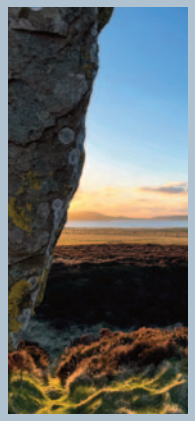

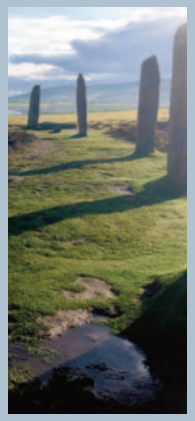

Scoping a route to a **locally driven approach**

to agricultural research *in Orkney*

University of the Highlands and Islands Orkney College
Orkney Islands Council
HIE Highlands and Islands Enterprise
SEFARI
Moredun

Contents

Summary

Agriculture is central to the economy, culture and heritage in Orkney and the successful adoption of new research and technology may bring significant benefits to the islands. Key challenges to the industry are to increase the efficiency of food production while protecting and enhancing the natural environment. The Orcadians have a strong history of being successful innovators and are also aware of the unique opportunities available within Orkney's landscapes and communities. Improving connectivity and trust between researchers and islanders will help to maximise the benefits from new research and increase uptake of useful technologies. This report summarisies recent (2015-2025) agricultural research projects relevant to Orkney in a research directory that can be used to help collate and raise awareness of current research projects. A workshop was held in Orkney with local stakeholders to discuss their views on future research directions, knowledge gaps, how to improve local involvement and input and the potential for setting up a "Living Lab" on Orkney. Recommendations to move forward are to establish a Research Hub in Orkney to help coordinate research activity, communicate outputs and encourage collaborations and new funding streams. Establishing key links with the SEFARI Research Institutes is a timely opportunity as the new Scottish Government Strategic Research Programme is currently being developed and there are opportunities for researchers and stakeholders to co-design agriculture research questions relevant and useful for Orkney. To help support moving research into practice, demonstration fields, farms or specific managment practices could be tried out using UHI's Agronomy and Agricultural Institute facilities to de-risk the testing of new technologies. The project also identified new opportunities for education, both secondary and tertiary, and training to encourage more people to take up careers in agriculture and to create new skilled jobs and opportunities in the isands.

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Abbreviations

AKIS	Agriculture Knowledge and Information System
ARIOB	Agricultural Reform Implementation Oversight Board
BVDV	Bovine viral diarrhoea virus
CLLD	Community Led Local Development projects
EFA	Ecological Focus Areas
HIE	Highlands and Islands Enterprise
LAGS	Local Action Groups
LEADER	Liaison Entre Actions de Developpement de l'economie rurale initiative
LED	Light-emitting diode
LiDAR	Light Detection and Ranging technology
LoRaWAN	Long range wide area network
NFU	National Farmers Union
OADS	Orkney Agricultural Discussion Society
OIC	Orkney Island Council
OLA	Orkney Livestock Association
ORIC	Orkney Research and Innovation Campus
RSPB	Royal Society for the Protection of Birds
SEFARI	Scottish Environment Food and Agriculture Research Institutes
SRP	Scottish Government Strategic Research Programme
UHI	University of Highlands and Islands
UKRI	UK Research and Innovation

Photo: www.shutterstock.com

Introduction

Agriculture and farming are very important to the economy, culture and heritage in Orkney but there are challenges to the industry to increase the efficiency of food production while reducing impacts on the environment and protecting nature. These aspirations require a greater understanding of the impacts of different farming practices and land use strategies and choices along with the opportunities arising from new research and technology to bring maximum benefits locally to Orkney.

Due to its size, location and defined boundaries, Orkney has proven to be well suited for a range of agricultural research projects. One of the issues is that research is frequently conducted in the Islands by a range of organisations, with little consultation, little to no lead-in and with externally driven outcomes. The process can appear that research is being done to the Islands rather than with the Islands. There is a view that more can be gained by ensuring a place-based approach, which would lead to closer academic-industry-community linkages and more enduring relationships that would result in greater local impact of agriculture research.

This project is a collaboration between Moredun Research Institute, the Agronomy and Agricultural Institute, UHI, Orkney, Highlands and Islands Enterprise, Orkney Island Council and a number of key stakeholders in the islands involved in agriculture to scope out a locally driven approach to agricultural research in Orkney.

Photo: www.pixabay.com

Aim

The aim of the project is to scope out a route to a locally driven approach to agricultural research in Orkney.

Objectives

The key objectives are to:

- Produce a Research Directory summarising current and previous (2015–2025) research relating to agriculture in Orkney
- Identify key research needs relevant to local stakeholders (Figure 1)
- Explore opportunities with local stakeholders, academics and researchers to identify opportunities for a locally driven approach to research in Orkney

Figure 1: Project aspirations

Diagram created in Biorender.com

Methods used

The information presented in this report came from a review of key documents provided by the project steering group and documents researched by the project team. The information on projects and publications for the Research Directory was obtained through conducting a search of scientific literature databases (PubMed, ScienceDirect), Google Scholar, individual Scottish University repositories, UKRI Gateway to Research website, the SEFARI website, and reports from current and previous rounds of the Scottish Government Strategic Research Programme. All sources were searched for the word "Orkney" and the research was included in the repository if i) the work related to agriculture; ii) sample collection (including growing of crops) had taken place in Orkney, either historically or currently; iii) it involved interviews or data collection from the population of Orkney; iv) the research had taken place from 2000 onwards. We also included selective exemplars for projects focusing on areas such as food and drink production, biodiversity, and marine ecosystems to highlight other areas of research in Orkney which are relevant to the project.

Further information came from conducting interviews with SEFARI researchers currently involved in research projects in Orkney and with individual key stakeholders in Orkney involved in different aspects of agriculture, academia, education and enterprise in the islands.

The research team hosted a workshop in Kirkwall in March 2025 with stakeholders and key industry groups involved in agriculture to explore their views and attitudes to agricultural research, identify research needs and gaps and look at ways to improve the implementation, translation and impact of research to maximise benefits to Orkney.

Background

ISLAND DEMOGRAPHICS, TOPOGRAPHY AND INFRASTRUCTURE

The Orkney islands are located approximately 10 miles off the coast of northern Scotland and comprise 70 islands of which 20 are currently inhabited. The population of Orkney is around 22,500 with the majority living on the mainland island.

The islands are predominantly low lying with limited trees and woodland, due to the strong winds. The land is very productive for agriculture and grassland in particular supporting livestock farming and some arable crops. The mild climate on the islands is influenced by the North Atlantic Drift with a growing season of approximately 5–6 months[1].

HISTORICAL CONTEXT OF AGRICULTURE ON THE ISLANDS

The unique climate on the islands has been favourable to human settlements and productive agriculture dating back to 7,000 years BC with evidence of livestock farming and growing crops in the neolithic age from 4,000 to 2,000 years BC[2]. The main agricultural industries historically have involved the kelping industry where seaweed was harvested and used in glass and soap manufacturing and the whaling and fishing industries built up through the Hudson Bay Company. Oats and Bere barley were traditional crops grown in Orkney from the 1800s and water mills were used to grind the grain. Barony mill at Birsay, built in 1873, has been restored and is still used to produce Beremeal using an old genetic breed of barley that is very well suited to the Orkney climate[3].

Following the First World War there was a national push towards increasing food production, and in Orkney many crofts and farms were amalgamated resulting in larger fields and increased numbers of cattle and sheep being farmed. In the 1950s and 60s there was a shift to pasture and grassland fields to support livestock farming, and the traditional haymaking was gradually being replaced by silage. The main arable crops grown at this time, included spring barley, oats and seed potatoes[1].

1. Orkney Landscape Evolution and Influences, Landscape Character Assessment, NatureScot, 2019
2. https://archaeologyorkney.com/farming
3. Scarth, R and Watt, G (1939) Agriculture of Orkney. Transactions of The Highland and Agricultural Society of Scotland. Vol LI. pp1–23

PRESENT DAY AGRICULTURE

Farming and agriculture makes a significant contribution and impact to the landscape, economy and culture of the Orkney islanders with 10% of the population employed within the agriculture and fishing industries. The majority of agricultural land in Orkney is classified as being productive for grassland and supports a narrow range of crops with some areas of rough grazing. A significant part of Orkney's agricultural economy involves rearing beef and dairy cattle and sheep, producing beef, lamb, dairy products and wool. There are around 77,000 cattle on Orkney in 483 holdings and around 130,000 sheep in 537 holdings. The numbers of cattle and sheep have decreased slightly over the last 20 years. Aquaculture is a significant industry in Orkney with several fish farm developments[4].

Arable farming is on a smaller scale with approximately 70% involving barley, with the rest comprising oats, seed potatoes and turnips. There is limited forestry and woodland on Orkney and the Forestry Commission has assessed that smaller scale woodlands in specific sheltered areas may be feasible to develop. Moorland areas of the mainland island and some of the outer islands such as Hoy, Rousay and Eday have peat that has been cut and used for fuel by the islanders over many generations[5].

Photo: Elisabeth Innes

Orkney has several protected sites for RSPB reserves, local nature reserves and sites of special interest. The islands provide important habitats for wader birds such as curlew, lapwing, redshank, snipe and oyster catchers whose numbers have declined in other parts of Scotland[6]. Predators such as foxes and badgers, who may eat bird eggs as well as be potential sources of disease to livestock, are absent from the islands although the recent introduction of stoats[7] to the islands has caused concern through the effects of their predation on wild bird eggs and the Orkney vole[8]. The farmers in Orkney have had increasing issues with the significant numbers of resident and migratory Greylag geese that are estimated to be 70,000 in number over the winter months causing significant damage to pastureland and crops as well as competing with wild bird populations for nesting sites. There is an Orkney Goose Management Group that works with Scottish Government and others to apply culling and other measures to try to reduce the numbers of geese on the islands[9]. There are also rare breeds of livestock in Orkney such as the North Ronaldsay sheep that are of special interest with the rare breed survival trust[10].

4. Thomson, S., Pirie, S., Atterton, J., Moxey, A., Sellars, A., Chapman, P., Nelson, B., Naab, F., Jamwal-Fraser, O., MacMillan, I., McCracken, D., Sutherland, J., Macdonald, S., Stevens, J and Glendinning, J (2024). Rural and Agricultural Development – Maximising the Potential in the islands of Orkney, Shetland and Outer Hebrides. https://doi.org/10.58073/SRUC.26125552)
5. Orkney Islands Council Strategic Environmental Assessment Topic Papers 2025 https://www.orkney.gov.uk/media/zo3fcmyu/ trees-and-woodland-strategy-sea-environmental-report-topic-papers.pdf
6. https://www.orkney.gov.uk/ our-services/planning-and-building/development-policy/natural-and-built-environment/natural-heritage-natural-areas/
7. NatureScot Commissioned Report 871 (2015): Stoat (Mustela erminea) on the Orkney Islands-assessing the risks to native species. https://www.naturescot-commissioned-report-871-stoat-mustela-erminea-orkney-islands-assessing risks-native
8. https://www.orkney nativewildlife.org.uk/project/stoats-in-orkney
9. National Goose Policy Framework in Scotland Review 2022 https://www.gov.scot/binaries/ content/documents/govscot/publications/corporate-report/2024/02/scottish-government-goose-management-policy review-2022/documents/national-goose-policy-framework-scotland/national-goose-policy-framework-Scotland/govscot%3Adocument/national-goose-policy-framework-scotland.pd9
10. https://www.rbst. org.uk/north-ronaldsay

There are many other industries linked to the agriculture supply chain in Orkney that provide jobs and bring economic benefits. These include the provision of seeds, feed, fertiliser, farm machinery, haulage and mart services. For livestock farmers, veterinary services are vital, along with other processing facilities such as a creamery to process dairy products and an abattoir for meat products. The abattoir in Orkney is currently closed making it difficult to create added value to farm businesses from locally sourced meat. The current system involves local butchers buying finished cattle and sending them off the island to Dingwall to be processed and then getting carcasses sent back to Orkney for local sale. Previously when the abattoir was open, Orkney meat was very successfully marketed as a premium product, Orkney Island Gold (beef and lamb). There are plans to re-open the abattoir in Kirkwall with funding from the Scottish Government's Small Producers Pilot Fund[11]. This scheme aims to increase the proportion of food grown and processed by small farms and small holders and consumed within the local community. Reinstating the facility would support economic growth in the area as well as the future sustainability of the island's food production industry. Agricultural productivity is also linked to business opportunities in the food and drink sector and Orkney has a high reputation for the quality of its produce. The dairy sector produces ice cream, butter and the world-renowned Orkney cheese, that has a protected geographical indicator[12]. Many other local businesses involving arts, crafts and wool products rely on local agricultural products such as the famous Orkney chairs[13] made with oat straw.

11. https://www.gov.scotnews/supporting-orkneys-farmers-and-food-producers/
12. https://www.gov.uk/protected-food-drink-names/ orkney-scottish-island-cheddar
13. https://www.heritage crafts.org.uk/craft/orkney-chair-making

Photo: Elisabeth Innes

Photo: Elisabeth Innes

Bere barley is a traditional landrace grown in Orkney and used to be the most important barley variety grown in the Highlands and Islands of Scotland over 100 years ago. It was thought to have been introduced to Orkney by the Vikings. Bere is a very versatile variety being used for food products, brewing and distilling, animal feed and straw. Importantly for Orkney, Bere barley can be grown in poor soils and is resilient to the climate. It also has important nutritional properties being high in fibre, folate, iron, iodine and magnesium compared to modern varieties of barley[14]. Today the Bere barley is grown in Orkney and processed in Barony Mill, Birsay[15], where it is sold locally in several bakery products including bread, biscuits and Bannocks and is an ingredient in local beers (Swannay brewery), local whisky (Scapa distillery) and Orkney bere malt vinegar. Bere barley grown in Orkney has also been used to produce Bruichladdich single malt whisky at the Bruichladdich distillery on Islay[16]. Work at the Agronomy and Agricultural Institute, UHI, Orkney, has helped to encourage understanding and use of this ancient crop and to promote new local commercial opportunities.

Farming on the islands also incurs increased costs related to the purchase of feed, fertiliser, fuel, haulage and transport to reach markets compared with farmers in mainland Scotland. There has been a decline in the numbers of farms on the outer islands potentially due to issues with accessing farm labour, succession planning with existing farms, increased transport and feed costs and access to markets[4].

Photo: Elisabeth Innes

14. Martin, P., Russell, J., Wishart, J., Brown, L.K., Wallace, M., Iannetta, P.M., George, T.S (2023) Back to the future: Using ancient Bere barley landraces for a sustainable future. Plants, People, Planet. https://doi.org/10.1002/ppp3.10432
15. https://baronymill.com
16. https://uk.bruichladdich. com/products/bruichladdich-bere-barley-2013

Photo: www.pixabay.com

Orkney currently has an aging population which may affect the availability of labour for the agricultural industry and it is estimated that 10% of the population aged 16–75 years are involved in agricultural activity in the islands so it is an important sector for Orkney and a key source of employment. A challenge for Orkney is the lack of affordable and available housing and accommodation for workers, contractors and students coming to the islands. There is interest in encouraging young people into local jobs and careers relating to agriculture in Orkney with the recognition that many people are now looking for flexible careers and working opportunities[17].

Digital connectivity is a very important service for Orkney to enable many aspects of life, education and business on the islands. A more reliable and effective network would enable farmers to more easily access opportunities in precision agriculture, education and training materials.

Orkney currently leads the way in the UK in the use of Light Detection and Ranging (LiDAR) technology. The Orkney Isles now have access to full LiDAR scanning data, which provides crucial information on soil types and content[18]. This data can then be exploited to advise farmers on the optimum farming practices for their specific soil types. For example, water erosion, can manifest itself in a dramatic fashion following storms, resulting in wash outs and gullies, or can be more subtle with sheet and rill erosion following heavy rain. This can result in a loss of topsoil and seeding, leading to long-term productivity losses and increased production costs. LiDAR technology can help to prevent soil erosion through 3D mapping and modelling to facilitate accurate planning for preventative measures and the creation of risk maps. The LiDAR technology has the potential to bring many benefits and it would be helpful for further awareness and coordination to inform future use of the technology.

Scottish Agricultural Organisation Society (SAOS) SmartRural project is helping farmers to capture and access data through establishing a LoRaWAN network[19].

17. Orkney Economic Review 2023 https://www.orkney.gov.uk/media/rfpiuao0/orkney-economic-review-2023.pdf
18. https://www.orkney.gov.uk/latest-news/lidar-surveys -take-to-orkney-s-skies/
19. https://saos.coop/what-we -do/technology/smartrural/

AGRICULTURAL POLICY CONTEXT

Agriculture is a very important cornerstone in the history, culture, economy and well being of the Orkney islanders and agricultural policy has impacted farming and land use over the years. Current agricultural policies are changing to encourage sustainable, efficient and safe food production, to mitigate against the challenges of a changing climate, to encourage nature restoration and biodiversity and to provide economic and societal benefits to local communities.

In 2023, the Scottish Government published the Agricultural Reform Route Map that set out the range of future agricultural policies from 2025 for Scotland. This route map included the Agricultural Reform List of Measures describing the actions that farmers and crofters would have to take to receive support payments in the future[20].

The Agricultural and Rural Communities (Scotland) Bill, passed by the Scottish Parliament in 2024, provides a framework to guide future support payments to farmers. The detail of what this will cover is being worked on by the Agricultural Reform Implementation Oversight Board (ARIOB)[21].

Some of the key areas involve looking at ways to improve production efficiency of livestock involving animal health and welfare, nutrition, genetics and breeding, to help reduce green house gas emissions associated with agriculture to meet the government's NetZero aspirations. Coupled with this, is how to manage land and natural resources to bring maximum benefits to improve nature restoration, biodiversity, protect ecosystems, critical habitats and soil health. In Orkney, agriculture contributed to 64% of the total island net emissions[4] and therefore it is important to focus on how to improve livestock production efficiency while also acknowledging the intrinsic importance of livestock to the economy, societal cohesion and prosperity of the islands.

There is still some uncertainty about what farmers will have to do to receive the conditional farm support payments and how it will affect their farm businesses. It is important that local knowledge, data and impacts are considered when applying these new policies on the ground.

The Scottish Government is currently consulting on the design of a future Agriculture Knowledge and Information System (AKIS)[22] to help support farmers. It is important that knowledge exchange, training and communications activities are suitable for Orkney and work within effective communication channels and networks.

The Scottish government have recently added new greening rules that will form part of the basic payment schemes to be implemented in 2026[23].

Photo: www.pixabay.com

These include updates to the existing options along with an introduction of 4 new Ecological Focus Areas (EFA) options. This is likely to involve a larger number of farm businesses requiring to comply with the scheme than previously.

20. https://www.ruralpayments.org/topics/agricultural-reform-programme/arp-route-map/
21. Agricultural Reform Implementation Oversight Board https://www.gov.scot/ groups/agriculture-reform-implementation-oversight-board/
22. The Agricultural Knowledge and Information System in the UK https://www.hutton.ac.uk/sites/default/files/files/AKIS%20in%20the%20UK_flyer.pdf
23. https://www.ruralpayments.org/topics/all-schemes/ basic-payment-scheme/basic-payment-scheme-full-guidance/greening---bps/greening-guidance-2026/

ENGAGING COMMUNITIES

The European Community LEADER (Liaison Entre Actions de Developpement de l'economie rurale) initiative was set up to harness the energy and resources of local communities through the creation of Local Action Groups (LAGS). These groups would lead in the implementation of local strategies in decision making and allocation of resources to promote rural development[24].

Following Brexit/EU Exit, the Scottish Government committed funding to support Community Led Local Development (CLLD) projects. In Orkney these local community groups have been looking at projects involving current challenges and opportunities in agriculture to benefit local communities on the islands. Orkney Island Council and Highlands and Islands Enterprise have recently commissioned a short series of films to highlight some of the interesting, impactful and diverse projects being developed and run by community groups across Orkney. An additional source of funding for the CLLD groups also comes from the Crown Estates[25].

Effective community engagement enables shared learning and knowledge exchange in a place-based system representing local issues and needs.

There is an opportunity for further development of Knowledge Exchange activities to support farmers, and agricultural and related businesses in Orkney to make the right choices and encourage the uptake of new research and technologies that may be helpful. New developments in science and technology may also lead to new job opportunities and economic development in Orkney and provide vital place-based research data to enable evidence-based decision making that is specific and relevant to local communities.

24. https://ec.europa.eu/enrd/leader-clid_en.html
25. Our Islands, Our Projects. Series of videos https://www.youtube.com/@OrkneyIslandsCouncil/videos

Photo: www.shutterstock.com

The Scottish Government Strategic Research Programme (SRP)

The Scottish Government currently funds a Strategic Research Programme involving agriculture, environment and natural resources. The current 5 year programme runs from 2022–2027[26] with a new SRP planned for 2027–2032[27].

The aims of the research are to:

- Provide data and evidence to support policy making
- Develop innovative solutions to tackle some of the major challenges: climate change, loss of biodiversity, nature restoration, ensuring safe and sustainable food and water supplies, improving health and wellbeing and prevention and control of disease
- Encourage economic growth, wellbeing and new opportunities through knowledge and innovation

The research is mainly conducted by a group of world-renowned Research Institutes based in Scotland:

- The Moredun Research Institute (www.moredun.org.uk)
- The James Hutton Institute (www.hutton.ac.uk)
- Scotland's Rural College (SRUC) (www.sruc.ac.uk)
- The Rowett Institute, University of Aberdeen (www.abdn.ac.uk)
- Biomathematics and Statistics Scotland (www.bioss.ac.uk)
- Royal Botanic Garden Edinburgh (www.rbge.org.uk)

Collectively the group is known as SEFARI (Scottish Environment Food and Agriculture Research Institutes) and they conduct longer term and applied research that is relevant to stakeholder needs.

The research topics covered in the current Strategic Research Programme include:

- Plant and Animal health and welfare
- Sustainable food systems and supplies
- Agricultural practice
- Food security
- Nutrition, diet and food safety
- Natural resources and the environment
- Land Use
- Air quality
- Water
- Soils
- Biodiversity
- Natural capital
- Circular economy
- Rural economy
- Rural Futures
- Horizon Scanning
- Science education and training

Further information on some of the research projects can be found at SEFARI Gateway (www.sefari.scot).

This is one of the largest research portfolios focusing on agricultural research in the UK delivering both multi-disciplinary and inter-disciplinary research and is a fantastic resource for Scotland.

A key aspiration for this project is to look at ways to improve connectivity between SEFARI research and stakeholders in Orkney and look for new opportunities to develop place-based research projects that are relevant and useful to local communities in Orkney.

26. Environment, natural resources and agriculture – strategic research 2022-2027: overview. https://www.gov.scot/ publications/environment-agriculture-and-food-strategic-research-2022-2027-overview/pages/strategic-research-programme-2022-to-2027/
27. Consultation on 2027-32 Environment, Natural Resources and Agriculture (ENRA) Research Strategy https://www.gov.scot/publications/consultation-2027-32-environment-natural-resources-agriculture-enra-research-strategy/

EXAMPLES OF CURRENT SEFARI RESEARCH PROJECTS RELEVANT TO ORKNEY

Researchers at Moredun have been conducting work with livestock farmers and the Orkney Goose Management Group to look at the impacts of the increasing numbers of both resident and migratory greylag geese in the islands. The numbers of geese have increased dramatically over recent years, and they cause damage to pasture and crops as well as competing with native wild birds for nesting sites. The Moredun researchers are looking at the impacts of pathogen transmission involving the geese and grazing livestock and also the potential impact on public health through contamination of water supplies with zoonotic pathogens that can cause disease in both animals and people[28].

Researchers at James Hutton Institute are exploring barley diversity for resilience and sustainability with work being conducted to further understand how Bere barley, an ancient variety commonly grown in Orkney, is able to grow in poor soils and withstand harsh climatic conditions. A further aim of the research is to look at the genetic diversity within Bere varieties to support breeding progammes[29].

A project proposal for an Orkney Community Vertical Farm has been put together by James Hutton Institute, Advanced Plant Growth Centre and also involving Intelligent Growth Solutions (a company that manufactures vertical farm technology). Vertical farming involves growing fresh produce using vertical stacks in indoor facilities. The vertical farm takes up less land space than conventional agriculture and the atmosphere can be easily controlled. The system requires fewer inputs and can enable local food production all year round. Work is also on going with the Rowett Institute, University of Aberdeen to look at the effect of changing the light intensity and the light spectrum on plant growth and antioxidant, mineral and phytochemical content of plants resulting in higher nutritional value[30].

The Agronomy and Agricultural Institute, UHI, Orkney are currently installing a hybrid vertical farm (financially supported by HIE) inside a polycrub at facility. The hydroponic towers will have supplementary LED lighting to produce various plants (fruits, vegetables, trees) for around 9 months of the year. This system has the potential for scalability across the highlands and islands.

Information and mapping of Scotland's soils has involved work by the James Hutton Institute and has digital versions of 1:25 000 scale maps that can be searched by postcodes enabling users to get information about soil types in their area. There is also some archive material giving further details relating to soils in Orkney[31, 32]

SRUC has been involved in work with a consortium led by Orkney Islands Council and also involving Shetland Island Council, Comhairle nan Eilean Siar, Orkney Local Action Group, Shetland Local Action Group, Outer Hebrides Local Action Group and Highlands and Islands Enterprise, to look at the impacts of proposed agricultural policy changes to the islands and the specific implications for island economies, environments and communities[4].

The Royal Botanic Garden Edinburgh (RBGE) has a historic herbarium collection from Henry Halcro Johnston (1856–1939) which contains around 5,000 specimens from Orkney. The archive also contains field notes and correspondence[33].

28. Assessing the impact of changing migratory patterns and population size of greylag geese on livestock and public health. https://sefari.scot/research/projects/assessing-the-impact-of-changing-migratory-patterns-and-populations-size-of-greylag
29. Exploring barley diversity for resilience and sustianability https://sefari.scot/research/projects/exploring-barley-diversity-for-resilience-and-sustainability
30. https://sefari.scot/ blog/2022/11/15/vertical-farming-is-the-sky-the-limit
31. https://soils.environment.gov.scot/maps/ soil-maps/national-soil-map-of-scotland//
32. https://www.hutton.ac.uk/sites/default/ files/files/soils/142141013_THE_SOILS_OF_ORKNEY.PDF
33. https://data.rbge.org.uk/search/herbarium/?family=&genus=&species=&coll_name=johnston&coll_num=&barcode=&accessionnumber=&specimens_region=1A%7C1A%25A0%28Britain%2Band%2BIreland%29&british=1&vice_county=&major_taxon=&cfg=british.cfg&keywords=

Directory of agricultural research in Orkney (2015-2025)

A directory of research projects in Orkney, over the last 10 years, was prepared using information from scientific literature databases (PubMed, ScienceDirect), Google Scholar, individual Scottish University repositories, UKRI Gateway to Research website, the SEFARI website, and reports from current and previous rounds of the Scottish Government Strategic Research Programme. All sources were searched for the word "Orkney" and the research was included in the repository if:

i) the work related to agriculture

ii) sample collection (including growing of crops) had taken place in Orkney, either historically or currently

iii) it involved interviews or data collection from the population of Orkney

iv) the research had taken place from 2000 onwards.

Selective exemplars for projects focusing on areas such as food and drink production, biodiversity, and marine ecosystems were also included, to highlight other areas of research in Orkney which are relevant to the project.

A list of the projects is shown in Table 1

Photo: Henry Creissen

Photo: www.pixabay.com

Table 1

Project	Category	Title	Link	Funder/ Network	Type of Activity, Reference & Duration	Year of Publication	Main Individual	Main Individual's Affiliation (& Academic & Non-Academic Partners)	Associated Stakeholders	For Projects: Associated Publications (Inc. DOI)
1	Farming & Nature	Integrating social and ecological approaches for sustainable food production and biodiversity management: the case of Orkney farmers and Greylag Goose	https://gtr.ukri.org/projects?ref=studentship-2607475	BBSRC (BB/T00875X/1)	Studentship (2607475) (30/09/2021-29/09/2025)		Ana Payo-Payo	University of Aberdeen, Inst of Biological & Environmental Sci		
2	Farming & Nature	Assessing the impact of changing migratory patterns and population size of greylag geese on livestock and public health	https://sefari.scot/research/projects/assessing-the-impact-of-changing-migratory-patterns-and-population-size-of-greylag	RESAS	SRP 2022-2027 (MRI-D4-2)		Eleanor Watson	Moredun Research Institute	Orkney Goose Management Group; NatureScot	
3	Farming & Nature	Sources of Cryptosporidium in a drinking water catchment in Orkney	https://sefari.scot/blog/2021/03/22/protecting-water-catchments-from-zoonotic-cryptosporidium-parasites	RESAS	SRP 2016-2022 (Theme 1 (WP 1.2.1))	2019	Beth Wells	Moredun Research Institute	NatureScot, Orkney Goose Management Group, NFUS, RSPB, Scottish Water, Vets, Farmers	https://pmc.ncbi.nlm.nih.gov/articles/PMC6920911/
4	Crops	Genetic diversity and local adaptation of Bere barley		RESAS	SRP 2016-2022 (Theme 1 (WP 1.3.1))	2023	Joanne Russell	JHI (University of Copenhagen)		https://www.sciencedirect.com/science/article/pii/S1360138523000274?via%3Dihub
5	Crops	Ancient barley landraces adapted to marginal soils demonstrate exceptional tolerance to manganese limitation	https://pure.uhi.ac.uk/en/publications/ancient-barley-landraces-adapted-to-marginal-soils-demonstrate-ex/persons/	RESAS; Independent Research Fund Denmark – Technology and Production Sciences	SRP 2016-2022 (Theme 1 (WP 1.3.1); grant no. DFF-5054-00042)	2019	Joanne Russell	JHI and UHI (University of Copenhagen)		https://academic.oup.com/aob/article/123/5/831/5248548
6	Crops	Back to the future: Using ancient Bere barley landraces for a sustainable future	https://www.radiantproject.eu	EU	Horizon 2020 project (101000622)	2023	Peter Martin	Agronomy Institute, UHI, Orkney		https://nph.onlinelibrary.wiley.com/doi/full/10.1002/ppp3.10432
7	Livestock	Perinatal Losses in Beef Herds in Orkney: Assessing Incidence and Associated Pathology from General Practice	https://theses.gla.ac.uk/8704/	Not given	Masters student (2015-2016)	2020	Jayne Orr	University of Glasgow (Teagasc, SRUC, Scotvet Animal Health; SAC Consulting)		https://bvajournals.onlinelibrary.wiley.com/doi/10.1136/vr.105536
8	Livestock	Prevalence of Johne's disease among cattle in Orkney	https://eprints.gla.ac.uk/53717/		Publication	2011	K. A. Ellis	University of Glasgow, Scottish Centre for Production Animal Health and Food Safety	Orkney Livestock Association (OLA)	https://bvajournals.onlinelibrary.wiley.com/doi/10.1136/vr.d891

Table 1 (continued)

Project	Category	Title	Link	Funder/ Network	Type of Activity, Reference & Duration	Year of Publication	Main Individual	Main Individual's Affiliation (& Academic & Non-Academic Partners)	Associated Stakeholders	For Projects: Associated Publications (Inc. DOI)
9	Livestock	Compensatory growth in suckler beef cattle production systems on two commercial farms in Scotland	https://www.cambridge.org/core/services/aop-cambridge core/content/view/EB1D1050502ABFC6BC2B512EC52D142E/S204047001000350Xa.pdf/compensatory-growth-in-suckler-beef-cattle-production-systems-on-two-commercial-farms-in-scotland.pdf	QMS	Publication	2010-2011	JJ Hyslop	SRUC		https://www.sciencedirect.com/science/article/abs/pii/S204047001000350X?via%3Dihub
10	Livestock	Farmer Attitudes and Livestock Disease: Exploring Citizenship Behaviour and Peer Monitoring across Two BVD Control Schemes in the UK	https://randd.defra.gov.uk/ProjectDetails?ProjectId=12738	DEFRA	Research Project Jan-Mar 2010 (SE4003)	2016	Claire Heffernan	University of Bristol (SRUC)		https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0152295
11	Farming & rural society	Landscape, Farming and Rural Social Change in Orkney, Scotland	https://www.proquest.com/openview/e3031e651e7757fbea79ef1b26d7c66c/1?pq-origsite=gscholar&cbl=51922&diss=y		Studentship	2007	Jo Lee	University of Aberdeen		https://www.sciencedirect.com/science/article/pii/S0743016706000313#aep-acknowledgment-id14
12	Farming & Nature	Long-term impact of changes in sheep Ovis aries densities on the breeding output of the hen harrier Circus cyaneus	https://abdn.elsevierpure.com/en/publications/long-term-impact-of-changes-in-sheep-ovis-aries-densities-on-the-/fingerprints/?sortBy=alphabetically		Publication	2010	Arjun Amar	RSPB-Scotland (Aberdeen University & Macaulay Institute)		https://besjournals.onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2010.01896.x
13	Crops	Why bother with Bere? An investigation into the drivers behind the cultivation of a landrace barley	https://www.sciencedirect.com/science/article/pii/S0743016716300328?via%3Dihub		Publication	2016	Niamh Mahon	Nottingham Trent University (University of East Anglia)		https://www.sciencedirect.com/science/article/pii/S0743016716300328?via%3Dihub
14	Crops	Adding Value to a Scottish Rye Landrace: Collaborative Research into New Artisanal Products	https://eresearch.qmu.ac.uk/handle/20.500.12289/12153	European Social Innovation Funds and the Scottish Government	Research Project (SIF-R5-S2-HI-004)	2022	Stan Blackley	Queen Margaret University (Scottish Crofting Federation; Science and Advice for Scottish Agriculture (SASA))		https://eresearch.qmu.ac.uk/bitstream/handle/20.500.12289/12153/12153.pdf?sequence=1&isAllowed=y
15	Wildlife	Wildlife tourism and seasonal factors: can Scotland use its birdlife to expand its tourism market in wintertime?	https://eresearch.qmu.ac.uk/handle/20.500.12289/8179		Thesis (BA (Hons))	2016		Queen Margaret University		
16	Crops	University research shows ancient island grain creates a uniquely flavoured Orkney Oatcake	https://www.qmu.ac.uk/news-and-events/news/2016/20160112-university-research-shows-ancient-island-grain	Scottish Funding Council	News story (Innovation voucher)	2016	Laura Wyness	Queen Margaret University		

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17		A Feasibility Study on an Anaerobic Digester (AD) Plant Installation in Orkney	https://rgu-repository.worktribe.com/project/828886/a-feasibility-study-on-an-anaerobic-digester-ad-plant-installation-in-orkney	Industrial Biotechnology Innovation Centre	May 1, 2020 - Mar 30, 2021	2022		Robert Gordon University (Orkney) (Strathendrick Biogas)		https://www.sciencedirect.com/science/article/pii/S1364032122002702?via%3Dihub
18	Crops / History	The management of arable land from prehistory to the present: Case studies from the Northern Isles of Scotland	https://onlinelibrary.wiley.com/doi/epdf/10.1002/gea.20089		Publication	2005	Erika Guttmann	University of Stirling		https://onlinelibrary.wiley.com/doi/10.1002/gea.20089
19	Farming & Nature	Quantifying the expected value of uncertain management choices for over-abundant Greylag Geese		Australian Research Council Centre of Excellence in Environmental Decisions (CEED) Early Career Researcher Travel Grant. H2020/ERC grant agreement no 679651 (ConFooBio)	Research	2017	Nils Bunnefeld	University of Stirling (University of Queensland; The Australian National University, Carl Mitchell, Eric Meek, Scottish Natural Heritage, Wildfowl and Wetlands Trust, and the Scottish Government Agricultural Census)		https://www.sciencedirect.com/science/article/pii/S0006320717309412?via%3Dihub
20	Waste Processing	Experimental evidence for conservation conflict interventions: The importance of financial payments, community trust and equity attitudes	https://research-portal.st-andrews.ac.uk/en/publications/experimental-evidence-for-conservation-conflict-interventions-the	European Research Council under the European Union's H2020/ERC; Leverhulme Trust EarlyCareer Fellowship (Network: Resolving conflicts between food security and biodiversity conservation under uncertainty)	Publication (679651)	2020	Nils Bunnefeld	University of Stirling (Université d'Antananarivo, New York University, Universidad Mayor, St Andrews University)		https://besjournals.onlinelibrary.wiley.com/doi/10.1002/pan3.10155
21	Biodiversity	Comparison of defence buzzes in hoverflies and buzz-pollinating bees	https://www.stir.ac.uk/research/hub/publication/1684936	Leverhume Trust	Research (RPG-2018-235)	2020	M. Vallejo-Marín, G. C. Vallejo	University of Stirling (Natural Power Consultants)		https://zslpublications.onlinelibrary.wiley.com/doi/10.1111/jzo.12857
22	Conservation	Pup Mortality in a Rapidly Declining Harbour Seal (Phoca vitulina) Population	https://research-portal.st-andrews.ac.uk/en/publications/pup-mortality-in-a-rapidly-declining-harbour-seal-emphoca-vitulin/projects/	Scottish Government, NatureScot, NERC	Publication	2013	Nora Hanson	University of St Andrews		https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0080727
23	Marine	Comparison of the 1988 and 2002 phocine distemper epizootics in British harbour seal Phoca vitulina populations	https://discovery.dundee.ac.uk/en/publications/comparison-of-the-1988-and-2002-phocine-distemper-epizootics-brit		Publication	2010	Mike Lonergan	University of St Andrews (University of Glasgow; University of Aberdeen)		https://www.int-res.com/abstracts/dao/v88/dao02153

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Project	Category	Title	Link	Funder/ Network	Type of Activity, Reference & Duration	Year of Publication	Main Individual	Main Individual's Affiliation (& Academic & Non-Academic Partners)	Associated Stakeholders	For Projects: Associated Publications (Inc. DOI)
24	Marine	Using sparse survey data to investigate the declining abundance of British harbour seals	https://research-portal.st-andrews.ac.uk/en/publications/using-sparse-survey-data-to-investigate-the-declining-abundance-o		Publication	2007	Mike Lonergan	University of St Andrews		https://zslpublications.onlinelibrary.wiley.com/doi/10.1111/j.1469-7998.2007.00311.x
25	Marine	Modelling the population size and dynamics of the British grey seal	https://discovery.dundee.ac.uk/en/publications/modelling-the-population-size-and-dynamics-of-the-british-grey-se		Publication	2019	Len Thomas	University of St Andrews (University of Dundee)		https://onlinelibrary.wiley.com/doi/10.1002/aqc.3134
26	Marine	Genetic Connectivity and Diversity of a Protected, Habitat-Forming Species: Evidence Demonstrating the Need for Wider Environmental Protection and Integration of the Marine Protected Area Network	https://researchportal.hw.ac.uk/en/publications/genetic-connectivity-and-diversity-of-a-protected-habitat-forming	Heriot-Watt University (James Watt Scholarship); NatureScot; Marine Alliance for Science and Technology for Scotland	Publication (MASTS grant HR09011)	2022	Joanne Porter	Heriot-Watt University (Stromness) (University of Aberdeen; University of Dundee, Natural History Museum; Fisheries and Oceans Canada)	NatureScot	https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2022.772259/full#fun1
27	Marine	Understanding marine food web dynamics using fatty acid signatures and stable isotope ratios: Improving contaminant impacts assessments across trophic levels	https://marine.gov.scot/sma/content/understanding-marine-food-web-dynamics-using-fatty-acid-signatures-and-stable-isotope-ratios	Scottish Government, Robert Gordon University	Publication	2019	Colin Moffat	Robert Gordon University (University of Dundee)	Scottish Government, Marine Scotland Science	https://www.sciencedirect.com/science/article/pii/S0272771419300411?via%3Dihub
28	Water	Large-scale risk screening of raw water quality in the context of drinking water catchments and integrated response strategies	https://discovery.dundee.ac.uk/en/publications/large-scale-risk-screening-of-raw-water-quality-in-the-context-of		Publication	2019	Carolin Vorstius	University of Dundee (BioSS)	Scottish Water	https://www.sciencedirect.com/science/article/pii/S1462901118313960?via%3Dihub
29	Biodiversity	Developing effective agricultural wetland management to reduce predation and improve wader breeding outcomes	https://gtr.ukri.org/projects?ref=studentship-2753833#/tabOverview	NERC	Studentship (2022-2026) (2753833)		Thomas Bodey (primary supervisor); Leah Gray (student)	University of Aberdeen		
30	Food & Drink	Peat source and its impact on the flavour of Scotch whisky	https://www.ros.hw.ac.uk/handle/10399/2032	Suntory	Studentship		Barry Harrison (student); Fergus Priest (supervisor)	Heriot-Watt University (Scotch Whisky Research Institute)		
31	Livestock	Eradication programme for bovine viral diarrhoea virus in Orkney 2001 to 2008	https://pure.sruc.ac.uk/en/publications/eradication-programme-for-bovine-viral-diarrhoea-virus-in-orkney-		2001-2008	2010		University of Glasgow (SRUC)	Orkney Livestock Association (OLA)	https://bvajournals.onlinelibrary.wiley.com/doi/10.1136/vr.c4944

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32	Marine	Exposure of harbour seals (Phoca vitulina) to Brucella in declining populations across Scotland	https://pure.sruc.ac.uk/en/publications/exposure-of-harbour-seals-iphoca-vitulinai-to-brucella-in-declini	NERC	1992-2013 (SMRU 10001)	2017	Joanna Kershaw	University of St Andrews (APHA)		https://pure.sruc.ac.uk/ws/portalfiles/portal/35323557/d126p013.pdf
33	Wildlife	Illegal killing associated with gamebird management accounts for up to three-quarters of annual mortality in Hen Harriers Circus cyaneus	https://pure.sruc.ac.uk/en/publications/illegal-killing-associated-with-gamebird-management-accounts-for-	Hen Harrier LIFE project; Northern England Raptor Forum (NERF); Lothian and Borders Raptor Study Group; Lush Retail Limited; Natural Resources Wales; Scottish and Southern Energy; Welsh Government	2014-2020 (LIFE13 NAT/UK/000258)	2023	Steven Ewing	RSPB Centre for Conservation Science (SRUC; University of East Anglia)		https://www.sciencedirect.com/science/article/pii/S0006320723001738?via%3Dihub
34	Livestock	Small-scale sheep and cattle enterprises in Scotland: Demographics, animal health, and biosecurity	https://pure.sruc.ac.uk/en/publications/small-scale-sheep-and-cattle-enterprises-in-scotland-demographics	RESAS	SRP 2016-2022	2024	Sue Tongue	SRUC		https://www.sciencedirect.com/science/article/pii/S0167587724001223?via%3Dihub
35	Crops	Just here for the bere: Distilleries and breweries help to conserve ancient Scottish barley	https://pure.uhi.ac.uk/en/publications/just-here-for-the-bere-distilleries-and-breweries-help-to-conserv		Publication	2015	Peter Martin	UHI		https://pureadmin.uhi.ac.uk/ws/portalfiles/portal/1891680/B_D_Jan_2015_05_Bere_Barley.pdf
36	Crops	Transnational cooperation to develop local barley to beer value chains	https://www.degruyterbrill.com/document/doi/10.1515/opag-2020-0014/html	Northern Periphery and Arctic Programme	Publication	2020	Peter Martin	UHI (Norwegian Institute of Bioeconomy Research; Matis- Icelandic Food and Biotech R&D)		https://www.degruyterbrill.com/document/doi/10.1515/opag-2020-0014/html
37	Wildlife	Using a modelling approach to inform progress towards stoat eradication from the Orkney Islands	https://abdn.elsevierpure.com/en/publications/using-a-modelling-approach-to-inform-progress-towards-stoat-eradi	NERC, NatureScot, RSPB	2017-2021	2021	Xavier Lambin	University of Aberdeen (Mammal Research Institute, Poland)		https://www.frontiersin.org/journals/conservation-science/articles/10.3389/fcosc.2021.780102/full
38	Wildlife	The changing pace of insular life: 5000 years of microevolution in the orkney vole (microtus arvalis orcadensis)	https://abdn.elsevierpure.com/en/publications/the-changing-pace-of-insular-life-5000-years-of-microevolution-in		Publication	2014	Keith Dobney	University of Aberdeen (University of Highlands and Islands; Durham University; Academy of Sciences of the Czech Republic; University of Helsinki)		https://academic.oup.com/evolut/article/68/10/2804/6852279

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39	Agriculture	The agronomic performance and nutritional content of oat and barley varieties grown in a northern maritime environment depends on variety and growing conditions	https://abdn.elsevierpure.com/en/publications/the-agronomic-performance-and-nutritional-content-of-oat-and-barl		2012-2014	2017	Andrew Chappell	UHI; University of Aberdeen (Aberystwyth University; JHI)		https://www.sciencedirect.com/science/article/pii/S0733521017300139?ia%3Dihub
40	Food & Drink	In what ways do Orkney food and drink companies use provenance in marketing their products?	https://eresearch.qmu.ac.uk/handle/20.500.12289/7773		Honours project?			Queen Margaret University		
41	Environment	Strategic environmental assessment practices in European small islands: insights from Azores and Orkney islands	https://strathprints.strath.ac.uk/54830/	Fundação para a Ciência e Tecnologia scholarship	PhD? (SFRH/BD/77091/2011; Pest-OE/AMB/UI4085/2013)	2016	Alexandra Polido	CENSE, Center for Environmental and Sustainability Research, Universidade NOVA de Lisboa, Portugal (University of Strathclyde)		https://www.sciencedirect.com/science/article/pii/S0195925515001195?via%3Dihub
42	Agriculture	Experiencing landscape: Orkney hill land and farming	https://www.sciencedirect.com/science/article/pii/S0743016706000313?via%3Dihub		Publication	2007	Jo Lee	University of Aberdeen		
43	Conservation	Evidence for food limitation in the declining hen harrier population on the Orkney Islands, Scotland	https://www.sciencedirect.com/science/article/pii/S0006320702003063		Publication		Simon Thirgood, Arjun Amar	University of Aberdeen		
44	Agriculture	An appetite for arsenic: The seaweed eating sheep from Orkney	https://books.rsc.org/books/edited-volume/508/chapter-abstract/160077/An-appetite-for-arsenic-The-seaweed-eating-sheep		Book chapter			University of Aberdeen		
45	Agriculture / History	Further isotopic evidence for seaweed-eating sheep from Neolithic Orkney	https://www.sciencedirect.com/science/article/pii/S2352409X16304552?via%3Dihub		Publication	2022		University of Aberdeen		
46	Crops	Evaluating variation in germination and growth of landraces of barley (Hordeum vulgare L.) under salinity stress	https://www.frontiersin.org/journals/plant-science/articles/10.3389/fpls.2022.863069/full	AHDB (Cereals and Oilseeds Ph.D. Studentship); JHI	Studentship	2016	Tim George	James Hutton Institute (Swedish University of Agricultural Sciences, University of Aberdeen)		
47	Soil	The Soils of Orkney	https://www.hutton.ac.uk/sites/default/files/files/soils/Orkney_Soil_Memoir_2016.pdf		Chapter	2020	F.T Dry	James Hutton Institute (Simon Fraser University (Canada); Stony Brook University (USA); Max Planck Institute for the Science of Human History (Germany); University of the Highlands and Islands; UMR 7209 Archéozoologie, France)		

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48	Agriculture / History	Identifying seaweed consumption by sheep using isotope analysis of their bones and teeth: Modern reference δ13C and δ15N values and their archaeological implications	https://pureadmin.uhi.ac.uk/ws/portalfiles/portal/8074774/Blanz_et_al_2020_JAS_Identifying_seaweed_consumption_by_sheep.pdf	NERC; European Social Fund; Scottish Funding Council	Publication (NERC NER/B/S/2003/00223; Scotland 2014-2020 European Structural and Investment Fund Programme)	2020	Magdalena Blanz; Jörg Feldman	UHI; University of Aberdeen (Simon Fraser University (Canada); Scottish Universities Environmental Research Centre)		https://www.sciencedirect.com/science/article/pii/S0305440320300625?via%3Dihub
49	Agriculture / History	Seaweed fertilisation impacts the chemical and isotopic composition of barley: Implications for analyses of archaeological skeletal remains	https://pureadmin.uhi.ac.uk/ws/portalfiles/portal/3573217/JAS_104_2019_34_to_44_pre_print_002_.pdf	European Social Fund; Scottish Funding Council; RESAS	Publication	2019	Magdalena Blanz	UHI; University of Aberdeen (Scottish Universities Environmental Research Centre; JHI)		https://www.sciencedirect.com/science/article/pii/S0305440318306058?via%3Dihub
50	Crops / Fruits	Salal (Gaultheria shallon) and aronia (Aronia melanocarpa) fruits from Orkney: Phenolic content, composition and effect of wine-making	https://www.sciencedirect.com/science/article/pii/S0308814616303764	RESAS	SRP (2011-2016)	2016	Gordon McDougall	James Hutton Institute		https://www.sciencedirect.com/science/article/pii/0308814616303764#s0010
51	Diet	Regular crabmeat consumers do not show increased urinary cadmium or beta-2-microglobulin levels compared to non-crabmeat consumers	https://www.sciencedirect.com/science/article/pii/S0946672X18303602?via%3Dihub	Orkney Fisherman's Society Ltd and MacDuff Shellfish Ltd; UK Sea Fish Industry Authority's (Seafish) Strategic Investment Programme 2015-2018. RESAS	Research	2019	Alan Sneddon	Rowett, University of Aberdeen (BioSS; Stromness surgery and Balfour hospital, NHS Orkney)		
52	Wildlife (seabirds)	Validating the use of intrinsic markers in body feathers to identify inter-individual differences in non-breeding areas of northern fulmars	https://abdn.elsevierpure.com/en/publications/validating-the-use-of-intrinsic-markers-in-body-feathers-to-ident	NERC (Additional funding fromTalisman Energy (UK) Ltd)	Studenship	2016	Paul Thompson	University of Aberdeen (Queen's University Belfast, Wageningen University & Research)		https://link.springer.com/article/10.1007/s00227-016-2822-1
53	Biodiversity	Influence of habitat on breeding performance of Hen Harriers Circus cyaneus in Orkney	https://nora.nerc.ac.uk/id/eprint/6359/	Scottish Natural Heritage	Publication	2007	Arjun Amar	Centre for Ecology and Hydrology (NatureScot)	RSPB	https://onlinelibrary.wiley.com/doi/10.1111/j.1474-919X.2007.00765.x
54	Crops	The potential for kelp manufacture to lead to arsenic pollution of remote Scottish islands	https://abdn.elsevierpure.com/en/publications/the-potential-for-kelp-manufacture-to-lead-to-arsenic-pollution-o:	The Leverhulme Trust	Publication	2006	AA Meharg	University of Aberdeen		https://www.sciencedirect.com/science/article/pii/S0045653506001895?via%3Dihub#aep-acknowledgment-id48
55	Agriculture	Iodine Excretion and Accumulation in Seaweed-Eating Sheep from Orkney, Scotland	https://www.publish.csiro.au/en/EN06041		Publication	2006	Jörg Feldman	University of Aberdeen		https://www.publish.csiro.au/en/EN06041

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56	Food & Drink / Energy	Hyspirits I & II	https://www.emec.org.uk/projects/hydrogen-projects/hyspirits/	Department of Business, Energy, and Industrial Strategy (BEIS); phase 1 of the Green Distilleries Competition	2020-2021 (II) 2019-2020 (I)			Edinburgh Napier University (Edrington (Highland Park) Orkney Distilling Ltd. EMEC)		
57	Crops	Heritage genetics for adaptation to marginal soils in barley	https://discovery.dundee.ac.uk/ws/portalfiles/portal/100596246/1_s2.0_S1360138523000274_main.pdf	EU Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie grant, The Independent Research Fund Denmark, RESAS	Research 9840829, (grant DFF 7017-00082))	2023	Joanne Russell	JHI (UHI (Agronomy Institute); University of Copenhagen; Innovation Centre for Organic Farming (Denmark))		https://www.cell.com/trends/plant-science/fulltext/S1360-1385(23)00027-4?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS1360138523000274%3Fshowall%3Dtrue
58	Livestock / Social	The role of livestock in food system resilience in remote, upland regions	https://gtr.ukri.org/projects?ref=BB%2FR005796%2F1#/tabOverview	BBSRC (Co-funders Economic and Social Research Council (Co-funder) Scottish Government (Co-funder) Natural Environment Research Council (Co-funder))	Research (BB/R005796/1)	2021	Ann Bruce	University of Edinburgh (University of Oxford; SRUC; RAFT Solutions Ltd, QMS, Scottish Crofting Federation, North Yorkshire and East Riding Enterprise Partnership, Yorkshire Agricultural Society, HIE)		https://journals.sagepub.com/doi/10.1177/003072702098481 2
59	Livestock / History	Revealing the History of Sheep Domestication Using Retrovirus Integrations	https://www.research.ed.ac.uk/en/publications/revealing-the-history-of-sheep-domestication-using-retrovirus-int	BBSRC; Wellcome Trust; NIH; Scottish Funding Council (plus others)	Publication	2009	Massimo Palmarini	University of Glasgow (University of Edinburgh (plus 25 others))		https://www.science.org/doi/10.1126/science.1170587
60	Crops / History	Climatic controls on the survival and loss of ancient types of barley on North Atlantic Islands	https://research-portal.st-andrews.ac.uk/en/publications/climatic-controls-on-the-survival-and-loss-of-ancient-types-of-ba	RESAS; NERC	Publication (NERC project SCOT2K; NE/K003097/1)	2023	Peter Martin	UHI (University of Manchester; JHI; Stockholm University; Swansea University; University of St Andrews)		https://link.springer.com/article/10.1007/s10584-022-03474-0
61	Marine	Monitoring long-term changes in UK grey seal pup production	https://research-portal.st-andrews.ac.uk/en/publications/monitoring-long-term-changes-in-uk-grey-seal-pup-production	NERC	Publication (SMRU1001)	2019	Debbie Russell	University of St Andrews (Sea Mammal Research Unit; Conservation Research Ltd)		https://onlinelibrary.wiley.com/doi/10.1002/aqc.3100
62	Nature	Factors affecting breeding distribution of Storm-petrels Hydrobates pelagicus in Orkney and Shetland	https://eprints.gla.ac.uk/4215/	Marie Curie	Publication	2006	Robert Furness	University of Glasgow (Universidad Miguel Hernández; Shetland Biological Records Centre)	RSPB	https://www.tandfonline.com/doi/abs/10.1080/00063650609461417
63	Nature	Stable isotope analysis of feathers taken from greylag geese on Orkney	https://www.nature.scot/doc/naturescot-research-report-1337-stable-isotope-analysis-feathers-taken-greylag-geese-orkney	NatureScot	NatureScot Research Report 1337 (2016)	2023	Jason Newton	NatureScot		

Project	Category	Title	Link	Funder/ Network	Type of Activity, Reference & Duration	Year of Publication	Main Individual	Main Individual's Affiliation (& Academic & Non-Academic Partners)	Associated Stakeholders	For Projects: Associated Publications (Inc. DOI)
64	Marine	Rocky shore biodiversity: Separating the effects of anthropogenic impacts from natural variation and climate change impacts	https://gtr.ukri.org/projects?ref=studentship-2932969#/tabOverview	NERC	Studentship (2024-2028) (2932969)		Thomas Blaxter (PI)	University of St Andrews (Orkney Harbour Authority)		
65	Crops	Back to the future: using ancient barley in a changing climate	https://gtr.ukri.org/projects?ref=studentship-2920188#/tabOverview	BBSRC	Studentship (2024-2028) (2920188)		Joanne Russell (PI)	University of Dundee (Bruichladdich Distillery (Islay))		
66	Wildlife (seabirds)	Lagged effects of ocean climate change on fulmar population dynamics	:		Publication	2001	Paul Thompson	University of Aberdeen		https://www.nature.com/articles/35096558#Ack1
67	Food & Drink	Orkney fruit kombucha	https://pure.uhi.ac.uk/en/projects/orkney-fruit-kombucha	Innovation Voucher - college	Project		Peter Martin	UHI (Orkney Craft Vinegar)		
68	Agriculture / History	Looking in from the Edge (LIFTE): The impact of international commercialization on north-west Europe's peripheral communities 1468-1712: production, commerce and consumption in Orkney and Shetland	https://pure.uhi.ac.uk/en/projects/looking-in-from-the-edge-lifte-the-impact-of-international-commer	Arts and Humanities Research Council (AHRC) & German Research Foundation (DFG)	2020-2023		Sarah Jane Gibbon	UHI		
69	Crops	Is Bere barley specifically adapted to fertilisation with seaweed as a nutrient source?	https://pure.uhi.ac.uk/en/publications/is-bere-barley-specifically-adapted-to-fertilisation-with-seaweed	RESAS; European Social Fund and Scottish Funding Council	Publication	2020	Tim George	JHI (UHI; University of Aberdeen)		https://link.springer.com/article/10.1007/s10705-020-10090-w
70	Crops	Fields with no recent legume cultivation have sufficient nitrogen-fixing rhizobia for crops of faba bean (Vicia faba L.)	https://pure.uhi.ac.uk/en/publications/fields-with-no-recent-legume-cultivation-have-sufficient-nitrogen	RESAS; EU-FP7; EU H2020; Genomia; BBSRC	Publication (TRUE, Grant Agreement Number 727973; DIVERSify, Grant Agreement Number 727824; TOMRES, Grant Agreement Number 7279290	2022	Euan James	JHI (University of Stirling; UHI; University of Reading; University of York; Addis Ababa University; Royal Botanic Gardens)		https://link.springer.com/article/10.1007/s11104-021-05246-8
71	Marine	Toxins from harmful algae in fish from Scottish coastal waters	https://pure.uhi.ac.uk/en/publications/toxins-from-harmful-algae-in-fish-from-scottish-coastal-waters	Scottish Government Marine Mammal Scientific Support Programme; NERC; Interreg Atlantic Area	Publication (MMSS/002/15; NE/R015007/1; EAPA-182-2016; EAPA-317-2016)	2021	Joanna Kershaw	University of St Andrews; UHI (The Norwegian Directorate of Fisheries; US Fish and Wildlife Service Alaska Region; Marine Scotland Science; Cefas; Scottish Marine Institute)		https://www.sciencedirect.com/science/article/pii/S1568988321000986?via%3Dihub

Table 1 (continued)

Project	Category	Title	Link	Funder/ Network	Type of Activity, Reference & Duration	Year of Publication	Main Individual	Main Individual's Affiliation (& Academic & Non-Academic Partners)	Associated Stakeholders	For Projects: Associated Publications (Inc. DOI)
72	Crops	N, P and K Fertilizers Alter Plant Growth, Essential Oil Yield and Gender of Sweet Gale (Myrica gale L)	https://pure.uhi.ac.uk/en/publications/n-p-and-k-fertilizers-alter-plant-growth-essential-oil-yield-and-	HEI; Boots; Highland Natural Products; Essentially Scottish Botanicals	Publication	2014	Peter Martin	UHI (Royal Agricultural University)		https://benthamopenarchives.com/contents/pdf/TOPSJ/TOPSJ-8-9.pdf
73	Crops	Production potential and crop agronomy of sweet gale (Myrica gale L.) in the north of Scotland	https://pure.uhi.ac.uk/en/publications/production-potential-and-crop-agronomy-of-sweet-gale-myrica-gale-	HEI; Boots; Highland Natural Products; Essentially Scottish Botanicals	Publication	2013	Peter Martin	UHI (University of Liverpool)		https://doi.org/10.1016/j.indcrop.2012.12.0343
74	Crops / Fruits	Fruit production and polyphenol content of salal (Gaultheria shallon Pursh), a potential new fruit for northern maritime regions	https://pure.uhi.ac.uk/en/publications/fruit-production-and-polyphenol-content-of-salal-gaultheria-shall	Scottish Government's interface programme; UK Government's Strategy Board	Publication	2015	Peter Martin	UHI (JHI)		https://www.cabidigitallibrary.org/journal/fruits
75	Crops	Effect of nitrogen, phosphorous, potassium,plant growth regulator and artificial lodging on grain yield and grain quality of a landrace of barley	https://pure.uhi.ac.uk/en/publications/effect-of-nitrogen-phosphorous-potassium-plant-growth-regulator-a	UHI	Studentship	2017	Peter Martin	UHI (Royal Agricultural University; Agrii)		https://ijeab.com/detail/effect-of-nitrogen-phosphorous-potassium-plant-growth-regulator-and-artificial-lodging-on-grain-yield-and-grain-quality-of-a-landrace-of-barley/
76	Marine	The Gonyaulax spinifera (Dinophyceae) "complex": Perpetuating the paradox?	https://pure.uhi.ac.uk/en/publications/the-gonyaulax-spinifera-dinophyceae-complex-perpetuating-the-para	NERC	Publication (GR3/10803)	2009	Andre Rochon	University of Westminster (University of Copenhagen; University of Southampton)		https://www.sciencedirect.com/science/article/pii/S0034666709000050?via%3Dihub
77	Crops	The effect of seaweed fertilisation on sulfur isotope ratios (δ34S) and grain size in barley: implications for agronomy and archaeological research	https://pure.uhi.ac.uk/en/publications/the-effect-of-seaweed-fertilisation-on-sulfur-isotope-ratios-δ34s	European Social Fund; Scottish Funding Council; RESAS; NERC	Publication (NERC Strategic Environmental Science Capital Call grant (#CC018))	2024	Magdalena Blanz	University of Vienna (UHI; Durham University)		https://www.frontiersin.org/journals/environmental-archaeology/articles/10.3389/fearc.2024.1465082/full
78	Crops	Effect of dose and timing of application of different plant growth regulators on lodging and grain yield of a Scottish landrace of barley (Bere) in Orkney, Scotland	https://pure.uhi.ac.uk/en/publications/effect-of-dose-and-timing-of-application-of-different-plant-growt	UHI	Studentship	2017	Peter Martin	UHI (Royal Agricultural University; Agrii)		https://ijeab.com/detail/effect-of-dose-and-timing-of-application-of-different-plant-growth-regulators-on-lodging-and-grain-yield-of-a-scottish-landrace-of-barley-bere-in-orkney-scotland/
79	Crops	The nutritional properties of flours derived from Orkney grown bere barley (Hordeum vulgare L.)	https://pure.uhi.ac.uk/en/publications/the-nutritional-properties-of-flours-derived-from-orkney-grown-be		Publication	2006	J.H French	UHI (British Nutrition Foundation)		https://onlinelibrary.wiley.com/doi/10.1111/j.1467-3010.2006.00528.x

Project	Category	Title	Link	Funder/ Network	Type of Activity, Reference & Duration	Year of Publication	Main Individual	Main Individual's Affiliation (& Academic & Non-Academic Partners)	Associated Stakeholders	For Projects: Associated Publications (Inc. DOI)
80	Farming & Rural Society	Farming and the Nature of Landscape: Stasis and Movement in a Regional Landscape Tradition	https://abdn.elsevierpure.com/en/publications/farming-and-the-nature-of-landscape-stasis-and-movement-in-a-regi	ESRC	Publication (RES-000-23-0312)	2012	Jo Vergunst	University of Aberdeen		https://www.tandfonline.com/doi/abs/10.1080/01426397.2011.652808
81	Crops	Yield response of Bere, a Scottish barley landrace, to cultural practices and agricultural inputs			2003-2005	2010	Peter Martin	UHI		https://oaj.fupress.net/index.php/jaeid/article/view/11004
82	Agriculture / Economy	Rural and Agricultural Development: Maximising the potential in the islands of Orkney, Shetland, and Outer Hebrides	https://www.ruralexchange.scot/projects/island-agriculture/	Scottish Government's Community Led Local Development Fund, as part of the Scottish Rural Development Programme, and was delivered by the Orkney Local Action Group in collaboration with the Shetland Local Action Group, Outer Hebrides Local Action Group, Orkney Islands Council, Shetland Islands Council, Comhairle nan Eilean Siar and Highlands and Islands Enterprise	Report (OIC/PROC/1802)	2024	Steven Thomson	SRUC (Pareto Consulting; SAC Consulting)		https://sruc.figshare.com/ndownloader/files/47677282

SUMMARY OF RESEARCH TOPICS FROM THE DIRECTORY

Research on crops

Many of the studies focused on Bere barley looking at genetic diversity, local adaptation, breeding strategies, requirement and response to different fertilisers, nutritional qualities of the grain and product development.

Production of Sweet Gale (*Myrica gale*) or Bog Myrtle in Orkney as an agricultural crop for use in the food and cosmetic industries.

The use of legume crops to enable biological Nitrogen fixation resulting in high yields of crops without the application of additional fertilisers and also providing fixed Nitrogen for the succeeding non-legume crop.

Soil contamination with arsenic from historic drying and burning of seaweed to produce kelp. Historically, Orkney was a major producer of kelp in Scotland and the study shows that there are still elevated arsenic levels in the soils in the immediate vicinity of the kelp burning pits.

Salal (*Gaultheria shallon*) and aronia (*Aronia melanocarpa*) fruits were grown in Orkney and assessed for their suitability as a locally produced fruit to make distinctive fruit wines. Other fruits currently being studied are elderberry, blueberries, cranberries and tea.

Research on livestock

A study of perinatal mortality in beef herds in Orkney to determine incidence, cause and associated risk factors to help develop evidence-based advice to optimize production performance on farm.

Research to determine the prevalence of Johne's disease in cattle in Orkney.

Compensatory growth is the ability of cattle to compensate for a period of growth restriction, usually over the winter months, with a period of enhanced growth in the summer months. Practicing this system may save on winter feeding costs and this was evaluated in a beef suckler farm in Orkney.

Orkney farmer attitudes to bovine viral diarrhoea virus (BVDV) eradication were examined to determine how farmers felt about advice networks, information sharing, motivation, benefits of getting involved in the scheme, perception of BVDV as a priority disease and attitudes to regulation.

Orkney's BVDV eradication programme (2001-2008) strategy and results. The study involved the local veterinary practices, the Orkney Livestock Association and Orkney Islands Council.

A study exploring the demographics, animal health, husbandry and biosecurity practices of small holders keeping livestock and how they interact with other livestock sectors.

Understanding the critical factors that influence the resilience to change of beef and sheep farmers in Orkney and the impact of livestock farming on local and global food supplies, the upland environment, local employment opportunities and local culture.

Endogenous retroviruses were used as genetic markers to determine the history of domestication of sheep and showed a primitive grouping of sheep including the Orkney, Soay and Nordic short-tailed sheep.

Photo: www.unsplash.com

Research on farming and nature

The research includes work on: assessing the impact of changing migratory patterns and population size of greylag geese on agriculture and public health on Orkney; transmission and impact of zoonotic pathogens in drinking water catchments and interactions between livestock and wildbird populations.

Research on conservation, wildlife and nature

The research includes work on: pup mortality in harbour seals; mortality in wild bird populations; eradication of stoats; microevolution in the Orkney vole; markers in body feathers of northern fulmars; breeding distribution of wild birds; ocean climate change effects on fulmar populations.

Research on biodiversity

The research includes work on: hoverflies and pollinating bees; agricultural wetland management to reduce predation and improve wader breeding; habitat and breeding performance of hen harriers.

Research on food and drink

The research includes work on: peat source and impact on the flavour of Scotch whisky; provenance and marketing of Orkney food and drink products.

Research on marine science

The research includes work on: phocine distemper epizootics in harbour seals; declining abundance of harbour seals, marine food web dynamics; rocky shore biodiversity and toxins from harmful algae in fish.

Photo: www.shutterstock.com

Research Facilities in Orkney

University of Highlands and Islands (UHI) Orkney has campuses in Kirkwall and Stromness and leads research at UHI in Agronomy, Archaeology and Northern Studies. UHI Orkney has a wide range of full time or part time courses for students ranging from vocational, professional, National 5, NC-NQ, HNC, HND, Degree and post-graduate qualification[34].

In the area of Agriculture, UHI Orkney offers courses in Agriculture, mixed farming, Livestock, Horticulture and Rural skills ranging from NC to HNC. The course covers a combination of practical and theoretical work that includes a significant component of work placements on farm.

The Agronomy and Agricultural Institute has focussed on the development and commercialisation of new crops and plant products that would have a positive impact in Orkney and the Highlands and Islands of Scotland. Over recent years this has included, research into Bere barley, wheat, oats and malting barley. There has also been work looking at the use of short rotation willow and woody plants as a biomass energy source. Research investigation has taken place with plants such as arnica, bog myrtle and some berry species such as salal and aronia to be used in the pharmaceutical, cosmetic and food and drink industries.

The institute continues the work on bere and bere products but has diversified since the introduction of a new Director in 2024. Along with research on cereals the institute now focuses on sustainable cropping systems and protected plant production as well as integrated pest management[34].

There are laboratory facilities at UHI Orkney and office space with IT infrastructure that could be used by visiting researchers undertaking field work in Orkney depending on the type of work and range of laboratory facilities required. There is no dedicated student accommodation or temporary accommodation for visiting researchers on the island.

The Orkney Research and Innovation Campus (ORIC)[35] is located in Stromness at the site of the former Stromness Primary School. The campus is a joint investment involving Orkney Islands Council and Highlands and Islands Enterprise and provides facilities for academic and commercial activities, collaborations and new business start ups. ORIC is currently a focus for marine renewables research and energy and low carbon innovation and provides premises for Heriot Watt University International Centre for Island Technology; Robert Gordon University; European Marine Energy Centre; Aquatera Ltd; Orkney Hyperbaric Trust and Sula Diving (https://www.hw.ac.uk/uk/schools/energy-geoscience-infrastructure-society/research/icit.htm https://www.rgu.ac.uk/research/rgu-orkney https://www.emec.org.uk https://www.aquatera.co.uk https://www.oht.scot https://www.suladiving.com)

Space can be hired at the facilities including lecture theatres, teaching spaces, collaborative working spaces and meetings rooms. The Campus will benefit from investment through the Islands Growth Deal,

34. https://www.uhi.ac.uk/en/research-enterprise/res-themes/silk/agronomy-and-agriculture-institute/
35. https://www.orkneycampus.co.uk

Island views on future research directions and local impact

The research team hosted a workshop in Kirkwall with stakeholders and key industry groups involved in all aspects of agriculture. The workshop explored their views and attitudes to agricultural research, identified research needs and gaps and looked at ways to improve the implementation, translation and impact of research to maximise benefits to Orkney.

Using the Ketso kit to visually display ideas from the workshop.

Around 30 people attended the workshop enabling representation from a wide group of organisations and industries relevant to the project including: Orkney Livestock Association, Rural Payments and Inspections Division Scottish Government, Orkney Mart, Orkney Agricultural Discussion Society, National Farmers Union Scotland, SAC consulting, UHI Orkney College, Highlands and Islands Enterprise Orkney, Orkney Islands Council, Northvet Veterinary Practice, Flett and Carmichael Veterinary Practice, Island Centre for Net Zero, Developing the Young Workforce Orkney, Biomathematics and Statistics Scotland, Moredun Research Institute and several farmers from different parts of the islands. Most of the participants were from mainland Orkney with representation from the outer islands of Westray and Stronsay.

The workshop comprised group working with chaired plenary feedback sessions and open discussion along with the use of the interactive presentation platform (mentimeter) to enable participants to interact in real time through voting options or directly responding to particular questions. The group also used a Ketso kit[36] to capture further insights, encourage wider participation and the sharing and linking of ideas. Ketso is a visual and colourful toolkit that displays information in an efficient and effective way to enable people to build on ideas and encourage wider participation.

Partcipants at the workshop in Kirkwall.

36. https://ketso.com/the-history-of-ketso/

Discussion Topics

Identify key research gaps and questions relevant to your industry/ community

The participants were asked to discuss this topic by focusing on 3 key areas.

- What do you want from research?
- Opportunities and challenges for place-based research?
- Experience of previous research projects?

What do you want from research?

A wide-ranging discussion was held and several research areas and topics were put forward by the groups.

Mentimeter

What **3 words** come into your mind when you think of research?

48 responses

3 16

Mentimeter

How can research be **effectively communicated** to relevant stakeholders

Visual evidence-based media centered around the real world work that has been done and the impacts that have/could lead from that.

Short, concise reports in basic farmers friendly language. Email or whatsapp messages..

Easy to understand messages communicated through different ways such as videos, radio interviews, press releases, and face to face meetings.

Money saved and profit increased

Short videos, podcasts and webinars on youtube etc. Must be made by trusted individuals/ organisations Whatsapp groups

Hardcopy of info (newsletter) by post and Email Social media Physical meeting Local newspaper App

Target audiences better. What is relevant in some areas of Scotland may not be relevant in others.

Podcasts/YouTube series

1 15

Mentimeter

How can research be **effectively communicated** to relevant stakeholders

Peer group engagement and adoption of innovation and new tech and knowledge

Feedback may vary depending on the involvement of certain stakeholders with the project, compared to others. I.e. Some in person and more detailed, others just an overview via other means

Whatever format used has to be relevant and concise. Podcast, social media, email, web, in person, practical sessions. Not a one size fits all.

Farming press/journals. Email Orkney radio Orkney farmers Facebook

Don't rely on one platform to communicate. Look at local outlets too.

Through groups like OADS, NFU and OLA. Facebook?

WORKSHOPS OF COURSE!

1 15

Photo: www.pixabay.com

FUTURE RESEARCH PRIORITIES FOR ORKNEY

Research on crops

- There was interest in looking at different crop plant species that would work in the Orkney climate and would be quick growing, provide high protein, require low inputs and aid in regenerative agricultural practices.
- Information is required on the ability to harvest new crops.
- Investigate options to produce better grass and barley from using new varieties in Orkney. Is it possible to produce a variety of grass that is good for livestock grazing but would not be eaten by geese?
- Information on what would be the best types of cover crops to grow to improve soil fertility and health and help to prevent soil erosion.
- Is there a way to achieve better seed selection for growing species or varieties of crops in Orkney relating to local climate conditions to give optimal yields.
- There was discussion around the pros and cons of growing single species monoculture crops compared with a permaculture approach that would incorporate crop rotations and companion planting and participants were interested to know the benefits of the different approaches relating to carbon loss and capture and the inputs required for the different systems.
- Dealing with weeds, docks and leatherjackets were also raised as issues on Orkney.
- Are there waste products from other industries that could be used to help fertilise crops and improve soils – supporting the circular economy?

Research on soils

- There was real interest in finding out more about soil health, microbiology and biodiversity and understanding the difference between good and bad pests.
- The group were interested in dung beetles and how they are important in soil ecosystems by feeding on manure and improving the nutrient quality of the soil and bringing benefits for pasture and crop growth.
- Participants were also interested to find out more about the effects of different fertilisers, herbicides and pesticides on soil health.
- More information was sought on the benefits or downsides of soil tillage and how it might affect soil fertility and/or erosion.
- The interactions of soils and crop and animal diseases was discussed.
- The topic of One Health was raised as having great potential as a research topic on Orkney and this is now a key theme for UHI.

Photo: Elisabeth Innes

Research on livestock

- More information is required on understanding the roles of genetics, feeding and health on the productivity and efficiency of livestock production.
- Improved knowledge of suckler cow breeds or crosses as regards good maternal lines and better feed conversion.
- There was interest in understanding more about emerging or new diseases that may cause problems for livestock in Orkney and understanding how these may be detected and prevented. Linked to this was the recognition that it would be helpful to understand more about livestock coming into Orkney and where they have come from. The participants raised concerns about the risks of zoonotic or animal disease transmission from unmanaged livestock.
- Specific livestock diseases raised by the participants as being important for research in Orkney were Johne's disease, Infectious bovine rhinotracheitis (IBR), Neosporosis, roundworms and sheep scab. The participants were keen to have improved diagnostic tests for Johne's disease that were more reliable, more specific and more sensitive.
- Many of the participants highlighted concerns about the best way to control parasitic worms in sheep and cattle with recognition of the increasing issues around parasite resistance to treatments. Research should be focused on improved and more rapid tests to support treatment strategies and new treatments.
- Sheep scab was highlighted as an important issue in Orkney. There was a requirement for improved prevention and control strategies, improved treatments and safe ways to dispose of the organophosphate-based plunge dip waste relied upon for control of sheep scab and other ectoparasites.
- The need for more accurate and rapid diagnostic local testing and improved monitoring of disease was highlighted, especially reducing the time required between sending off samples and receiving back the test results as this can result in unnecessary delays to animal treatment.
- Research into vaccines to prevent disease was seen to be an important way to help prevent and control diseases. A specific ask was to look at the possibility of developing "one shot" vaccines that would aim to protect against a range of diseases in a syndrome e.g.: reproductive or respiratory diseases that are caused by multiple pathogens. A further idea was to create a standard way of delivering vaccines to animals as there are many different application techniques depending on the vaccine and the manufacturer and it would be helpful if this could be standardised or simplified. It would also be helpful to have vaccines and medicines available in suitable amounts to help with storage and reduce waste. Discussion also took place to try and understand the cost-benefit analysis of using vaccination to prevent disease versus allowing animals to develop natural immunity.

Photo: www.shutterstock.com

Research on wildlife

- Research is required to determine the economic, biological and one health impacts of the increasing numbers of resident Greylag geese in Orkney. Research is required to provide evidence to government to increase understanding of the local challenges and impacts of the situation and to help develop more effectives policies to tackle the problem.
- The roles of NatureScot and RSPB were felt to be important and relevant to research on wildlife in Orkney

Other research topics

- There was interest in finding out more about measurement of methane and understanding about carbon sequestration and carbon cycling to develop practical monitoring tools for use on the farm.
- There was interest in finding out more about the microbiome in soils, crops and animals and how this relates to health and disease.
- The group also discussed the importance of obtaining research funding for projects and the need to focus on the feasibility of the proposed work, the cost and the timescales.

What do you feel are the opportunities and challenges for place-based research?

OPPORTUNITIES

The aspiration to create disease-free status in Orkney, similar to what has been achieved in Shetland, and leading to many benefits including improved health and welfare of livestock, increased efficiency of production and providing new marketing opportunities for products and animals (high health status).

The positive benefits of the local authority providing support for disease control projects and the option of providing a coordinating role, which has been shown to be critical to coordinating disease control efforts.

Development of new feed grains that are hardy, have a good yield, early ripening and long straw stalk. It would be great to get all these traits in a single low-input crop.

Potential to learn more about livestock genetics and the potential for genetic gains.

Developing new collaborations between Agronomy and Agricultural Institute, UHI, Orkney and the SEFARI research institutes and other organisations active in agricultural research.

Investigate the benefits of applying new technologies, automation, remote sensing applications, robotics and use of green fuels to improve the efficiency and sustainability of farming.

The participants raised whether part of a farm should be set aside to conduct research or innovation and there was discussion on how this might be set up so that results could be captured and shared to bring further benefits. There was agreement on the need for locally driven solutions that would be suitable for use in Orkney.

Developing new opportunities for employment and jobs within agriculture and science in the islands.

Work with schools to raise awareness of career opportunities in agriculture and science.

Communication of new advances in agriculture and increasing public awareness and engagement in agriculture and farming.

CHALLENGES

There were concerns raised by the participants about the eligibility criteria to obtain support payments for biodiversity in the new agriculture policies being developed by Scottish government. It was felt that the policy should be more flexible to enable local decisions to be made that would be better suited to Orkney.

The group felt that there was a lack of understanding from the government about some of the current pressures and concerns in the farming communities and some of the specific issues pertinent to the island communities.

Participants discussed the proposed changes to the government support payments and the consequences to the viability of farm businesses. Concerns were raised about moving to a more market-driven approach with fewer or no support payments. Some recent arable studies suggest that agroecological farming is rarely profitable without support payments[37].

There were concerns raised about how to get knowledge to enable farmers to understand climate change threats and how to adapt farm practices.

There was recognition in the group of declining cattle numbers in Orkney and the subsequent effect of this to downstream businesses in the islands.

It was recognised by the group that there was a general shortage of skilled farm labour in the islands and this included issues with recruitment and retention of veterinary staff due to workload management and anti-social hours.

The group also raised issues of mental health, stress and high workloads of farmers and how this impacted succession planning for farms and encouraging new entrants to the industry.

Participants raised the lack of longer-term funding for schemes to help support changes in agricultural practice that were independent of a commercial agenda. The group felt that the research should be conducted independently without commercial bias.

There was concern in the group about the lack of people to carry out research, in particular research that may require longer time scales.

The risk and cost of innovation was discussed by the group in particular the cost of what was referred to as "negative experiments" where the innovation does not work in the farm setting. Further discussion took place on how to "de-risk" innovation through setting experimental trials up using facilities at the Agronomy and Agricultural Institute, UHI, Orkney or finding funding support to conduct research on farms in Orkney.

The group acknowledged that it was important to provide sufficient evidence that would help to convince people of the validity of the findings.

Photo: www.shutterstock.com

37. https://www.rothamsted.ac.uk/news/agroecological-farming-boosts-soil-and-biodiversity-economic-barriers-remain

Experience of previous research projects

The group raised several research projects they had been involved in that included:

The development and growing of Bere barley in collaboration with the Agronomy and Agricultural Institute, UHI, Orkney. Bere is an ancient variety of barley that has several positive attributes for growing well and being resilient in the Orkney climate. It has positive nutritional benefits and has supported several downstream businesses in the local food and drink industries.

With livestock health there have been successful projects involving Bovine Viral Diarrhoea (BVD) eradication in Orkney using a combination of testing, culling, vaccination and biosecurity and this scheme helped in the development of a Scotland wide initiative involving industry and government to eradicate BVD[38]. There has also been a long-term scheme to tackle Johne's disease in cattle involving testing, culling and biosecurity measures to reduce incidence of disease. The long incubation time of the disease in animals and the difficulties in interpretation of the diagnostic tests make this a difficult disease to control. Participants noted the increased costs may have led to a reduction in testing and there was a fear that this could lead to increased disease. There was also a report of collaborative work with the Royal Dick Veterinary School in Edinburgh on metabolic analysis of cattle.

There is an on-going One Health research project involving several farmers in Orkney with the Moredun Research Institute to look at the presence of pathogens, *Cryptosporidium* species and *Campylobacter* in cattle, geese and in environmental samples to further understanding of the transmission routes, impact and risk of these pathogens. *Cryptosporidium* is a gastrointestinal parasite that causes severe disease in young livestock and can also cause human disease through contaminated water. *Campylobacter* is a major cause of human intestinal disease and can cause reproductive diseases in livestock. Due to the large numbers of geese in Orkney the project is looking to determine if there is any evidence for pathogen transmission between the geese and the livestock[28].

Participants observed that there did not seem to be much evidence of coordination of research and there were examples discussed of student projects that seemed to be doing very similar work or repeating work that may have been done previously.

The group felt it would be helpful to have some coordinating point of contact in Orkney to support and advise on research. This would help to make the most of existing and previous data and research findings, to build on what has been achieved, avoid repetition of work and avoid over burdening stakeholders. A coordinating point of contact would support research projects and coordinate activities where possible and appropriate to maximise the impact of research projects and make more efficient use of scarce resources and budgets to drive innovation.

The group recognised that research projects can take many different forms e.g.: desk-based, laboratory-based, requiring field sampling and testing and those that are providing evidence to support policy decisions. These different types of research projects will require different levels of support, funding and resources.

The group felt that research projects should be useful and benefit the stakeholders that need the research directly.

The participants raised the issues around incentives and felt that if a problem had to be addressed it would require both a "carrot and stick" approach to help drive the project forward, ensuring maximum levels of uptake, engagement and retention.

The group discussed how farmers might be incentivised to get involved in a field research programme or set up a "living lab". The point was raised about how this might be funded and the associated costs incurred with changing practices and how this may be de-risked. One of the participants raised the issue of convincing other family members to take part in the "living farm lab experiment".

38. https://www.gov.scot/publications/bovine-viral-diarrhoea-bvd-consultation-phase-6-consultation-questions/pages/3/

Moving Research into Practice

The participants were asked to discuss this topic by focusing on 3 key areas.

- What are the barriers and opportunities to implement new research?
- How could research be better coordinated and communicated for Orkney?
- How would you like to find out about research projects?

The following quotes are taken directly from workshop participants using Mentimeter.

Feedback may vary depending on the involvement of certain stakeholders with the project, compared to others. I.e. Some in person and more detailed, others just an overview via other means

Barriers and opportunities to implement new research

A wide-ranging discussion took place with the different groups and covered the following areas:

Funding and the competition for resources was raised along with time scales required to implement the research effectively.

Some of the participants raised the perceived barriers involved, both financial, time, and expertise to change farm practices. Would there be financial or other incentives to implement new research?

The benefits of the new research would have to be effectively communicated to farmers and be relevant to their businesses e.g.: reduction of disease, increased efficiency of production. Farmers were much more likely to get involved in changing practice if there was a clear benefit and it involved an issue they were interested in.

Several participants brought up the influence of family generations on farms and how it can be difficult to change mindsets and change farm practices. Some participants also raised issues of a fear of being judged by others for trying something new and also the influence of peer pressure in changing behaviours (social norm).

Don't rely on one platform to communicate. Look at local outlets too.

There was a recognition that there had to be a willingness to participate and engage with something new to maximise the benefits from new research and encourage wider involvement.

The point was raised that there was a disconnect between the farming community and the research community where it was felt that each group had different objectives and that it was important that both groups took time to define the problem and agree on common objectives for the project and ensure that the research addresses a relevant issue and that the outputs are practical and useful to apply on farm.

Whatever format used has to be relevant and concise. Podcast, social media, email, web, in person, practical sessions. Not a one size fits all.

How could research be better co-ordinated and communicated for Orkney?

The group felt that having a recognised point of contact for agricultural research in Orkney to help coordinate activities, provide information, raise awareness of research projects and respond to queries would be very beneficial.

Participants felt that having a research point of contact would also help to reduce duplication of effort, signpost projects towards appropriate collaborators and local stakeholders, improve communication with research organisations conducting research in Orkney and be more tailored towards local industry priorities and needs.

Some points were made about the potential of samples collected for research projects to be used for multiple projects to maximise benefits e.g.: use of samples in surveillance projects.

The group discussed different ways that research might be communicated in Orkney and these included: through local farming groups, the Orkney Agricultural Discussion Group, local press and radio, social media and by email.

How would you like to find out about research projects?

The participants discussed several communication routes to help find out more about research projects.

The point was raised that it was important to maintain information in more traditional hard copy/printed platforms e.g.: Farmers Weekly alongside more modern social media platforms to make the information accessible to a wide range of different people who have different preferences.

Participants were also interested to hear directly from the researchers so that they could ask questions and have the opportunity to discuss the research.

Many people expressed that the information about the research should be communicated in "plain English" be concise, easy to understand and presented in a relevant context for the audience.

Relevant "Case Studies" were felt to be a good approach as well as showing the economic and other impacts of the research in a real-world setting.

Short videos and webinars on YouTube were thought to be useful although participants pointed out that these had to be from trusted sources.

Some of the participants noted that having additional references and links were helpful if people wanted more in-depth information on a research topic, although most of the participants did not necessarily want all the scientific data to be presented.

Local farmers groups, the Orkney Agricultural Discussion Group, Orkney Livestock Association and other independent groups were seen as good fora to discuss research projects. Participants raised the issue of conflicts of interest when feed or animal health companies were providing the information as they had a vested interest. Participants felt that depending on the research it can be helpful to see how it might work in a farm context with a more practical approach to the communication methods.

Local media both print and radio were thought to be useful dissemination routes and participants mentioned how helpful it was to be able to listen to information from a podcast which could be combined with other work on the farm e.g.: when working in the tractor.

Peer group engagement and adoption of innovation and new tech and knowledge

Conclusions & Recommendations

Place-based approach to Agricultural Research

- Agriculture and farming are crucial aspects of the economy, culture and heritage in Orkney and there are challenges to the industry to increase the efficiency of food production while reducing impacts on the environment and protecting nature. This requires a greater understanding of the impacts of different farming practices and land use strategies along with the opportunities arising from new research and technology to bring maximum benefits locally to Orkney.
- There is great potential to set up “Place-Based” research in Orkney focusing on Agriculture and working closely with local stakeholders to ensure that the research is relevant and useful with the overall objective of creating a locally driven approach to research in the islands. Orkney is an interesting location to establish a "Living Lab" approach involving a user centred open innovation ecosystem that integrates research and innovation through co-creation in a real world environment. Orkney farmers are very innovative and have a high reputation for the quality of their produce. They have a skilled workforce with a strong work ethic and long-standing family ties to the land.

Creation of a Research Hub

- The creation of a research hub contact point on Orkney would help to provide an important base to coordinate research activity, communicate outputs, encourage collaborations, signposting and assisting with the development of funding opportunities and acting as a point of contact. The research hub could also provide information and signposting about availability of resources to support research such as lab space, equipment and refrigeration storage.
- The point of contact could also be responsible for curating the Orkney Research Directory a searchable resource for anyone interested in finding out more about research being conducted in Orkney and to encourage collaboration, avoid duplication of effort and over-engagement of stakeholders, leading to fatigue.
- To help support funding of the Orkney Research Directory there could be a system where researchers have to pay a small overhead fee to register to conduct research in Orkney and then provide a contact point and a summary of their research for the Directory.
- A project called the Scottish Islands Research Network has established a useful set of guidelines to help researchers working in island communities[39].
- The Agronomy and Agricultural Institute, UHI, Orkney would be a good location for visiting researchers to get access to temporary office space, IT support, basic laboratory facilities and access to meeting rooms.
- It would also be very helpful if in the future there might be access to temporary, affordable accommodation for visiting researchers and students to maximise the potential of place-based research in Orkney.

39. https://islandsresearch.scot

Key Strategic Research Links

- The SEFARI group of Research Institutes conduct research, both applied and longer term, on agriculture, food and the environment and already have some connections and collaborations with Orkney. There is great potential in exploring new opportunities for SEFARI researchers to conduct research in Orkney working with local stakeholders to help develop solutions for some of the challenges faced by farmers and to set this up in a more coordinated way to achieve maximum local benefits.
- The current Strategic Research Programme for Scottish Government runs from 2022–2027 and work is currently underway to look at what type of research will be needed for the future programme from 2027–2032. This is a timely opportunity for engagement with key stakeholder groups, to co-design new research projects relevant to Orkney that could be part of the new SRP.
- An action would be to set up a crucible type event to bring researchers together from different disciplines to discuss new research projects that would be relevant and helpful to Orkney.
- An output could include a roadmap for success for place-based research that could be used in other parts of Scotland.
- A SEFARI based knowledge broker for regional research would be a helpful post to provide a link between SEFARI researchers, the new SRP, the Agronomy and Agricultural Institute, UHI, Orkney and local stakeholders in Orkney.
- There are also opportunities to link up with other Universities and organisations interested in agricultural research that would be relevant to Orkney and these could involve those working in similar climatic conditions, for example a Northern Alliance involving Scandinavia. An example of this is the Circumpolar Agricultural Association[40].

40. https://circumpolaragriculture. wordpress.com/

Photo: www.pixabay.com

Moving Research into Practice

- To help de-risk testing out new innovations it would be helpful to look at options to set up demonstrations of the new technologies in fields or farms owned or leased by the Agronomy and Agricultural Institute, UHI, Orkney or an arrangement with local farms. This would enable farmers to see how the new technologies might bring benefits before making the necessary changes or investments in their businesses.
- To help with communication and collaborations it would be useful to have a regular communication link through the Orkney Agricultural Discussion Group and Orkney Livestock Association along with specialist farmer-led groups for particular topics and research areas.
- Public engagement and communication of activities could also be done through local media and the Orkney International Science Festival.

Education and Training opportunities

- There are opportunities for education and training from supporting work in schools and Developing the Young Workforce through raising awareness of career opportunities in agriculture and related sciences.
- Newton Scotland is a project to provide Newton rooms in various parts of Scotland to offer an educational experience within science, technology, engineering and mathematics and focusses on learning through practical activities. Thurso has a Newton Room[41].
- There may be options for post-graduate studies through setting up a MRes in Agriculture or other related sciences to enable students to study in Orkney and take part in different research projects that may involve placements within the SEFARI Institutes to gain access to new expertise and technologies that could be applied to research projects in Orkney.
- New research will bring new opportunities for innovation and commercial enterprise and it will be important to ensure connectivity with HIE and OIC to discuss the potential of new ideas.
- Educational resources and materials based on research findings need to be developed to include as wide a range of formats as possible including local press where appropriate.

41. https://newtonroom.com

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Photo: Elisabeth Innes