improving Scotland's wildfire risk assessment and efforts to enhance the resilience of Scotland's food system by identifying key strengths and vulnerabilities and fostering innovation.

The focus of this strategy is to ensure that the research we fund has real world impact not only for our environment but also for communities. We are also keen to ensure that research outputs are enabled through a network of living labs across Scotland; real-world testbeds where communities, researchers, and land managers collaborate to trial and scale up innovative solutions to support adaptive land and water management, biodiversity restoration, and climate-smart practices tailored to local needs.

Foreword by Prof Mathew Williams, Chief Scientific Adviser-ENRA

Environmental and agricultural research is vital for Scotland's people and rural economy. Scottish Government's main way of funding research on this area is via the ENRA Research Programme. This research is primarily delivered via Scottish organisations which have been informing debate and shaping policy in this area for over a century - back to 1899 for Scotland's Rural College (SRUC), 1913 for the Rowett Institute, 1920 for the Moredun Institute, and 1930 for the Macaulay Institute (now James Hutton Institute, JHI). These institutes and others have pioneered a transformation in land management, food supply, and environmental stewardship in Scotland. For instance, work at the Rowett informed UK food policy during wartime in

the 1940s and continues to do so; JHI has bred virtually all British-grown blackcurrants and mapped Scotland's soils; SRUC has improved the efficiency of UK beef and dairy production; Moredun has created key vaccines for livestock, Biomathematics and Statistics Scotland (BioSS) provided expertise to assist with wastewater monitoring during the COVID-19 pandemic. There are many other examples of impact that are detailed within this document.

Now, more than ever, investment in research and development is critical for Scotland. There are great opportunities for innovation using new technology, to allow Scotland to grow its land-based economy sustainably. Scotland has world-class strengths in breeding new varieties of plants and animals to mitigate and adapt to climate change. Its institutes and researchers have built relationships with farmers to develop sustainable operations. Our Centres of Expertise (CoE) have linked researchers to government, finding ways to accelerate progress to net zero, to manage water excess and drought, and to respond to animal and plant health emergencies. Climate change, global political uncertainty, and loss of biodiversity increasingly threaten Scotland's people, land and economy. Scientific research allows us to develop effective actions to resolve these threats.

This document lays out a strategy for investment in research for environment, natural resources and agriculture, for 2027-2032. The strategy has been developed by the Office of the Chief Scientific Adviser ENRA and Rural and Environment Science and Analytical Services (RESAS), the division of Scottish Government responsible for ENRA research delivery. The process of development has included (i) feedback from our Scientific Advisory Board, based on scrutiny of the current programme of ENRA research; (ii) consultation with Scottish Government, particularly the Directorates of Agriculture and Rural Economy, Environment and Forestry, and Energy and Climate Change; (iii) discussions with scientists and other key stakeholders. This consultation is intended to widen participation and draw in feedback from other users of ENRA research, including organisation with an interest in Scotland's land and rural economy.

There are several key refinements in our strategy. We now focus on **missions**, whereby all research delivers against key government priorities. Research will be commissioned for its capacity to deliver impact by **co-working** with policy teams, farmers, or entrepreneurs to meet key challenges for missions. Research will be organised to support **systems thinking**, recognising that the challenges we face are interconnected, and that Scotland has a finite land resource that is subject to many demands. Research needs to be efficient, **sharing data and knowledge** widely. And research needs to take advantage of Scottish Government investments such as the Land Light Detection and Ranging (LiDAR) Programme.
I am excited to share this research strategy. I thank those who have contributed their time to supporting this strategy so far. We will look carefully at all responses to develop the final strategy.

Consultation on 2027-32 Environment, Natural Resources and Agriculture Research Strategy

Contents

1.0 Overview

The Environment, Natural Resources and Agriculture (ENRA) Research Programme is a multidisciplinary portfolio of research. It is structured in five-year cycles to enable long-term strategic research and provide clarity on research priorities and programme structure. This strategy outlines the approach for the next cycle, covering the period 2027–2032.

This is a draft version of the ENRA Strategy prepared for public consultation. The questions that we would specifically like answered and preferred means of response are detailed in Section 6.

The programme covers a broad range of issues critical to Scotland's environmental and agricultural futures including:

- Regenerative and sustainable agriculture
- Optimising Scotland's land-use for multiple objectives
- Protecting soils (including peatland)
- Plant and animal health
- Sustainable food systems
- Circular economy
- Reforming Scotland's land system
- Climate change mitigation and adaptation in ENRA
- Nature loss and biodiversity

Therefore, the programme directly supports Scotland's commitment to addressing global challenges such as the climate and biodiversity crises. The research contributes to key sectors like agriculture, food production, and land management, helping Scotland build a sustainable and resilient economy. The ENRA research programme also maintains strong links to other areas of related research within Scottish Government, including within the health and marine topics.

The Scottish Government's vision for the research programme is:

"***To support research that is relevant, respected and responsive to Scotland's environment, communities, its people and to the rural economy***"

This Strategy sets out how we will achieve this vision. It highlights our research priorities, how we expect our research to achieve impact, the mechanisms we will use to fund research, and the governance structures which will be used during the next cycle from 2027-2032.

Research in the next programme will be delivered through five core Missions aligned with key Scottish Government priorities and specifying the outcomes our research will target:

1. Delivering sustainable and regenerative agriculture and food systems
2. Delivering climate-positive and resilient landscapes
3. Restoring nature and protecting our environment
4. Enhancing rural and island communities
5. Building the circular economy

Underpinning these Missions are a series of more specific Challenges, and further detailed Areas of Research Interest (ARIs). ARIs highlight policy topics where further research is needed to address Challenges.

The ENRA Research Strategy 2027–2032 will adopt an outcome-driven, whole-system approach to deliver impact, defined as the real-world difference research makes — changing lives, shaping policy, strengthening the economy, improving the environment, and enhancing health and wellbeing. To increase the impact of research, we use a 'theory of change' approach to support delivery of:

- well targeted and designed policy interventions assisted by decision support tools, robust data and models,

- wider and deeper uptake of good practice across agricultural, rural and island sectors,
- enhanced readiness and delivery of new technologies and processes to improve economic and environmental outcomes.

The development of the strategy has been informed by the recommendations of the ENRA Research Portfolio Board (RPB)[1], ENRA Scientific Advisory Board (SAB)[2] and the First Minister's Environment Council. These recommendations are summarised below:

- **Priority Research Needs**: Funding must reflect the future priority evidence needs of the Scottish Government.

- **Systems Thinking**: Research should support interdisciplinary working and recognise the interconnectedness of key challenges. SAB recommended mechanisms should be adopted to support cross-programme working and that the connection between policy and research projects should be made clearer.

- **Maximising Impact**: Funding must maximise the impact for research including supporting business innovation, facilitating adoption of good practice and providing evidence-based communication and decision support systems for policy. SAB recommended that the programme should develop a formal Impact Strategy and utilise 'Living Labs' to link science and policy to practitioners.

- **Increase Value:** The programme should maximise value by increasing collaboration with public and private stakeholders and other funders.

- **Supporting Scotland's Research Sector**: the programme should continue to underpin central elements of Scotland's wider agri-environment and biotech sectors, and support Scotland's leading expertise while encouraging research providers to diversify their income.

[2] The ENRA Science Advisory Board (SAB) provides independent challenge and scrutiny of the research delivered through the programme

- **Flexibility and Responsiveness:** The programme must be responsive to changing policy priorities in the delivery of its strategic research.

- **Data Practices**: Promoting data reliability and standardisation across the programme.

[1] The Research Portfolio Board is the lead governance body for the programme. Its members will represent the users of research in Scottish Government and external stakeholders

1.1 Research Purpose

The ENRA research programme will continue to support Scotland's national capacity to:

1. **Provide the evidence and advice needed to deliver on the government's key priorities.** It is the central source of research to inform the government's approach to key areas including Climate Adaptation and Mitigation, Nature Restoration, Agriculture and Land Management. For example, the work undertaken in the programme has been critical to reducing greenhouse gas (GHG) emissions from degraded peatland and developing practical solutions to reducing emissions from Scottish agriculture.

2. **Deliver applied solutions to real world challenges with direct benefits to industry and wider society**. This includes funding the development of prototype vaccines and diagnostic tests for animal diseases and supporting the development of new varieties of fruit, barley and potatoes that are resilient to changing climatic conditions and diseases. These investments are key to longer term food security, and positive climate and environmental outcomes.

3. **Underpin Scotland's wider agri-tech and bio-tech sectors.** In 2023 a report[3] detailing the economic impact of the 2016-2021 Research Programme found that the programme supported around 1,900 research jobs in Scotland directly and indirectly. It also provides a platform to allow Scottish institutes to secure additional funding from other UK and international funders. In 2023-24, £39 million of external income was leveraged because of the programme. It has also supported the creation of spinout companies and wider commercialisation activity in new sectors such as indoor vertical farming.

To achieve these outcomes the investment made by the programme is directed through a variety of routes:

- Long-term research with strategic objectives defined by Missions, Challenges and ARIs. This is delivered through our Strategic Research Programme and associated investment in Underpinning National Capacity.

[3] 2016-22 Rural Affairs Food and Environment Research Programme Evaluation

- Short-term research on more applied problems. This includes through the Responsive Research Fund which supports new research needs which emerge during the programme.
- Expert advice and opinion. This is primarily delivered through our Centres of Expertise which provide specialist advice on subjects where demand is highest.

- Knowledge exchange with stakeholders, including co-construction of new research and delivery of innovations.

We will maintain these funding routes in our next programme cycle but will review individual elements to ensure that the impact of our investment is maximised. This is set out further in Section 5.

During the current research cycle, funding was used to support research at our Main Research Providers (MRPs)[2], a group of Scottish research organisations with specialist expertise in areas directly relevant to the research programme. The MRPs have developed a collective identity as SEFARI (Scottish Environment, Food and Agriculture Research Institutes). These institutes will remain the primary route through which research undertaken by the programme is delivered.

Case Study - Hemp contributing to net zero, nutrition and food security

Hemp has significant potential to support both net zero goals and food security, due to its versatility as a crop, relatively low environmental impact and ability to absorb comparatively large amounts of carbon.

ENRA-funded research at the Rowett Institute has shown that hemp can be successfully grown in Scotland, producing a nutritionally rich seed high in oil and protein. This opens new business opportunities for farmers and the food industry by offering a sustainable alternative to soya-based feed and expanding the range of domestic crops.

Hemp-based ingredients have been incorporated into staple foods, enhancing dietary protein, fibre, and essential nutrients. Notably, hemp cake—a by-product of oil extraction—has been used to replace soya in poultry feed, resulting in nutritionally superior eggs and a lower-carbon supply chain. ENRA-funded work has also shown hemp's value in diversifying agriculture, improving public health, and contributing to net zero. With its ideal omega-6 to omega-3 ratio, hemp oil, along with its co-products like hemp cake and oil fudge, can be used in a variety of food products, including breads, milk alternatives, patties, and sausages, making it a versatile and sustainable option for Scotland.

1.2 Research & Economic Impact

[2] James Hutton Institute, Scotland's Rural College, Moredun Research Institute, Royal Botanic Garden Edinburgh, Biomathematics and Statistics Scotland and Rowett Institute

The Scottish Government's ENRA research programme plays a key role in ensuring that scientific data and evidence is embedded within policy development across government. However, the impact of the programme is far wider.

An evaluation conducted in 2023 found that the research programme delivers significant economic benefits, with the 2016–2022 programme estimated to have generated between £470 million and £680 million in economic impact[3]. This means that for every pound invested Scotland sees a positive return of £2.40. This impact is from a variety of factors, including the economic return on public research, job creation, income generated from spinout companies and intellectual property, reduced greenhouse gas emissions and various social benefits.

The evaluation also found examples of commercial, community and scientific benefits. For example, a range of innovation pathways have been developed due to the ability to leverage funding from the ENRA Research Programme:

- The James Hutton Institute (JHI) campus at Invergowrie hosts Intelligent Growth Solutions. This is Scotland's first indoor vertical farm at a commercial scale which builds on ENRA research to address the key challenges facing the indoor farming industry.
- SRUC's Barony Campus hosts the Dairy Nexus, a hub to drive innovation in the UK dairy industry, focusing on sustainability and productivity. This includes research and development around the biorefining of manure, grass, and milk to create new revenue streams for dairy farmers.
- The Moredun Research Institute developed Barbervax® to treat Barber's Pole worm, a significant roundworm parasite of sheep and goats in the world. Barbervax® is manufactured in Australia by Wormvax, a wholly owned subsidiary of the Moredun, with net profits flowing back to Scotland where they are used to support further research into reducing livestock disease.

Case study - Providing insights into the impacts of climate change on Scotland's natural capital

Scotland's natural capital – its land, water, plants and wildlife – plays a vital role in the economy, supporting around £40 billion of economic output and 261,000 jobs. That is more than 14% of the country's total economic activity. Given this, it is crucial to understand how climate change could affect our natural resources in the future.

[3] Rural affairs, food and environment research programme 2016 to 2022: evaluation report - gov.scot. As the current programme cycle (2022-2027) is not yet complete, a full evaluation has not been undertaken. However, a mid-programme review was conducted in 2023-24 to provide assurance of deliverability, efficacy, and direction of the programme - Environment, Natural Resources and Agriculture (ENRA) research programme 2022-2027: mid-programme review report - gov.scot

Research funded by the ENRA research programme and carried out by the James Hutton Institute has used detailed climate projections to quantify these impacts. The findings show a likely shift from having plenty of water to experiencing water shortages during late summer and early autumn. The research has then identified how this change will affect different landscapes, especially farmland, grassland and broadleaf woodland.

Hotter, drier conditions are also expected to increase the risk of wildfires, which could further damage nature and reduce the benefits we get from it. While some crops might grow better if spring rainfall is good, in general, yields are expected to fall—particularly in areas where soils are poor or cannot hold much water.

These insights have shaped Scotland's latest climate adaptation plan and improved understanding of the risks to nature restoration. The research has also reached the public through national TV, radio and newspapers, helping raise awareness of how climate change could affect our natural environment.

2.0 Outcome Focused Research: Missions

The ENRA Research Programme takes a mission-oriented approach to ensure research is delivered in a systematic and outcome-focused manner.

A **Mission** is a portfolio of projects that target key policy outcomes. Missions can span sectors and scientific/analytical disciplines and are designed to achieve outcomes that surpass what individual projects could accomplish independently.

The following Missions have been created to ensure alignment to Scottish Government priorities and key policy drivers are:

- **Delivering sustainable and regenerative agriculture and food systems**

Focused on safeguarding plant and animal health, improving agricultural practices, and promoting resilient food systems. It also encompasses innovation in disease control, climate adaptation, strengthening food safety and sustainable farming to reduce environmental pollution and boost productivity.

- **Delivering climate-positive and resilient landscapes**

Focused on creating climate-resilient landscapes through optimised land use, and climate positive landscapes through research to reduce emissions and enhance natural carbon sinks. Emphasises systems thinking and leveraging data, modelling, and decision-support tools to mitigate climate impacts, enhance land management, and promote a just transition.

- **Restoring nature and protecting our environment**

Focused on safeguarding and enhancing Scotland's natural resources — its air, land, water, plants and wildlife — so they can continue to support thriving communities, nature, and the economy in a changing climate.

- **Enhancing rural and islands communities**

Focused on strengthening Scotland's rural and island communities, by improving our understanding of service delivery, investment and land reform, alongside the characteristics of diverse rural and island areas. Aims to empower rural and island communities through innovative and place-based research methods, and provision of the right data and tools, to ensure that they can thrive.

- **Building the circular economy**

Focused on advancing circular economy practices through systems thinking, behavioural insights, and material analysis.

Missions are connected, and therefore our funded research needs to build appropriate links across Missions and alignment across projects. The Mission structure (Figure 1) will not only drive our approach but will be used as an

overarching structure to steer, align and focus research across our entire research programme and all funding streams.

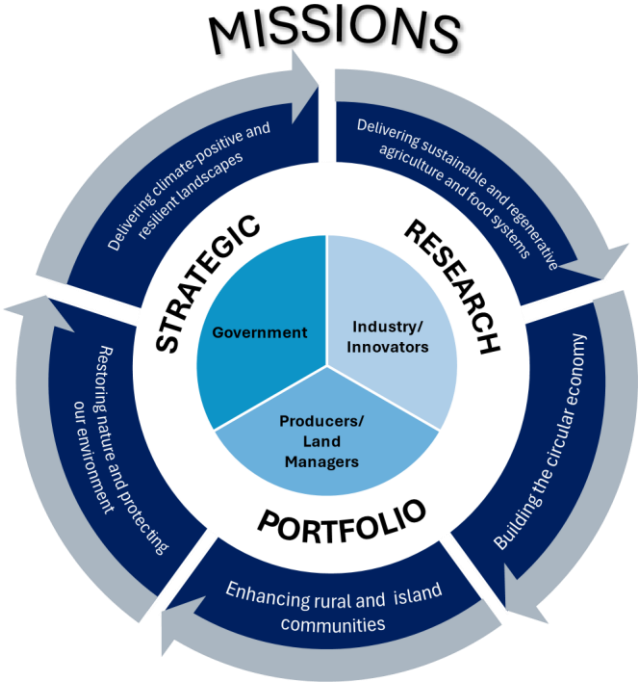

Figure 1: 2027-2032 ENRA Research Strategy approach. The dark blue outer ring shows the five Missions, which are synonymous with impact outcomes. The main customers or stakeholders benefiting from impacts are shown in the centre in lighter blues. Research activities will support one or more missions and engage with one or more stakeholders.

A set of supporting Challenges have been identified to support the Missions. For instance, the Mission to 'Deliver regenerative and sustainable agriculture and food systems' has Challenges focused on: maintaining high plant health status, promoting crop and livestock improvement, and protecting food system resilience. The Challenges are in turn underpinned by Areas of Research Interest (ARIs), indicating where project outcomes are expected to generate significant impact. Further information on the approach to developing ARIs is provided in Box 1.

Missions: A portfolio of interdisciplinary projects

Challenges: A more granular grouping of interdisciplinary projects

Areas of Research Interest: Specific priority questions that the government is interested in

Research Projects: A piece of work that will answer the identifies ARIs

Research will address one or more ARIs and contribute to meeting one or more Challenges, and one or more Missions.

Box 1 - Areas of Research Interest (ARIs)

ARIs are specific research topics or questions that reflect the evidence needs of the Scottish Government. These ARIs identify key priorities where research can support policy development, enhance decision-making, and drive innovation. The following criteria were considered when identifying a priority ARI:

a. Uniqueness to Scotland – an ARI must be directly applicable to Scotland's policy, landscape and/or communities.

b. Multiple Co-Benefits – the ARIs that are the highest priority will have co-benefits and/or serve numerous stakeholders.

c. Links to Scottish Policy - an ARI should have a line of sight to a relevant policy, legislative or delivery challenge for the Scottish Government.

d. Economic Opportunities - The programme should support opportunities for the biotech industry, agri-tech industry, environmental and food and drink sectors.

e. Supporting key research capacity – supporting underpinning expertise to deliver national priorities for Scotland, statutory duties or international commitments.

The full list of ARIs underpinning the strategy is provided in Annex A: Areas of Research Interest and below is a summary of the cross-linkages between Missions and Challenges (Figure 2). The majority of the ARIs align to themes and priorities in the current research cycle. However, several new areas of interest are also captured. These include:

- Developing approaches to assess the risks of wildfire in Scotland.
- Identifying the impact of climate-related food safety risks.
- Investigating barriers to achieving Scottish Dietary Goals.
- Strengthening Scotland’s food system resilience.
- Tackling mis/disinformation while promoting healthier, safe and sustainable food choices.
- Maximising use and value of LiDAR data to better understand our landscape, target policy interventions and optimise land-use.
- Understanding and resolving human-wildlife conflicts to enable nature restoration.
- Developing an approach within Scottish policy to prioritizing chemicals that pose a risk to environmental quality and human health.

- Developing adaptive management approaches for grazers for nature positive and net zero land use outcomes.
- Advancing soil sustainability: developing national monitoring, studying long- term soil amendments, climate impacts, and new methods to detect emerging soil contaminants.
- Exploring private finance options for nature restoration.

Figure 2: Demonstrating the cross-linkages between Missions and Challenges.

Mission: Delivering climate-positive and resilient landscapes Challenges:

- Adapting to climate change
- Protecting and restoring soils & peatland
- Maximising the circular economy and reducing waste
- Protecting and enhancing biodiversity
- Investing in Scotland's natural capital
- Optimising Scotland's land use

Mission: Delivering sustainable and regenerative agriculture and food systems Challenges:

- Ensuring Scotland's food safety
- Maintaining high plant health
- Promoting crop & livestock improvement
- Protecting our food system resilience
- Protecting and restoring soils & peatland
- Protecting and enhancing biodiversity
- Maximising the circular economy and reducing waste
- Reforming Scotland's agricultural system
- Promoting healthy and sustainable food in Scotland
- Improving animal health and animal welfare

Mission: Restoring nature and protecting our environment Challenges:

- Protecting and enhancing biodiversity
- Enhancing Scotland's environment
- Protecting and restoring soils & peatland
- Reforming Scotland's agricultural system
- Maintaining high plant health
- Investing in Scotland's natural capital

Mission: Enhancing rural and island communities Challenges:

- Reforming Scotland's land system
- Adapting to climate change
- Supporting rural & island communities & economies

Mission: Building the circular economy

Challenges:

- Maximising the circular economy and reducing waste
- Reforming Scotland's agricultural system
- Protecting our food system resilience

3.0 An outcome focused approach

The ENRA Research Strategy 2027-2032 will promote an outcome-focused approach to maximise the impact of our research. The approach calls for better targeted and designed policy interventions, wider uptake of good practice across key sectors, cross-cutting research to include behavioural science, and development of new technologies and processes.

A theory of change defines the impact pathway from project activities to the project outputs, leading to outcomes, and finally the impact delivered (Figure 3). Impact requires co-development, with stakeholders engaged at each stage. Stakeholder engagement is vital for research to deliver outcomes for wider society.

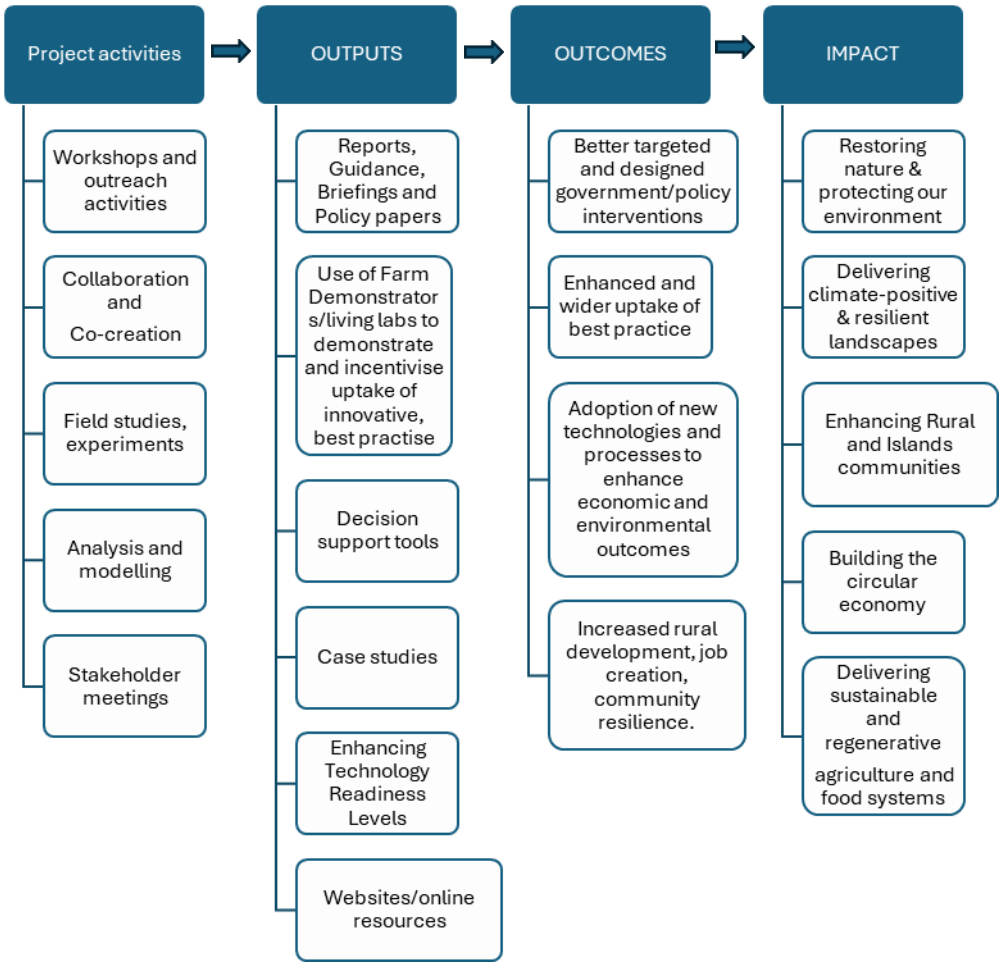

Figure 3: Theory of change impact pathway. All projects will undertake activities (examples in left column) that generate a range of outputs (second column). These outputs are co-created to ensure that they can deliver outcomes (third column), that support our Missions (final column).

We envision achieving impact within our Missions by delivering the following outcomes, detailed in Sections 3.1-3.3 below:

3.1 Decision Support for Policy Impact

The ENRA research programme plays a critical role in supporting evidence-based policy making across land use, agriculture, land reform and natural capital. A key priority for the next programme will be to ensure that data and modelling across the programme are well-integrated and responsive to evolving policy needs, providing robust decision support. This was a key recommendation of the ENRA Science

Advisory Board (SAB) and the First Ministers' Environmental Council (FMEC)[4]. Currently, decision support tools are lacking in key areas. Modelling and data use is fragmented, preventing systems approaches to decision making.

A new data and modelling framework for the 2027-2032 Research Programme (Annex C: ENRA Strategy for Decision Support) is being developed for the programme which will:

- Develop options for more collaborative and interoperable decision-making capability across the programme.
- Support greater standardisation of data management, quality assurance and data reliability practices, to promote greater data sharing and collaboration.
- Deliver enhanced governance and communications arrangements that support greater collaboration across the research-policy interface.
- Support the effective utilisation of the outputs from the Scottish Land LiDAR programme to facilitate better targeted policy interventions and optimise land-use, and to ensure appropriate links are made to other earth observation projects within Scottish Government such as coastal monitoring.

Case study - Helping Scotland's farming sector transition towards net zero

Scotland's agriculture has a critical role to play in supporting rural economies and helping the country achieve net zero. To support this transition in a just way, appropriate evidence on measures to reduce greenhouse gas (GHG) emissions is needed from the national to the farm scale. Research funded by the ENRA research programme (2022-27) and undertaken by Scotland's Rural College (SRUC) has used national scale integrative modelling and analytical methods to identify practical farm level changes to reduce GHG emissions.

This has included detailed farm level modelling of suckler beef systems to identify options for improving efficiency and reducing emissions – e.g. faster finishing times, reduced calving intervals. This work has helped to identify farm measures which would simultaneously reduce farm cost and GHG emissions per animal. Results from this modelling have been used to inform Scotland's Agricultural Reform Programme, in the development of the Committee on Climate Change's 7th National Carbon Budget and in industry by informing the Institute of Grocery Distribution's Net Zero Plan for the food sector.

3.2 Enhanced and wider uptake of good practice for producers/land managers

The scientific research in the programme is targeted at filling knowledge gaps identified in land use and land management. At present, sustainable farming practices/land use approaches are being tested by land managers/farmers. However, this is often at a local/individual farm level meaning it is difficult to assess

[4] First Minister's Environmental Council minutes: May 2025 - gov.scot

the scalability of specific practices, which may be more suited to specific environments. We know that peer-to-peer transmission is critical in land manager uptake of new initiatives and so needs to be central to our systems if we want to effect change.

Living Labs can address this challenge. By moving scientific knowledge into practical action they help drive adoption of good practice, allowing researchers and producers to co-create realistic land use solutions.[5] An example of how Living Labs are currently used in the ENRA Research Programme is provided in the case study box below.

Through the 2027-2032 programme we will:

- Support the formation of a network of living lab initiatives, which are codeveloped with researchers, users and communities to help deliver sustainable land use and land management practices across Scotland.
- Drive innovation in sustainable practices by providing a testbed for new tools and technologies aimed at improving animal, plant and ecosystem health.
- Use living labs to inform government policy and disseminate good practice guidance to land users and communities on sustainability.

Case study – Living Lab

The Lewis & Harris Animal Health and Welfare Project is a successful example of a living lab approach to tackle livestock diseases, particularly sheep scab.

Funded through the ENRA research programme and co-developed with crofters, vets, scientists, and regulators, it shows how working in partnership and putting communities at the heart of decision-making can lead to practical improvements in animal health.

The project included workshops, flock testing, and joint treatment campaigns—helping over 500 crofters and treating more than 60,000 sheep. It also trialed simple at-home worm testing kits, giving crofters the tools to manage parasites more effectively and reduce resistance to treatments.

The project led to real benefits: better animal welfare, improved biosecurity, more sustainable land use, and stronger community wellbeing. It was recognised in the Place-based Impact category at the 2025 Scottish Knowledge Exchange Awards.

Its success has sparked wider change, including a new network for disease control across Lewis, Harris, Orkney, and Shetland. Building on this, a new project led by

[5] Living labs are also key to enabling peer-to-peer learning, the importance of which was highlighted in the recent Knowledge Transfer and Innovation Fund Evaluation (2025).

Moredun and funded through SEFARI is now working with Orkney communities to co-create research that supports both farming and the environment.

3.3 Adoption of new research, technologies and innovations

Innovation is critical to delivering the Missions of this programme and more broadly to deliver economic growth in a competitive environment. New vaccines, practices and diagnostics are needed to support animal and plant health as novel diseases are spread by climate change. New breeds of plants and animals are required to deliver food production resilience to changing climate. Innovative approaches can accelerate the embedding of circular economy practice / approaches, for instance the use of 'Green Sheds' to capture ruminant methane emissions and generate power. eDNA technology has the potential to build better national maps of biodiversity, and hence support action by NatureScot, Forestry and Land Scotland, and other land managers. This research would complement ongoing eDNA initiatives within the Marine Directorate, fostering alignment across terrestrial and marine environments. LiDAR has the potential to accelerate mapping and restoration of peatlands. New codes of practice such as the Peatland Carbon Code have supported investment in natural capital.

The ENRA research programme will aim to deliver and expand innovation pathways, reduce barriers to uptake of innovations and support their adoption and commercialisation. Through the 2027-2032 programme we will:

- Support research to enhance the readiness of innovations, including technology, user, market, societal and regulatory readiness.
- Develop an ENRA innovation strategy, building on the experiences of the MRPs, and supporting the sharing of good practice in commercialisation.
- Nurture links between researchers and commercial partners to enhance collaboration around research and development, particularly in agri-tech and bio-tech areas, and making use of living labs.
- Build links to dedicated enterprise and development agencies in Scotland, the UK and globally to stimulate development.

4.0 Maximising Impact

A new impact framework (Annex B: ENRA Research Programme Impact Framework) will set out how the impact of the investment made in the research programme will be maximised.

Impact in the context of the ENRA Research Programme 2027-2032 refers to the positive changes or benefits that extend beyond academic circles. This includes improvements to the economy, society, culture, public policies, businesses, services, health, the environment, and overall quality of life. Another specific focus will be to strengthen links, thereby increasing impact, with other research programmes within Scottish Government including DG Health and the Marine Directorate.

The impact framework will promote a more outcome focused approach. A summary of the proposed new requirements within the impact framework are as follows:

- Commissioning: Impact will form a key part of the commissioning phase of the Research Programme. Impact pathways will be required to highlight how project outputs and outcomes will deliver on the programme's Missions, linking to key Scottish Government priorities.
- Co-Development: For research to have an impact it must be used by stakeholders. Projects and initiatives commissioned through the Research Programme will be co-developed with research users e.g. policy teams, commercial partners, land managers.
- Evaluation and Monitoring: New reporting requirements will include enhanced annual project Impact Narratives, annual Mission Impact Summaries and annual Mission case studies. Feedback on impact will be provided by the CSA ENRA and the ENRA Scientific Advisory Board.
- Mission Impact Officers and project Impact Champions will support and champion a culture of impact across the programme working closely with RESAS and the Office of the CSA ENRA.
- Communicating Impact: We will promote the Impact of the Research Programme by highlighting case studies. We will also introduce an impact prize at the annual ENRA Science, Evidence and Policy Conference.

5.0 Delivering Our Investment

To deliver the research priorities set out in this Strategy, the programme will use five key funding mechanisms:

1) Strategic Research Programme (SRP)

- Longer-term (3-5 years) research which provides evidence relevant to Scottish Government ARIs.
- We will continue to use the MRPs to deliver the strategic research programme and will allocate resources accordingly.
- Processes that ensure flexibility and the ability to rapidly commission new, emerging areas of research need in the delivery of the strategic research will be maintained and developed.

2) Underpinning National Capacity Programme (UNC)

- The Underpinning National Capacity programme will continue to fund the maintenance of national collections of crops (such as potatoes, barley and soft fruit) along with pest and pathogen collections.
- New services will be expected to support the outcome focused approach discussed above including data and modelling capabilities and encouragement of utilisation of living labs.

3) Responsive Research Fund

- This flexible programme will deliver Scottish Government priority-led responsive projects. Medium-term research responding to new, unforeseen policy needs which emerge throughout the duration of the programme.
- The ability to deliver projects in collaboration with other UK funders or industry stakeholders to maximise the value and impact of our investment.

4) Centres of Expertise

- Centres of Expertise work at the interface between policy and research. They provide responsive work in areas of high policy importance: climate change, animal disease outbreaks, plant health, and water resources, drawing upon expertise from a range of different institutions and linking to policy teams.
- As part of the development of the next programme cycle, we will review the scope of subjects covered by the Centres of Expertise to ensure that the impact of our investment is maximised.

5) Impact Investment

- Funding used to deliver initiatives to maximise the impact of our research on government, business and public. Investment will be linked to the updated impact approach and deliver existing effective knowledge exchange tools. Funding here would deliver support for living labs and for innovation pathways, for example.

5.1 Governance & Reporting

Governance

The main components to the governance structure for the research programme detailed in Figure 4 below. No changes are envisaged from the current governance structure.

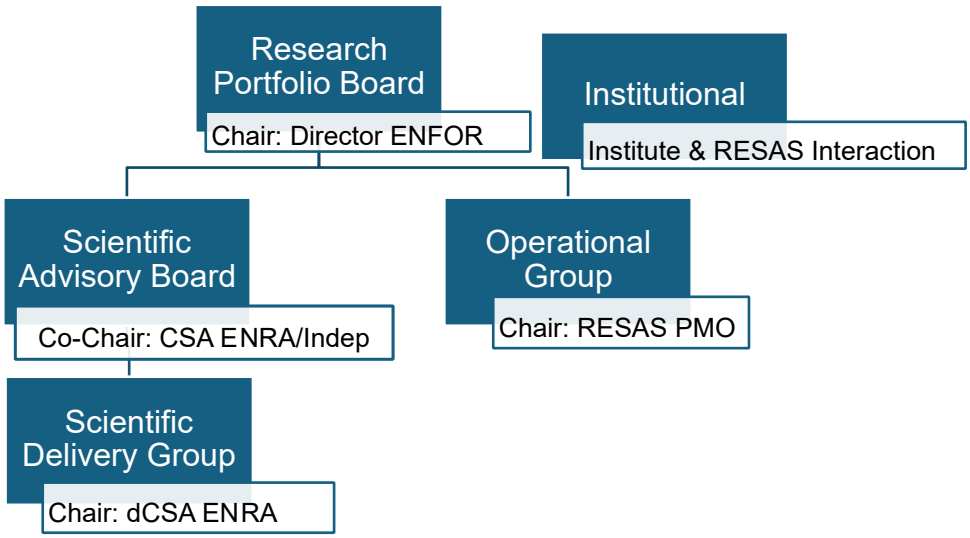

Figure 4: Governance structure for the research programme.

The **Research Portfolio Board (RPB)** oversees the whole programme on behalf of Scottish Ministers. It is responsible for ensuring the programme meets the priorities set out in this Strategy. The RPB is briefed by the Main Research Institutions to understand their operational status.

The **ENRA Scientific Advisory Board (SAB)** reports to the RPB and provides independent scrutiny and evaluation of the quality of research within the programme.

The **Operational Group** focuses on operations, finance, metrics and reporting. Attending it are officials from both the MRPs and Scottish Government at a mid-level, working through operational issues as they arise.

The **Scientific Delivery Group (SDG)** supports the SAB and promotes scientific alignment across the missions within the programme. Attending it are researchers from MRPs and Scottish Government officials at a mid-level, actioning key recommendations from the SAB.

6.0 Summary of questions for consultation

Overall Strategy

1. The research strategy outlines a new outcome focused approach with five core Missions and a set of corresponding Challenges. Do you think this is the right approach to take?
2. Do you think the research strategy will enable us to get the best research and scientific evidence from the best providers?
3. Do you support the proposals on delivering our investment, including the five key funding mechanisms and governance approach?
4. Do you have any other comments or suggestions on any part of the Strategy?

Impact Approach

5. Do you think the proposed Impact Framework is an appropriate way of defining, monitoring and evaluating the impact of research funded through this programme?

Areas of Research Interest

6. The government evidence needs are being captured as Areas of Research Interests within the Strategy. Do you think this is the right approach to take?
7. Do you agree that the key ARI questions are captured within the strategy?

Impact Routes – Decision Support, Living Labs and innovation

8. Which actions relating to data, data analysis, and modelling should the ENRA research programme prioritise?
9. What barriers exist to delivering effective data analysis and modelling in the current ENRA Research Programme?
10. Which principles relating to the delivery of analysis and modelling are most important (e.g., collaboration, innovation, impact)?

11. Is the Living Labs approach for co-production appropriate, and how could it be enhanced or adapted?
12. Is the Innovation approach well designed? How can it be improved?

Annex A: Areas of Research Interest

Areas of Research Interest in supporting documents.

Annex B: ENRA Research Programme Impact Framework

1. Purpose

Annex B sets out a proposed Impact Framework that describes the approach to defining, monitoring and evaluating research impact in the forthcoming ENRA 2027-2032 Research Programme.

2. Definition of Impact

In the context of the ENRA Research Programme 2027-2032 impact is defined as **"the real-world difference research makes — changing lives, shaping policy, strengthening the economy, improving the environment, and enhancing health and wellbeing."**

This refers to the positive changes or benefits that extend beyond academic circles. This includes improvements to the economy, society, culture, public policies, services, health, the environment, and overall quality of life.

3. Approach

The proposed Impact Framework will be embedded within the strategic approach to the next ENRA research programme 2027-2032. The research set out in the ENRA Research Strategy will be centered around a series of 'Missions for Scotland', each underpinned by a set of supporting Challenges aligned with Scottish Government priorities and key policy drivers (Figure 5):

- Delivering sustainable and regenerative agriculture and food systems
- Delivering climate-positive and resilient landscapes
- Restoring nature and protecting our environment
- Enhancing rural and island communities
- Building the circular economy

Missions	Challenges	Scottish Government Policy Areas

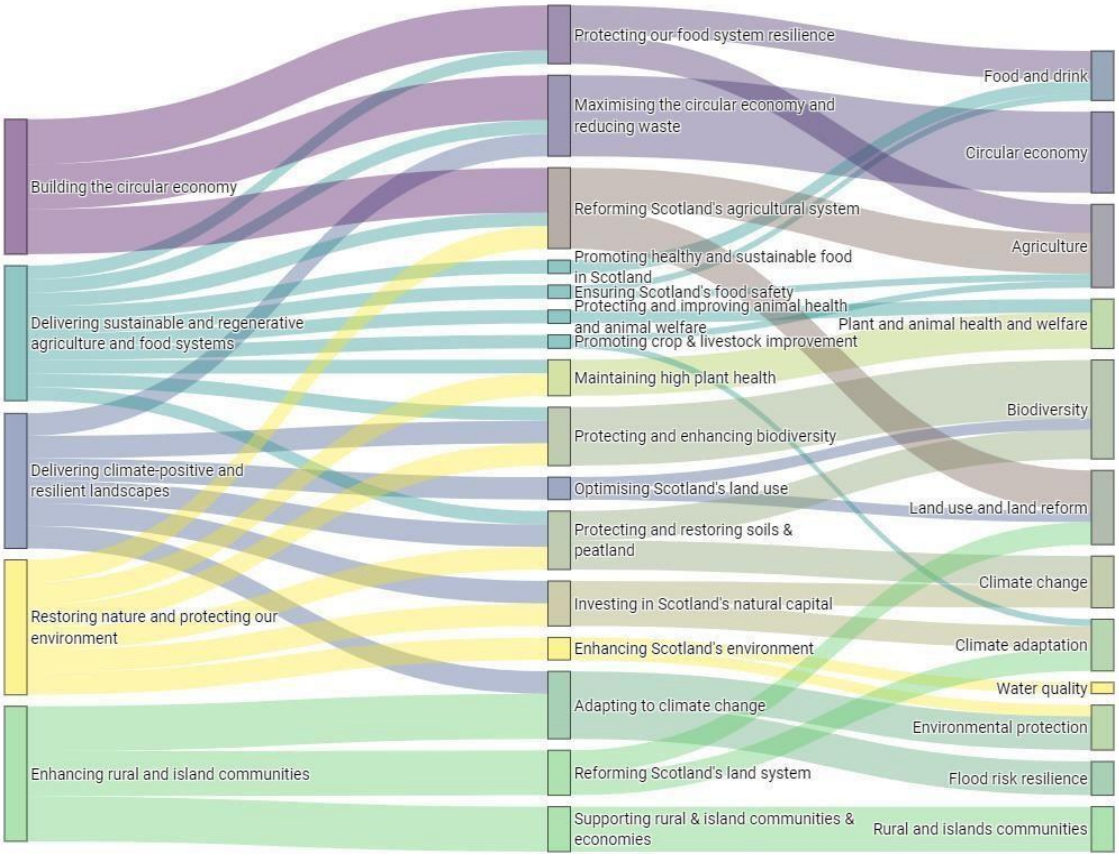

Figure 5: Shows the relationship between Missions, Challenges and Scottish Government policy areas.

Impact

The five 'Missions' can also be defined as the **ENRA research programme 'impact areas'** (see Figure 5) i.e**.** they define the areas that benefit from the project outputs and outcomes.

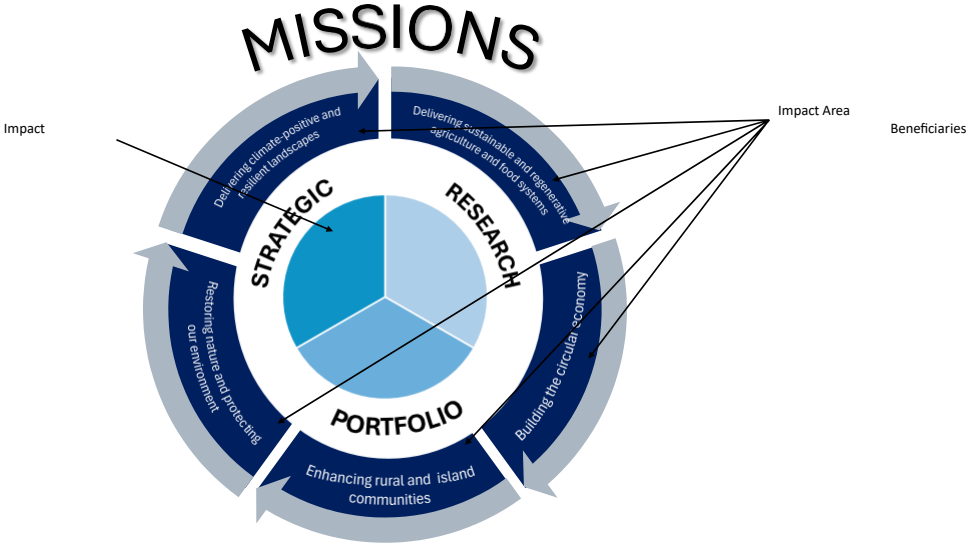

Figure 6. 2027-2032 ENRA Research Strategy approach. The dark blue outer ring shows the five missions, which are synonymous with impact areas. The main impact beneficiaries are shown in the centre.

It is important to note however that while the outputs and outcomes of the ENRA research programme will deliver significant impacts from 2027 to 2032, it is anticipated that longer term benefits will also accumulate, from this and previous research programmes, into the future. These longer-term cumulative impacts will take time to develop, however the outputs and outcomes in the ENRA research programme 2027-2032 will lay the foundations for these to happen**.**

Impact beneficiaries or customers for the ENRA research programme 2027-2032 include government, industry and innovators and producers/land managers and impacts could be realised for each in one or more of the missions/impact areas (see Figure 6).

Outputs

The outputs of the ENRA research programme are the tangible research products i.e. knowledge, resources or decision support tools[6] delivered or produced by projects within each Mission (see Figure 3). However, impact can be achieved throughout the lifetime of a project through research activities such as co-production processes, meetings/engagement with stakeholders, workshops, briefings and graphics. It could also result in the use of living labs/farm demonstrators to demonstrate and incentivise uptake of innovative best practise. The final project output such as a report, guidance or new model or system support tool should therefore not be considered the only impact delivered.

Outcomes

Outcomes are the ways in which research outputs are used to inform and

influence decisions and behaviours by impact beneficiaries. ENRA research programme will look to deliver impact on its Missions through four main types of outcomes i) better targeted and designed government/policy interventions, ii), enhanced and wider uptake of better practice, iii) creation and adoption of new technologies and processes to enhance economic and environmental outcomes, e.g. for business and iv) increased rural development, job creation, and community resilience (see Figure 7). These outcomes will help achieve impacts that will deliver wider environmental, economic and societal impacts for the ENRA Missions.

[6] Decision support tools assist individuals/groups make more informed decisions, by providing structured guidance, analysis or insights. This could range from simple checklists to complex models and software programs that analyse large data sets and predict outcomes.

The ENRA SRP Theory of Change Impact Pathway

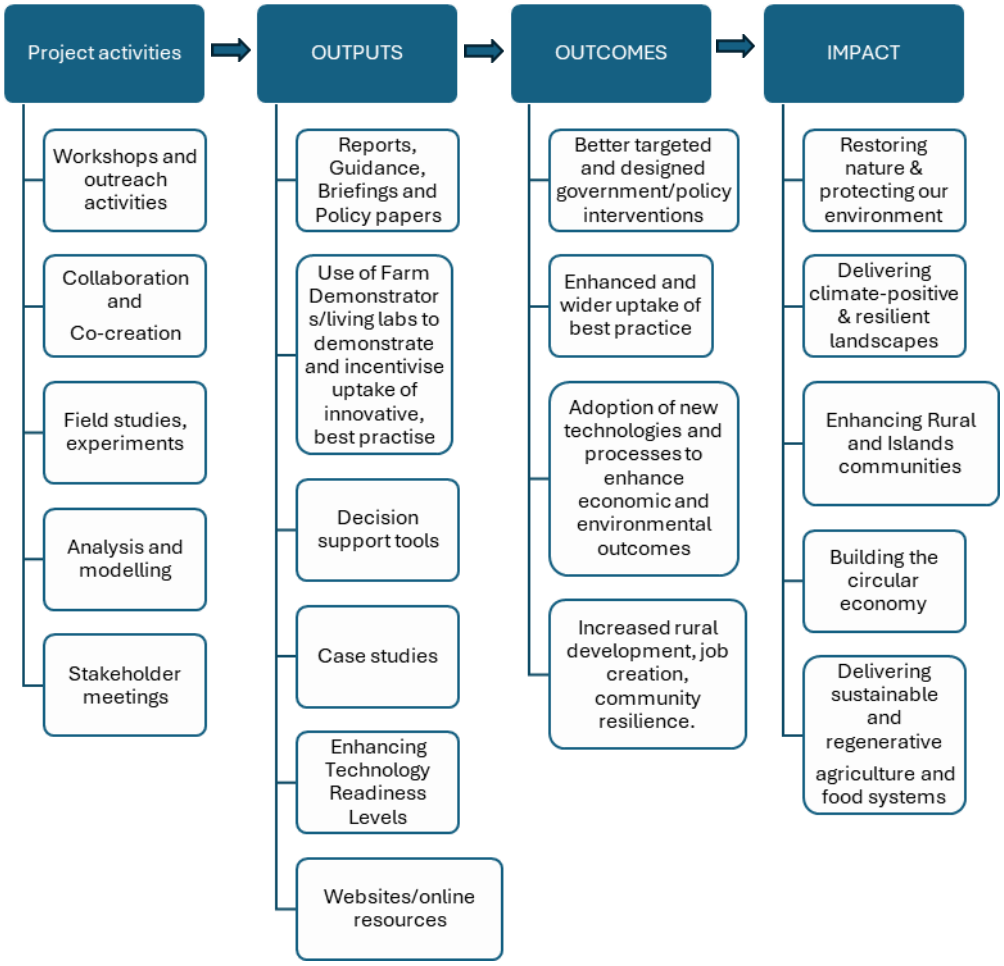

Figure 7. The ENRA SRP theory of change Impact Pathway shows the journey from the range of research/project activities to the project outputs, leading to outcomes, and finally the impact delivered. Impact requires that beneficiaries are engaged in each process, starting with activities.

4. Plan for Impact - Commissioning

Start with the impact we want to have.

By strategically thinking about the impact from the beginning of the research programme we can increase the likelihood of realising it.

Researchers will be asked to use an impact planning tool when drafting research proposals, i.e. theory of change, to map out the anticipated **impact pathway** for a project, highlighting how the project outputs and outcomes will deliver impact on the Missions, linking to key SG priorities. The theory of change is a schematic presentation with a narrative or illustration such as a logic model that shows how a project can bring about the desired change or outcome (see Figure 8). This approach will provide information on the expected timescales between activities, outputs, outcomes and impacts, external enablers and barriers to achieving the

intended impacts and underlying assumptions relevant to the pathway being achieved. In a theory of change, assumptions are the core beliefs or conditions that are considered true and necessary for the intervention to achieve its desired outcomes. They represent the underlying logic of the program and explain why certain activities are expected to lead to specific changes. Essentially, they are the conditions that need to hold for the theory of change to work effectively.

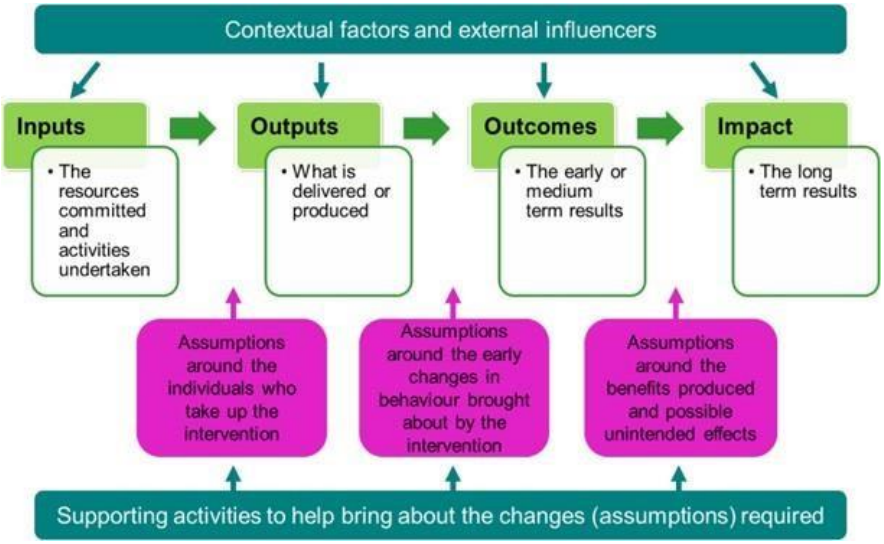

Figure 8. Example of a linear Theory of Change (based on Mayne 2017[7]). The figure depicts a straightforward, sequential progression of activities where interventions lead to specific outcomes, with a focus on direct benefits and behavioural changes.

Developing a theory of change typically involves considering the proposed inputs (what investment/regulation/actions will take place) and the causal chain that leads from these inputs through to the expected outputs and outcomes. It considers the causal mechanisms by which an intervention is expected to achieve its outcomes, basing this theory on the gathering and synthesis of evidence.

Researchers will also be expected to develop project proposals in a co-creative and collaborative way with research users/stakeholders i.e. policy teams and key partners. **Co-production will also be expected throughout the lifespan of the project. To emphasise this approach, it is suggested that researchers are asked to identify/map their key stakeholders/policy customers as part of their project bid**. Researchers should be invited to take a tailored approach and consider questions such as: Who needs to know what, and why? How can stakeholders use the research output? Where might outputs influence their policy/work/process?

[7] Mayne, J. (2017). Theory of change analysis; Building robust theories of change. Canadian Journal of Program Evaluation / La Revue canadienne d'évaluation de programme 32.2 (Fall / automne), 155–173 doi: 10.3138/cjpe.31122

5. Impact Monitoring

The annual reporting requirements for the 2022-2027 Research Programme require project Principal Investigators (PIs) to submit onto Researchfish a Narrative Summary, including a 250-word Impact Narrative. Feedback following the Researchfish 2023-24 Narrative Report, noted that while excellent examples of impact were demonstrated, there was a wide variance in the quality of the impact narratives and the evidence provided.

The Proposed Changes for the 2027-2032 SRP

The following section sets out how we intend to monitor and evaluate evidence of impact and record the pathway to help achieve impact of the ENRA Research Programme from 2027 (see Figure 9).

It is proposed that the additional annual Impact Narrative question continues to be part of the annual **Narrative Summary** with a small increase in word count from 250 to 500 words. The purpose of the Impact Narrative is to give a more detailed summary of the project impacts over the year, highlighting successes or changes to the impact pathway, and providing a chance to detail new or previously unforeseen impact opportunities. PIs will be encouraged to record project activities, which deliver impact such as workshops and outreach activities, policy briefings and interactions/engagements with policy customers and stakeholders. This will enable PIs to demonstrate the significance and breadth of impact. Testimonials from stakeholders who have used or benefited from the project could be used for example to help evidence/highlight impact.

It is proposed that an annual **Mission Impact Summary** (no more than 4 pages) is also produced by the Mission Impact Officer (see below) summarising impact across the Mission. Mission summaries will draw upon project Impact Narratives.

Figure 9. Summary of Impact Reporting Requirements for 2027-2032 SRP

It is acknowledged that while there will be continuity for some work from the 2022-2027 research programme, with a clearly defined impact pathway, the route to impact for some new projects is not always certain at the start of the project. The proposed approach is therefore intended to foster a flexible and agile approach to impact. PIs will be required to regularly review the project's impact pathway and to

work in a collaborative/co-production way with their policy customers/stakeholders to address issues and capitalise on new, unforeseen opportunities to maximise impact during the course of the project.

Impact Case Studies

It is proposed that a series of Impact Case Studies (2-3 per Mission) are developed annually over the course of the programme to demonstrate the impact of the ENRA SRP. These will be published on the SEFARI Gateway website following review by the CSA ENRA and Scientific Advisory Board members. Impact Case studies should describe and evidence how the SRP science and research has made a material contribution to a particular Mission and how the research funded through the SRP has strengthened the link between research and societal impact by promoting high-quality research that delivers measurable benefits to society, the economy and/or the environment.

The impact included in the case studies must have occurred within the 2027-2032 SRP programme but may reference research from previous programmes recognising the long-term nature of the research programme.

How will the Impact Narratives, Mission Impact Summaries and Case Studies be used?

The annual project Impact Narrative will be used to monitor and evaluate project funding. It will be uploaded onto Researchfish. The summary will inform Mission Impact Summaries and will be available on SEFARI Gateway webpages.

Mission Impact Summaries and Case studies will be used to monitor and evaluate the outcomes and impact of the SRP and will be available to Boards within the governance structure of the research programme 2027-2032. The process will mimic the Research Excellence Framework (REF) evaluation of UK Higher Education Institutes.

Clear guidance on how to complete impact reporting and what constitutes impact will be provided. Impact training will be made available to PIs for creating a theory of change impact pathway and impact reporting through the Centre for Knowledge Exchange and Innovation (CKEI) and Mission Impact Officers.

Roles and Responsibilities:

Mission Impact Officer

To support and champion a culture of impact across the programme it is proposed that two Impact Officers are appointed for each Mission from 1-2 of the SEFARI Institutes/CoEs. The role of the Impact Officer would be to lead and motivate a culture of impact across the ENRA SRP; Impact Officers will support researchers to deliver impact by building capacity and capability across the Institutes they will be key in; supporting and facilitating the generation of impact; increasing awareness and communication of impact; coordinating stakeholder identification and engagement; supporting and leading the monitoring, evaluating and recording impact; developing Mission Impact Summaries and Case Studies, and tracking progress.

Impact Officers would provide support and guidance to PIs annual impact reporting, would coordinate and produce annual Mission level Impact Summaries and coordinate the delivery of case studies across the Mission.

The Impact Officers would also have a role to look across the Missions to ensure the co-benefits of project outputs are realised and reported and to identify opportunities to increase impact i.e. where outputs from one Mission may be relevant to the outcomes of another Mission for example. This work would support efforts to break down silos and promote cross-Mission working. It is suggested that Impact Officers working with the CKEI could lead an annual impact meeting/workshop highlighting and championing positive examples of impact and sharing examples of best practise.

The Impact Officers would also be the first point of contact for Scottish Government on Impact.

Project Impact Champions

Each commissioned project within the SRP will have an identified Impact Champion who will support the activities of the Impact Officer to promote and report project impacts. The impact champion can change throughout the course of the project.

Topic Leads

Scottish Government Challenge Leads will continue to review quarterly reporting of milestones, deliverables on Researchfish. They will also review the annual project Impact Narratives. This activity, however, will be supported by Mission Impact Officers.

6. Evaluation

The impact of the SRP will be evaluated at project level by Scottish Government Challenge Leads. Challenge Leads will review annual impact narratives for their projects and feedback will be provided to Impact Officers and PIs as appropriate.

The annual Mission Impact Summaries will be reviewed and assessed by CSA ENRA and the ENRA Scientific Advisory Board. Feedback will be provided to Mission Impact Officers.

CSA ENRA and the ENRA Scientific Advisory Board (SAB) members will also review a number of impact case studies for each Mission.

7. Communicating for Impact

The benefits and importance of capturing and communicating the impact of the ENRA research programme research outcomes, Underpinning National Capacity (UNC) and CoE, to government and other key stakeholders are clear. Clear and demonstratable impact will enable Scottish Government to show the value of embedding environmental and agricultural evidence in the policy decision-making process, the positive impact for business, innovation and wider society and will be able to use this evidence to support the case for continued investment.

The audience is defined as the impact beneficiaries or customers i.e. Government, Industry and Innovators and Producers/Land managers.

Scottish Government already supports several routes to raise awareness of the impact of the ENRA research programme; for example - there is a monthly newsletter, regular events including an online Seminar Series focusing on discrete elements of the programme and an annual ENRA Science, Evidence and Policy Conference, which covers the breadth of the research programme. It is suggested that further opportunities to build on this activity could include:

- Impact Case studies - Impact case studies are already published on the SEFARI Gateway website[8] but these could be developed further and increased in volume. Case studies will be proactively shared with policy teams and stakeholders or post on social media.
- An impact prize (*non-monetary*) (including an Early Career impact prize/category) could be incorporated into the ENRA Conference. This could be judged by a panel including academic, policy, stakeholder/industry representation.

Policy Engagement and Co-production

For research to have an impact it must be used by stakeholders. Evidence suggests that co-productive forms of research offer increased potential for academic, economic and social impact. Its potential benefits include:

- facilitating more holistic research, including the representation of different knowledge systems
- bringing greater accountability of publicly funded research
- building trust between researchers, policy makers, and other stakeholders

Researchers should be encouraged to engage in activities that promote collaboration throughout the delivery of research programme on for example: co-development workshops, ongoing engagement meetings, impact events and visits to Research organisations and secondments/work shadowing opportunities (SEPAL).

Feedback on how research outputs are used by impact beneficiaries such as policy teams/stakeholders will be encouraged. A potential mechanism would be to introduce use of the **Single-Product Evaluation for Immediate Delivery (SPEIDY[9])**

SPEIDY framework Academic Report – March 2020

[8] Case Studies | SEFARI

[9] Saidi, N (2020) Evaluating the anticipated policy impact of research outputs: introducing the

Feedback Questionnaire on a Research output – which provides a picture of the likelihood of research use.

8. Conclusion

A summary of the key points:

In the context of the ENRA Research Programme 2027-2032 impact is defined as **the real-world difference research makes — changing lives, shaping policy, strengthening the economy, improving the environment, and enhancing health and wellbeing."**

This refers to the positive changes or benefits that extend beyond academic circles. This includes improvements to the economy, society, culture, public policies, services, health, the environment, and overall quality of life.

- **Commissioning**: Impact will form part of the Invitation to Tender for Grant Funding (ITGF) process for the ENRA SRP 2027-2032. Researchers bidding for funding will be asked to use an impact planning tool when drafting research proposals i.e. theory of change to map out the anticipated impact pathway for a project highlighting how the project outputs and outcomes will deliver impact on the Missions, linking to key SG priorities. This approach will provide information on the expected timescales between activities, outputs, outcomes and impacts, external enablers and barriers to achieving the intended impacts and underlying assumptions relevant to the pathway being achieved. Risk mitigation plans for mitigating against impact fail should also be included. Researchers will be encouraged to go through a Theory of Change workshop ahead of project initiation with the Mission Impact Officer.
- **Co-Development:** Researchers will be encouraged to co-develop project proposals in a co-creative and collaborative way with research users/stakeholders, i.e. policy teams and key partners. Co-production will also be expected throughout the lifespan of the project. To emphasise this approach researchers are asked to identify/map their key stakeholders/policy customers as part of their project bid, and their processes of engagement. Policy customers/stakeholders will be encouraged to provide feedback on research outputs.
- **Training and Guidance**: Clear guidance will be provided on how to complete impact reporting and what constitutes impact. Impact training will be made available to PIs for creating a theory of change impact pathway and impact reporting through the CKEI and Impact Officers.
- **Monitoring:** For the 2027-2032 SRP the following impact monitoring steps will be requested as part of the reporting and evaluation requirements: i) increased annual project Impact Narratives, ii) annual Mission Impact Summary, iii) annual Case Studies.

- **ENRA SRP 2027-2032 will have Mission Impact Officers:** to support and champion a culture of impact across the research programme it is proposed that 1-2 Impact Officers are appointed for each Mission from 1-2 of the

  SEFARI Institutes/CoEs. **Each project will also have an identified Impact Champion to support the activities of the Impact Officer.**

- **Evaluation:** Scottish Government Challenge Leads will review quarterly impact updates and annual impact narratives for their projects. The annual Mission Impact Summaries and Case Studies will be reviewed and assessed by CSA ENRA and the ENRA Scientific Advisory Board annually.
- **Communicating Impact:** Scottish Government will promote Impact Case Studies to ensure that research programme achievements are recognised. Scottish Government will introduce an Impact prize.

Annex C: ENRA Strategy for Decision Support

Introduction

The ENRA Decision Support Strategy sets a clear direction for enhancing the analytical capabilities of the 2027-2032 ENRA Research Programme. It focuses on strengthening the modelling and analysis activities delivered through the Strategic Research Programme, including supporting Underpinning National Capacity activities, to ensure a more integrated approach across the programme.

This strategy addresses current challenges and explores alternative approaches to meet future demands. Grounded in the principles of evidence-based decision-making, innovation, and alignment with national guidance and standards, it sets a vision for the development of Scotland's modelling and data analysis capabilities within the ENRA research programme over time. It aims to deliver long-term improvements by addressing current barriers and enabling more consistent, collaborative, and policy-relevant use of data and models.

This strategy focuses on modelling for decision support, and the underpinning data activities that support modelling, within the 2027–2032 ENRA Research Programme. Specifically, those activities organised through the Strategic Research Programme and Underpinning National Capacity. It also offers an optional framework through which other delivery partners can engage. The following activities are within the scope of this strategy:

- Modelling activity funded and delivered through the 2027-2032 ENRA Research Programme's Strategic Research Programme (SRP).
- Underpinning data and related processes that support modelling and analysis within the SRP, including data sharing, processing, quality assurance, and analytical workflows.

Purpose and Guiding Principles

The guiding principles of this strategy are:

- **Working for the Public Good**: Data and models are treated as shared assets that inform public policy and maximise societal benefit, delivering good value for public money. This includes ensuring that work with new and emerging technologies is ethical and transparent.
- **Co-Design and Collaboration**: Researchers, policymakers, and stakeholders will be engaged through consultations and workshops to co-create feasible and ambitious solutions.
- **Delivering Impact**: Data analysis and modelling activity underpin much of the wider research activity in the 2027-2032 ENRA Research Programme. This strategy will ensure analysis and modelling outputs support better policy outcomes and deliver cross-programme impact.

The desired modelling and underpinning data analysis outcomes for the 2027-2032 ENRA research programme, informed by these principles, are:

1. **Ensuring traceability and transparency in how data, analysis, and models inform decisions.**
2. **Enabling timely, evidence-based policy decisions through accessible, high-quality analysis and modelling.**
3. **Fostering a culture of reuse, collaboration and active engagement across research and policy communities.**

By delivering on these outcomes, the ENRA research programme will be better positioned for long-term success. Greater consistency and coordination in how underpinning data analysis and models are managed could help minimise duplication, encourage collaboration, and increase the overall utility of research outputs.

Vision for Modelling in the Research Programme

Ensuring a more integrated and accessible approach to modelling, and underpinning data, is a key priority for the next research programme. This annex sets out a series of guiding principles that reflect the Scottish Government's vision to improve how data, analysis and modelling are used across the programme and deliver decision support tools for government. These principles are intended to foster greater transparency, timeliness, and collaboration in research and policy contexts. By promoting integration, collaboration, and improving access to data and models, the vision seeks to support more coherent, responsive, and evidence-informed decision-making.

- **Ensuring traceability and transparency in how data, analysis, and models inform decisions.**
  - Building consistent approaches to underpinning data definitions and standards for analyses.
  - Enhancing collaboration by improving cross-programme visibility of the most actively used datasets.
  - Facilitating data linkage by identifying and sharing work across the programme that addresses common linkage challenges.
  - Ensuring open sharing of code using effective platforms, and ensure clarity on model assumptions, inputs and products.

- **Enabling timely, evidence-based policy decisions through accessible, high-quality analysis and modelling.**
  - Emphasising interoperability, collaboration, and coherent messaging in the delivery of models and analyses.
  - Empowering analysts and modellers to experiment with new approaches and advance the state of the art.
  - Committing to the role of clear, traceable quality assurance practices in delivering robust, reliable outputs.

- **Fostering a culture of reuse, collaboration and active engagement across research and policy communities.**
    - Building stronger relationships between modellers, analysts and their policy partners to increase the relevance and impact of modelling.
    - Creating new channels for policymakers to engage with the modelling community and raising awareness to help improve the understanding of modelling activity across Government.
    - Addressing barriers to the effective sharing of data, methods, and insights that limit the policy impact of modelling and analysis.

Recognising the diversity of modelling needs, data types, and organisational contexts within the programme, a 'one size fits all' approach is not appropriate. Instead, the research programme must encourage flexibility and innovation, providing a framework that can evolve as technology, policy priorities, and user needs change. Where helpful, the strategy will draw on relevant public sector guidance on data and reform to support consistency and collaboration. Established frameworks like the Green Book, Magenta Book, Aqua Book, and the Scottish AI Playbook offer useful principles for ensuring quality, transparency, and relevance in analysis and modelling.

Governance Support for this Vision

As the research programme is developed, we will explore how enhanced governance can help align modelling activity with strategic aims. Potential areas for a modelling governance framework to explore are:

- Facilitating clearer communication between researchers and policymakers.
- Keeping the wider research community informed of changes to key underpinning datasets that could impact their work.
- Giving researchers avenues to highlight challenges, opportunities, and limitations of data, analysis and modelling to policymakers.
- Providing policymakers with greater opportunities to have regular, responsive engagement with models and analyses.

The overarching objective of the governance framework will be to foster collaboration and integration between different areas of modelling and analysis in the program. This will be a proportionate approach and will not be, for example, a forum for approving changes to individual models or for directing the development of models.

As part of any governance, it will be important to understand how mechanisms are supporting better integration, collaboration, and use of modelling across the programme. This could involve identifying broad indicators of progress, embedding regular opportunities for reflection, and creating inclusive ways to gather feedback from those involved in research and policy. These activities can help ensure that governance remains adaptive, learning-focused, and responsive to the evolving needs of the programme.

Enablers

As well as timely and effective governance, several enablers are key to delivering on the vision detailed above. These include:

- **Skills and capacity development –** Identifying and supporting opportunities for engagement and knowledge exchange between the research community and the Scottish Government to build long-term capacity and alignment. This includes fostering a shared appreciation of research lifecycles, analytical best practices, and the contexts in which evidence is used.
- **Innovation and use of emerging technologies** - To ensure the research programme remains forward-looking, we must encourage exploration of emerging technologies. This may include AI and Machine Learning for pattern detection and predictive modelling, data from LiDAR and high-resolution remote sensing for environmental monitoring.
- **Best practice for model and data integration** –Establishing shared principles for integrating models and data is essential to delivering the vision. This requires collaboration across the research and stakeholder communities and alignment with international standards and exemplars.

Next Steps

We are keen to receive feedback from stakeholders on the proposals set out above. Details on how to respond are provided in Section 6 of this document. In addition, we will be undertaking further engagement sessions with researchers and end-users to explore how these objectives can be most effectively embedded within the programme.

Annex D: Integrating Research and Real-World Solutions: The Role of Living Labs in Scotland's Regenerative and Sustainable Agriculture and Land Management Strategies

Introduction

A key impact challenge for the research programme is to support changes to land use and land management practice that deliver against multiple objectives from a finite land resource. Change processes must acknowledge historical patterns of management and use, the knowledge and skills of land managers, ongoing climate change, and global economic uncertainty.

The scientific research in this programme is targeted at filling knowledge gaps identified in land use and land management. However, translating science and evidence into outcomes requires further steps. Engagement between researchers and practitioners (farmers, crofters, land managers) is critical. In a theory of change, outcomes (like sustainable, regenerative agriculture) arise from outputs, like improvements to management practice, deployment of innovations, changes in land use, coordination with wider networks on shared goals and so on. Research can provide inputs to support delivery of these outputs. But a co-creation and/or codevelopment process is critical to moving from lab study to field implementation, from experiment to farm decision making, and from model to landscape reality.

Living Labs (LL) are designed to help land managers apply better or best practices in working landscapes. They bring together scientists and practitioners to work on real-world economic and sustainability challenges. By combining scientific research with practical experience and delivery, LLs encourage shared learning, innovation, better understanding of problems and solutions, and identification of realistic and just solutions.

LLs promote collaboration across different fields and types of knowledge. Their success depends on trust among participants and long-term observation of results. In Scotland, it's especially important to consider the variety of landscapes and land uses. LLs can help create region-specific solutions and should be seen as a key part of national research efforts. LLs turn scientific knowledge into practical actions through deep collaboration.

Living Labs are flexible and varied, requiring engagement with the relevant land managers (farmers, crofters, forestry, FLS), regulators (SEPA, NatureScot) and/or other stakeholders (supply chains, local government, utilities, community groups, eNGOs). Good baseline data (e.g. on biodiversity, greenhouse gases, or production) is essential. With stakeholder support, research can then test new practices to see if they improve outcomes. Potential examples could include:

1. **Agroforestry Living Lab**. How can agroforestry practices deliver sustainable solutions? What are the costs and benefits of silvopastoral practice in terms of economics, nature and climate?
2. **Circular Bioeconomy Living Lab**. How can the circular bioeconomy deliver multiple benefits to farmers, from methane capture to power generation?

3. **Uplands Living Lab**. How can very low agriculture capability land be used to maximise value to local communities and meet national climate and nature goals? What are the options to support deer management, peatland restoration and rural communities?
4. **Regenerative Agriculture Living Lab**. How do varied proposed regenerative farm practices influence outcomes for biodiversity, climate and productivity, and the trade-offs among these?

There are many other options, and these are only provided to aid discussion and co-development of the optimal configuration.

Annex E: List of abbreviations and acronyms

- ENRA – Environmental, Natural Resources and Agriculture
- ARI – Area of Research Interest
- MRP – Main Research Provider
- SEFARI – Scottish Government, Food and Agriculture Research Institutes
- GHG – Greenhouse Gas
- JHI – James Hutton Institute
- SRUC – Scotland's Rural College
- BioSS - Biomathematics and Statistics Scotland
- FLS – Forestry and Land Scotland
- SEPA – Scottish Environment Protection Agency
- eNGOs – Environment Non-Governmental Organisations
- SAB – Scientific Advisory Board
- RPB – Research Portfolio Board
- SDGs – Science Delivery Group
- LL – Living Labs
- FMEC - First Minister's Environmental Council
- REF - Research Excellence Framework
- SRP – Strategic Research Programme

Responding to this consultation

Please respond to this consultation using the Scottish Government's consultation hub, Citizen Space. Access and respond to this consultation online at Consultation on 202 7-32 Environment, Natural Resources and Agriculture Research Strategy. You can save and return your responses while the consultation is still open. Please ensure that consultation responses are submitted before the closing date.

If you are unable to respond using our consultation hub, please complete and send the Respondent Information Form to:

Rural and Environment Science and Analytical Services (RESAS)

Scottish Government

Q Spur

Saughton House

Edinburgh, EH11 3XD

Email address: RESASConsultation2025@gov.scot

Handling your response

If you respond using the consultation hub, you will be directed to the About You page before submitting your response. Please indicate how you wish your response to be handled and, in particular, whether you are content for your response to published. If you ask for your response not to be published, we will regard it as confidential, and we will treat it accordingly.

All respondents should be aware that the Scottish Government is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and would therefore have to consider any request made to it under the Act for information relating to responses made to this consultation exercise.

If you are unable to respond via Citizen Space, please complete and return the Respondent Information Form provided alongside this document.

To find out how we handle your personal data you can view the privacy policy here: Privacy - gov.scot (www.gov.scot)

Next steps in the process

Where respondents have given permission for their response to be made public, and after we have checked that they contain no potentially defamatory material, responses will be made available to the public at Citizen Space. If you use the consultation hub to respond, you will receive a copy of your response via email.

Following the closing date, all responses will be analysed and considered along with any other available evidence to help us. Responses will be published where we have been given permission to do so. An analysis report will also be made available.

Comments and complaints

If you have any comments about how this consultation exercise has been conducted,

please send them to the contact address above or email above.

Scottish Government consultation process

Consultation is an essential part of the policymaking process. It gives us the opportunity to consider your opinion and expertise on a proposed area of work.

You can find all our consultations online: Citizen Space. Each consultation details the issues under consideration, as well as a way for you to give us your views, either online, by email or by post.

Responses will be analysed and used as part of the decision-making process, along with a range of other available information and evidence. We will publish a report of this analysis for every consultation. Depending on the nature of the consultation exercise the responses received may:

- indicate the need for policy development or review
- inform the development of a particular policy
- help decisions to be made between alternative policy proposals
- be used to finalise legislation before it is implemented

While details of particular circumstances described in a response to a consultation exercise may usefully inform the policy process, consultation exercises cannot address individual concerns and comments, which should be directed to the relevant public body.

This publication is available at **www.gov.scot**

Any enquiries regarding this publication should be sent to us at

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