



The Future of Food: Sustainable protein strategies around the world

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Who we are:

Zero Waste Scotland exists to lead Scotland to use products and resources responsibly, focusing on where we can have the greatest impact on climate change. Using evidence and insight, our goal is to inform policy, and motivate individuals and businesses to embrace the environmental, economic, and social benefits of a circular economy. We are a not-for-profit environmental organisation, funded by the Scottish Government and European Regional Development Fund.

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Endorsements:

“A protein strategy for Scotland would be a welcome rallying call for all and should identify opportunities and benefits across industry, environment and society. Protein is central to our diet and nutrition and we need to ensure that it is produced and delivered sustainably based on evidence-based decisions. Indeed, a protein strategy could be a key driver to delivering on the aims of Scotland’s carbon emission reduction targets whilst offering major new opportunities for growth in the Scottish food and drink sector.” **Professor Derek Stewart, Business Sector Leader – Agri-Food, James Hutton Institute**

“Vulnerability to supply chain challenges within the food and drink sector set the scene for a rethink around Scotland’s future to ensure food security but also to maintain value. This report is timely in its analysis of protein options as the circular economy gains traction and lays the foundation for a revised and revitalised strategy for the future.” **Professor Dave Little, Head of Aquatic Resources and Sustainable Aquaculture Development, University of Stirling**

“Sustainable, local, low carbon sources of protein for feed and food will not only support the goals of Scotland’s net-zero policy, but promote innovation, job creation, farm diversification and entirely new supply chains within Scotland.” **Allison McPherson, Sustainability Specialist, Scottish Enterprise**

“It is clear that national level programmes implementing and supporting circular solutions linking food waste and organic surplus to animal feeds have the potential to significantly increase the environmental and economic sustainability of European agriculture and reduce the impact of human activity.” **Dr Elaine Fitches, Research Fellow Biological and Biomedical Sciences, University of Durham**

1 Summary

Around the world, countries and regions have recognised the vital need to make our food and drink supply chains as sustainable as possible to reduce the negative environmental impact of feeding the growing global population while also securing the lasting and valuable economic and social benefits that sustainability offers.

Providing a sufficient and sustainable supply of protein is vital to support a healthy human population, a healthy economy and a healthy planet. It is vital to meeting key targets on cutting carbon emissions to end the climate crisis, and to achieving and maintaining food security and financial security alike to ensure the future prosperity of domestic food networks and the communities which rely on them to survive and thrive.

Working with key stakeholders, governments and local authorities across Europe and beyond have been developing a diverse range of strategic sustainable protein plans aimed at meeting those interlinked needs.

This paper reviews these emerging international strategies - and, where applicable, the impact they have had to date - in order to set out the need for a Scottish sustainable protein plan and provide a blueprint for what that might look like.

It provides a high-level overview of supranational (European Union (EU)), national (Netherlands, Finland, France, Germany, Denmark) and regional (Manitoba) protein plans, including how they were developed, who was involved, what their objectives were and what resources were invested.

While each protein plan is unique to its place of origin, they all share many common characteristics. Key shared features include:

1. Increase domestic protein production - to reduce reliance on imported protein and exposure to supply and market volatility, while also positioning domestic markets to capitalise on the global transition towards more sustainable proteins.

2. Legislative and regulatory reform - to accommodate and encourage circular bioeconomy innovations and closer, more agile links between industry, academia and government.

3. Funding support - for sustainable and innovative production models, leveraged (in the European Union) through Common Agricultural Policy (CAP) mechanisms, public/private partnerships, low risk funding for innovation, green loans, and partnerships between government, industry and academic institutions.

4. Bioeconomy focus - each strategy considers the wider bioeconomy, and the potential it offers in providing circular opportunities to turn waste products into valuable sources of protein, converting carbon emissions into carbon savings.

A sustainable protein plan for Scotland incorporating these features could be key to meeting the Scottish Government's landmark pledge to end the nation's contribution to the climate crisis by 2045 - offering a way to minimise the waste causing most of Scotland's carbon emissions while maximising the value of our resources to forge a stronger, greener food and drink sector safeguarding the environment, the economy and society.

By reviewing existing protein plans from around the world, this paper provides a blueprint for what a Scottish protein plan might look like.

2 Introduction

The world faces a global climate crisis. Solving it will require holistic, systemic change throughout the economy, including our food system, which has an immense environmental footprint in terms of the damage done to ecosystems and wildlife:

- 50 per cent of the global topsoil has been lost in the last 150 years¹
- 70 per cent of all freshwater consumption is for food production²
- 33 per cent of fisheries are no longer sustainable³
- 80 per cent of tropical deforestation is associated with food production⁴

The growth in agricultural impacts is a key contributor to the alarming collapse in biodiversity we are witnessing across the globe⁵. Since 1960, there has been:

- 60 per cent reduction in the biomass of wild animals (number of animals)
- 23 per cent reduction in species abundance (number of each species)
- 47 per cent decline in natural ecosystems
- 25 per cent increase in endangered species

Livestock farming is the single greatest source of environmental impacts within the agricultural sector:

- 77 per cent of all land used for food production is dedicated to raising or feeding livestock⁶
- 14.5 per cent of global greenhouse gases (GHGs) (25 per cent if land use change included) are linked to livestock production⁷
- 8 per cent of global GHGs are associated with food waste⁸

The risks are amplified because global food production and biodiversity are intrinsically linked⁹:

- 87.5 per cent of all flowering plant species are pollinated by animals
- 35 per cent of global food production crops pollinated by animals
- 60 per cent of birds rely on insects for foods
- 10 per cent loss in biodiversity causes 3 per cent loss in productivity

Without systemic change, livestock farming impacts will continue to grow. With the global population forecast to approach 9 billion in 2050, feeding the world's people under the current approach threatens the remaining ecosystems because it would mean converting an extra 539m hectares (Ha) of habitat - an area the size of Australia (or 44 times the size of Scotland) - into agricultural land in order to produce the extra 60m to 100m tonnes of protein needed.

The window of opportunity to resolve this growing crisis is closing. The following case studies from a worldwide review explore the different approaches which Scotland might take.

¹WWF (2016)

²World Bank (2017)

³FAO (2018)

⁴FAO (2016)

⁵FAO (2019)

⁶Our World in Data (2019)

⁷FAO (2013)

⁸FAO (2015)

⁹FAO (2019)





Bundesministerium
für Ernährung
und Landwirtschaft

BMEL

Background

In 2014, the Federal Ministry of Food and Agriculture (BMEL) launched the Protein Crop Strategy aimed at reducing dependence on imported plant protein in the livestock industry, increasing the competitiveness of domestic protein crops, and minimising the environmental footprint of the food supply chain.

Aims

- **Increase** and diversify domestic protein crop supply and demand, and strengthen regional supply chains
- **Reduce** environmental impact of food systems through improved ecosystem services, resource conservation, environmental protection, climate change mitigation and soil fertility
- **Promote** sustainable alternative protein sources for feeds and foods through knowledge transfer networks, and research and development objectives and measures

Objectives and measures

Displace imported plant proteins with domestically produced legumes: (£5.6b 2014-2020 from CAP, plus £539m from Committee for Agricultural Structures and Coastal Protection, with 30 per cent option for regional government top-up)

- **Accelerate legume production:** Subsidies of £81/Hectare (Ha) arable land (£63 if Ecological Focus Area (EFA); £49 if organic farms) for cultivation of legumes or mixed crops including legumes on at least 10 per cent of the arable land
- **Accelerate large-grain legume production:** Subsidies of £90/Ha arable land (£72 if EFA; £58 if organic farms) for cultivation of legumes or mixed crops including legumes on at least 10 per cent of the arable land, if at least five per cent of these crops are large-grain legumes
- **Accelerate ecosystem restoration:** Subsidies of £99/Ha arable land (£81/Ha if EFA; £67/Ha if organic farms) for cultivation of large-grain legumes on at least 10 per cent of the arable land and improve ecosystem services and resource conservation

Increase competitiveness of domestic protein crops and integrate into crop rotation system

- **Research and Development (R&D) of novel, alternative, and sustainable protein sources:** £2.7m provided for 2014, £3.6m per annum from 2015 to 2017, and £1.8m for 2018
- **Demonstration networks:** £14m to promote uptake, develop networks, close skills gaps, and disseminate best practice
- **Additional (top up) funding:** £5.4m allocated to the Protein Crop Strategy for 2019 with medium-term financial planning in the period up until 2020 also providing a further £7.2m

Decoupling agricultural primary production from consumption

- Fertiliser ordinance to reduce nitrogen surplus from 130 kg/Ha (2011) to 80 kg/Ha (40 per cent)
- Conservation and sustainable use of biomass and biodiversity for food and agriculture, and ensuring provision of ecosystem services

Development process

Dr Thomas Meier of BMEL is the national focal point. The strategy was developed and coordinated by BMEL, the German Agricultural Research Alliance (DAFA), The Farmers' Union (DBV), the Plant Breeders' Association (BDP), the Union for the Promotion of Oil and Protein (UFOP), Association of Agricultural Chambers (VLK), German Raiffeisenverband (DRV) and the German Horticultural Association (ZVG). The strategy is a key component in support of the German Climate Action Plan (2050) to reduce annual emissions from agriculture by 2030 compared to 2014 by 11m to 14m tonnes of CO₂ equivalents (MtCO₂e).

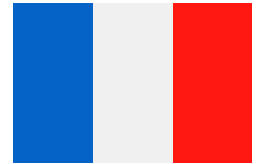
A draft protein strategy was published in 2012. However, it was always recognised that domestic plant proteins were less competitive than imports due to higher physical and monetary yields for the competing crops, more complex cultivation management, higher yield fluctuation, longer returns on investment, and a lack of support infrastructure. As such, a long-term focus on research and innovation to improve existing processes, generate innovations and, in particular, promote the breeding of high-performance varieties is a key component of the programme, with demonstration networks designed to disseminate best practice. Additional funds totalling £5.4m were allocated to the Protein Crop Strategy in 2017, with further provisions of £7.2m available to 2020.

Progress

Germany has developed an overarching agrobiodiversity strategy for the conservation and sustainable use of biodiversity for food, agriculture, forestry and fisheries as well as national programmes including the Protein Crop Strategy which are conducted and further developed with the participation of the stakeholders concerned. From provisional figures, the area of land under protein crops (grains and legumes) increased by an estimated 80k Ha (+74 per cent) between 2014 and 2016 and now amounts to around 188k Ha. Overall, there has been a 233 per cent increase in production between 2010 and 2016. However, the wider agenda is difficult to identify as the programme is coordinated through the bioeconomy council and then splits across initiatives depending on the nature of input materials, specific processes, and the end products. The model farm programme has led to the formation of nearly 50 sites since 2014.

Key lessons

- **Consulting with key agricultural trade bodies ensured widespread engagement** and support across government, industry, academia, and consumers
- **Including all protein production subsectors minimised conflicting goals** and maximised opportunities to explore synergies
- **Targeted national, regional and sectoral engagement mobilised citizens and stakeholders**, and helped create market demand for more sustainable bio-based products
- **A standardised definition of bioeconomy into accessible language helps stimulate private and public engagement** with the programme
- **Inclusion of sustainable protein in a focused strategy helped minimise cross-interference and maximise impact**
- **Coherent legislation and regulations maximised synergies and minimised interference between legislative programmes**, sectors and stakeholders
- **Adapting the regulatory framework to take account of circularity supported transition** to sustainable protein crops and derived products
- Transitioning to more sustainable production systems is a medium to long-term strategy due to 5-8 year rotation cycles (compared to single year in linear agriculture), lag time in optimisation, and similar factors, hence, **farmers need stronger incentives and support to change cultivation systems while bridging the financial gap**
- Helping farmers invest in **new equipment and longer term rotational systems is critical to sustainable intensification**



Protéines France

Background

In 2014, France launched the Proteins for the Future sector strategy with the aim of supporting and accelerating growth of domestic vegetable and alternative protein production, reducing exposure to imported proteins and minimising the environmental footprint of food systems without compromising industry growth, jobs, and wealth creation. Ultimately, the goal is to accelerate development in the plant-based and alternative protein sectors and make France a world leader in the field.



Aims

- **Guarantee** long-term, sustainable food security
- **Develop** efficient, resilient and circular supply chains
- **Engage** public to support local food systems and make more sustainable food choices
- **Support** sustainable innovation across the food system
- **Conserve** natural resources and ecosystems

Objectives and measures

Doubling area under legumes to 430k Ha by 2020 (£88m per annum to 2021)

- **Accelerated sustainable protein production:** £88-£180/Ha per year of protein crop production for farmers with 71 per cent dedicated to legumes (field peas, lupine, fava beans), 16 per cent to dehydrated fodders made of legumes (e.g., alfalfa, clover, sainfoin, vetch, and sweet clover), and 12 per cent to soybean
- **Increased utilisation of sustainable protein feeds:** £134-£180/Ha for livestock producers growing legumes as fodder
- **Diversification and optimisation in protein supply chains:** £4m per annum to drive and support research and innovation towards novel and/or optimised crop types and production of legume seeds

Accelerate novel protein production (£1b from public/private funding)

- **Facilitate innovation** throughout and across the value chain, from raw material production to new food products
- **Support circular applications** which displace fossil carbon (e.g. ingredients, synthetic chemistry and bio-based industry)
- **De-risk funding** for start-ups to access existing public and private schemes
- **Initiate market pull** for bio-based products through government procurement systems

Proposed: National register of bio-based companies and certification scheme for bio-based products using carbon isomer to quantify fossil carbon/green carbon ratio.

Additional funding: Investment funds are also available through the French public investments bank (Bpifrance), The French agency for environment and energy management (ADEME), and the Capagro Innovation investment fund, alongside the main R&D funding bodies, the National Research Agency (ANR), and the Investing for the Future Programme (PIA).

Development process

The Protéines France programme stems from a systemic policy shift to prioritise sustainability throughout the agricultural sector which began with the seven-year Plant Protein Plan, as initiated by Minister of Agriculture Stéphane Le Foll in 2014. Prior stakeholder engagement across the plant protein and novel protein value chains provided a foundation for further collaboration between government and industry, culminating in the formation of the consortium in 2016, tasked with implementation of the Plant Protein Plan.

Founding members: Avril, Limagrain, Roquette, Tereos, Terrena, Vivescia.

Associate members: Arbiom, Caussade Semences, Herta, Lesaffre, Nutrition & Santé, Poittemill, Royal Canin, Triballat Noyal and Ynsect.

Progress

Land under legume production in France declined from 750k Ha in 1993 to 197k Ha by 2012. 2015 Eurostat figures show a subsequent increase to 269k Ha. Whilst it is possible to meet the target of 430k Ha under legumes by 2020 (equal to 2005 level), there is still significant research and investment requirement. In 2018, the agricultural sector accounted for 19 per cent of all France's emissions (livestock 48 per cent, crops 41 per cent, machinery 11 per cent) and the High Council for Climate has called for a 40 per cent reduction from 1990 levels by 2030. Between 1990 and 2018, emissions fell just eight per cent, and current modelling predicts reductions of around two per cent per annum to 2025. In 2018, climate investments in the agricultural sector, contributing directly or indirectly to GHG reduction (including energy transition) amounted to £359m. Insect farming and similar (circular) applications have also seen significant investment through these channels.



Key lessons

- **Clear environmental and economic objectives at the outset helped to galvanise support**
- Food production and consumption patterns are intrinsically linked hence a **systemic change must also consider consumerism and behaviour change at a national level**
- Consumer and industry understanding of sustainable proteins and the effects of consumption patterns/food choices remains low hence **communications to raise awareness of the benefits of sustainable proteins and diets must be intensified**
- **Decoupling livestock production from resource intensity is critical** to ensure food security, and meeting climate policy agreements
- **Assimilation of sustainable protein planning into existing policies can dilute transformative potential**, hence a national protein plan should be a standalone policy
- **Agile management and checkpoints add significant value and flexibility** in a dynamic landscape
- **Including key stakeholders and trade bodies helped ensure widespread industry support** during development and implementation
- **Collaboration across sectors and between stakeholders helped overcome barriers** beyond the resources and skillsets of any single organisation
- **Sustainable practices should be promoted via structural public funding** linked to clear and progressive criteria
- **Creating market preference for bio-based products is essential** as supply subsidies alone are not enough to drive sustainable systemic change across the value chain
- **A holistic whole supply chain approach is critical** to ensure products are competitive in a global market and subsidies are effective long term

Find out more at:
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The EU

Background

The Development of Plant Proteins in the EU plan was published in 2018 to explore opportunities and support measures at member state levels to address the sizable deficit in vegetable proteins required to feed livestock and reduce dependency on imports from third countries to bridge this gap, to help unlock the economic potential of domestically produced plant proteins, and to reduce the environmental footprint of production-driven agriculture.

Aims

- **Support** growth and relative competitiveness of EU-grown protein crops
- **Develop** holistic supply chains and integrate Government-industry-academic axis
- **Rebalance** consumer behaviours and practices towards more sustainable food choices
- **Influence** policies and practices on sustainable production at the global and regional levels
- **Access** economic, environmental and social benefits of transition to more sustainable production systems and agri-ecological practices

Objectives and measures

Supporting farmers growing plant proteins

- **Sectoral programmes to disseminate the direct and indirect benefits of plant protein** production, strengthen supply chains, unlock the market potential of plant proteins, and make agriculture and food systems more resilient
- **Supported diversification of protein portfolios** and coordinated research into yield and characteristic optimisation
- **Incentivised transition towards sustainable production** through dedicating appropriate amounts of coupled income support and doubling the funding available through EU Horizon 2020 funding programme to make plant proteins more competitive and sustainable
- **Boost domestically produced sustainable protein competitiveness** through doubling the agri-food budget available for Horizon Europe R&I support programme and via the European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI) programme
- **Reward sustainable practice** by recognising and rewarding significant contributions towards environment and climate objectives including sustainable intensification, conservation agriculture, and agri-ecological practices
- **Mobilise rural development support** for on-farm investment, technical support, knowledge transfer, setting up producer organisations and cooperatives, and cooperation along supply chains
- **Improve sustainable protein market analysis and transparency** through developing a coherent monitoring system for prices, trade flows, production/consumption and emissions/environmental benefits
- **Promote the benefits of plant protein for nutrition, health, climate and environment:** £179m will be available for 2019 to co-finance promotion programmes at the supranational and national levels
- **Long term adaptive support** to stimulate regional and national approaches, and unlock the economic potential of plant proteins using current and future policy instruments

Development process

The EU has been working to accelerate sustainable protein production for many years but the increased awareness of opportunities to reduce emissions and sustainably intensify agriculture have galvanised action in recent years. The European Soya Declaration of 2017 was a key turning point with 14 members committing to reducing imported soy in favour of growing more protein crops (legumes including soya, broad beans, peas and lupins, and clover species such as alfalfa in their countries). Signatories included Germany, Hungary, Austria, France, the Netherlands, Italy, Poland, Croatia, Romania, Slovenia, Slovakia, Finland, Greece and Luxembourg. The Declaration also states: "Because of increasing consumer interest in genetically modified (GM)-free products, especially those of animal origin, the signatories are making efforts to bring forward an increasing choice for consumers with respect to GM-free food and feed". Following this, a stakeholder survey was launched in 2018 to help understand and map the protein situation and opportunities across the EU.

The Commission then set up four workshops on plant proteins to discuss research and innovation, agronomic best practice and environmental benefits, the supply chain in the EU sector, and the demand in different market segments. From this, in November 2018, the overarching strategy was published, presented and discussed. Although some member states including Germany, had already implemented strategies, there has been a clear acceleration in developing frameworks to align activities with the wider protein programme and activities since the plan was published.

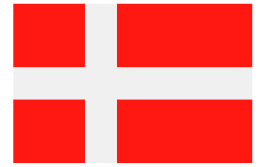
Progress

The production of protein crops (peas, beans and lupins) has improved since 2013/14, reaching a record level of 1.8m Ha and 5m tonnes in 2017/18. In several member states, soya surface area also grew significantly, and European production reached a record level of 2.8m tonnes in 2017/2018. Furthermore, the eligibility of nitrogen-fixing crops in ecological focus areas has had a greater impact on increasing the production of high-protein raw vegetable materials than voluntary coupled support (this is the case in Germany for example). Statistics show that the organic surface area increased by 30 per cent between 2010 and 2016, reaching a total of around 12m Ha in 2016. That is an annual growth rate of five per cent. In total, the area devoted to organic farming represented seven per cent of all agricultural land in Europe in 2016. However, the supply of organic plant protein remains insufficient to balance the rations of organic pigs and poultry. The CAP will be renewed in 2021 and is expected to continue/accelerate the current direction of travel.

Key lessons

- **There is significant concern around competition for use of arable land between food production and biomass for energy**, hence coherence in policy and regulations across multiple sectors is critical to identifying and maximising opportunities
- **Rewarding environmental, climate and ecological objectives is critical to initiating systemic change in food supply chains** through eco-schemes and environmental/climate management commitments under rural development programmes; mobilising rural development support for example to stimulate investments and cooperation along the food chain; coupled income support
- **Consultation was critical to create and maintain engagement** and considered a wide range of stakeholders including the wider supply chain, the R&D community, economic and finance bodies, market segments, and consumers
- **Strategic planning at regional levels is critical to optimisation** as it takes account of geographic differences in terms of climate, soil conditions, farm structure, and sector organisation
- **Agile management allowed the focus** and scope to shift with changing priorities and world events, and combining policies added significant synergies between processes
- Understanding the trajectory of consumer demand and **actively supporting the shift towards sustainable consumption is essential to supporting market pull for bio-based products**
- **Promoting and transitioning towards organic produce was a major factor in stimulating demand** for more sustainable products

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Proteins for the Future

Background

The Ministry of Environment and Food of Denmark published the Proteins for the Future roadmap in 2018 with a particular focus on developing sustainable and renewable foods, feeds and bio-based synthetic products.

Aims

- **Support** agricultural industry to achieve climate neutrality by 2050
- **Accelerate** sustainable production of high-quality raw materials and ingredients throughout the circular bioeconomy
- **Decouple** increases in agricultural production from resource consumption
- **Enhance** retention of nutrients and nutrition in the supply chain and develop cascade utilisation of all raw materials ingredients, energy, water and packaging
- **Convert** research and innovation in the circular bioeconomy into future activity and business opportunities

Objectives and measures

Accelerate the supply of sustainable raw materials for new protein value chains

- **Utilise residual and secondary flows in the production of proteins** to maximise efficiency and minimise resource intensity in supply chains
- **Accelerate exploration and production of new aquatic protein sources** (such as seaweeds but also including non-native urchins and mussels)

Promote sustainable biomass production in support of national environmental objectives

- **Develop understanding of true end-to-end environmental impacts** of various proteins in order to inform policy makers, regulators, industry and consumers
- **Incentivise protein-rich biomass production** to reduce environmental footprint of the food supply chain
- **Establish decentralised biorefineries for production of sustainable proteins** for feeds, foods and biofuels, linked to pilot scale facilities for testing food applications

Proposed: Monitoring is via patent applications per million capita, bio-based products as market share of total goods exports, bio-based products value added as per cent total value added per sector, long term trends in bio-based product exports, and bio-based products employment as percentage of total employment within sectors.

Additional funding: Combined government funding of £50m earmarked for the programme.

Development process

The National Bioeconomy Panel was first established in 2013, alongside the Government's "Plan for growth for water, bio, and environmental solutions", to improve resource efficiency and sustainability while accelerating economic and job growth in the sectors in collaboration with the Ministry of Energy, Utilities and Climate, the Ministry of Higher Education and Science, the Ministry of Industry, Business and Financial Affairs, and a consortium of experts from across the value chain including leading firms and researcher institutions, NGOs, and key stakeholder organisations including Biomasseforum, BioValue, and INBIOM. Following this, and with recognition of the growing risks and opportunities, the positioning paper "Denmark as a Growth Hub for a Sustainable Bioeconomy" was published in 2014 to inform future directions based on consensus from the expert panel, which included the Danish ministries for food, agriculture, climate, energy, education and science. It also includes experts from industry, research, NGOs, key organisations and various authorities. The strategy was reviewed in 2016 and, in 2017, the Minister of Environment and Food of Denmark, Esben Lunde Larsen, renewed the National Bioeconomy Panel. The aim of the Panel is to reduce environmental and climate impacts through more secure, local and sustainable resource supplies, including protein, by accelerating the bioeconomy.

Progress

In of the five years since the programme began, close to one third of Denmark's imports of feed proteins has been replaced by Danish protein sources. Notably, Danish research institutions and businesses have secured £670m in Horizon 2020 funding since 2014, funding 1,336 different projects to date.



Key lessons

- Conflict between sectors and **the rush to exploit biomass for energy risks the potential of other bio-based industries**
- Close **collaboration between political, economic, scientific and environmental stakeholders, as well as broad public engagement was vital to development** of a vibrant bioeconomy
- **Siloed sector-based approach leads to parallel and conflicting policy landscapes** (for example issues of the agri-food sector, treated separately from forestry sector or bio-based industries sector)
- **Biomass resources will become increasingly limited as the bioeconomy develops and materials are pushed up the value chain**, hence cascading refining is required to achieve optimal utilisation
- **State-of-the-art protein research and innovation centres were key to success**
- Raising public **awareness of the environmental and economic benefits of sustainable protein helped initiate market pull**
- **Demand-side policy tools such as standardisation, labelling, and public procurement help to create market pull for bio-based products**
- **Regional clusters and multi-stakeholder collaboration are important engines for synergies** in the bioeconomy strategy and help to reduce financial barriers for innovators and SMEs
- **A coherent policy approach was critical to ensuring fully integrated value chains** and exploring/establishing synergies
- **Existing regulatory frameworks can restrict development of new bio-based innovations** as these often cut across existing sectors and disciplines
- **Regulatory frameworks should be restructured to stimulate development of new value chains**, with incentives to promote resource efficiency
- Identifying **performance and sustainability indicators helped inform policies and regulations, identify opportunities and facilitate growth**

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National Protein Strategy Finland



ScenoProt

ScenoProt

Background

In 2015, Finland initiated the ScenoProt consortium and six year self-sufficiency roadmap which focused on replacing animal proteins with plant-based and alternative proteins, increasing self-sufficiency in proteins for feed ingredients and for foods, reducing exposure to volatile international markets, and supporting the Finnish bioeconomy. Responding to the urgency of the climate emergency and new technological and regulatory developments, a subsequent Implementation Plan to Increase Protein Self-sufficiency was launched in 2019 to consolidate and accelerate sustainable domestic protein production. The 2019 plan has six themes: cereals, pulses, oil crops, grasslands, aquaculture (focusing on fisheries), and insect production and cellular agriculture.

Aims

- **Guarantee** versatile, resilient, fair and sustainable food supply chain
- **Develop** low carbon and resource efficient society and a sustainable bioeconomy

Objectives and measures

Improve protein self-sufficiency in feed and food production from less than 20 per cent to 60 per cent by 2021

- **Strengthen food system research and innovation** by ensuring adequate funding
- **Expand cultivation of protein crops and diversity of cropping systems** with increased use of leguminous and oilseed crops in animal feed, crop rotation, and experimentation with new crops
- **Support the research, product development and marketing needs of small- and medium-sized innovators and food companies** through low-threshold funding

Promote alternative protein sources with a focus on circular solutions

- **Develop synergies between agriculture, aquaculture, fisheries, and downstream industries** to optimise added value and resource efficiency in supply chains
- **Reduce nutrient leakage in food production** by improving production techniques, maximising use of by-products, and minimising waste
- **Support novel protein production** including nonfeed macrophytes, insects, macroalgae, microalgae, mycoproteins, single cell organisms and residuals from bioenergy, biodiesel and bioethanol production
- **Revitalise rural areas** through the circular economy

Funding: ScenoProt is primarily funded by £7m from the Strategic Research Council at the Academy of Finland to 2021 but can also access £270m additional bioeconomy funding under the Finnish Bioeconomy Strategy.

Development process

The plan was developed by the Ministry of Agriculture and Forestry and the Ministry of Employment and Economy in close collaboration with the VTT Technical Research Centre of Finland, the VYR (the Finnish Cereal Committee), the Norwegian University of Life Sciences (NMBU), the University of Helsinki, the University of Turku, and the University of Jyväskylä.

Food systems and agriculture were a core tenet of the 2014 Finnish bioeconomy strategy, Sustainable Growth from Bioeconomy. However, it was recognised that a stand-alone protein strategy was required to focus efforts in this critical field. In 2015, the Ministry of Agriculture and Forestry and the Finnish Natural Resources Centre (LUKE) initiated the six year ScenoProt project to support sustainable protein production through plant production, animal nutrition, processing technologies and infrastructure, human nutrition and health, as well as enhanced bearing capacity of natural systems. This led to the publication of a formal plan and roadmap in 2019.

Progress

Consumption of plant-based protein products in food has increased from the 2015 baseline, particularly oats and pulses, as well as insect-based products in recent years. Growth is expected to continue as consumers shift towards more sustainable choices and the ingredient industry accelerates. Since the 2019 plan was conceived, a working group has been formed to coordinate delivery and develop a monitoring framework.



Key lessons

- **Food and energy security are intrinsically linked through increasing demand and competition** for biomass and land required to produce it
- Although renewable, **biomass production is limited and thus any major policy shift should consider peripheral impact** on other potential or existing uses
- **Considering food production and biomass as a single inter-related system accessed multiplier effects** across sectors which were not previously apparent
- An **open-source biomass 'atlas' service mapping biomass location and composition in real-time informed policy and investment**, enabled opportunities, and identified barriers for utilisation
- Although low carbon applications are fundamental to reducing the environmental footprint of food systems, **technological innovations can only be effective as part of a holistic approach**
- **To maximise economic, social and environmental benefits, circular applications should 'cascade' down a hierarchy**, first as food, then feed, then as value added products and, lastly, in energy production
- Promoting consumption of domestically produced food **and linking food choices to climate change and food security helped Finnish consumers make more sustainable food choices** and has created new demand for these products
- **The key challenge of transitioning to a truly circular bioeconomy is to diverge from sector-specific, market-driven thinking towards industrial symbiosis**, where multiple sectors including, the public and private actors cooperate to make the best, most sustainable use of resources
- **Agile management allowed the Finnish consortium to adapt to maintain alignment with dynamic developments and priorities**
- **Dedicated taskforces and 'champions' were essential to drive and maintain transitions** across the value chain

Find out more at:
zerowastescotland.org.uk



National Protein Strategy Netherlands



Alliance for Sustainable Foods

Background

In 2013, the Netherlands established the Alliance for Sustainable Foods (Alliantie Verduurzaming Voedsel) in collaboration with a wide-ranging consortium of organisations from across the Dutch food industries. The overall aim of the alliance is to advance the CE Biomass & Food Transition Agenda and improve sustainability in the meat and dairy sectors to support of the country's climate commitments, while protecting these key export industries and ensuring they are well positioned to meet increasing global protein demand. This led to the Green Protein Growth Plan and formation of the Dutch Circular Economy Taskforce in 2017 to consolidate the sustainable foods programme with existing initiatives. Its primary goal is to lead the transition towards sustainable intensification, and the development of circular solutions within the food and biomass supply chains.

Aims

- **Reduce** raw materials in the agri-food supply chain by 50 per cent by 2030
- **Accelerate** and scale-up sustainability across the agri-food chain towards 100 per cent circularity by 2050

Objectives and measures

Optimise the efficient use of food and biomass

- **Close nutrient cycles at local, regional and national levels** including linking urban and rural nutrient cycles, and regenerative use of soil
- **Support greater use of biomass and residual organic materials** through circular applications and bio-based production (for example cascading valorisation, synthetic chemistry and bio-based ingredients)
- **Embed sustainability throughout the food supply chain**
- **Promote sustainable consumption**, conservation and the sustainable use of natural capital
- **Remove legislative barriers and support circular use of recycled nutrients**
- **Displace fossil-based resources in the agri-food supply chain** with sustainably produced biomass
- **Facilitate innovation and knowledge sharing** across the value chain, from raw material production, through to processing, biorefining, new food products development
- **Support innovators and start-ups** through dedicated novel proteins fund
- **Reflecting the environmental and social benefits and costs of products in the price of products** and applying a 'sustainability discount' has created a demand for recyclates and promoted transition towards more closed loop food production

Additional funding: The Dutch Government has committed £72m to accelerate the circular economy agenda, £36m of which is earmarked for 'smart farming'. In addition, the Dutch Ministry of Agriculture, Nature and Food Quality will dedicate a further £6m over the next three years via investments in innovation, research, monitoring and education. Rabobank also offers criteria-based green loans up to £1m to help farmers transition to more sustainable practices on a whole farm basis.

Development process

The strategy was developed in association with the Dutch Food Retail Association (CBL), the Federation of the Dutch Food and Grocery Industry (FNLI), the Association of Dutch Catering Organisations (VENECA), the Royal Dutch Hospitality Association (KHN) and the Dutch Federation of Agricultural and Horticultural Organisations (LTO), the Dutch Association of Animal Feed Industries (NEVEDI), and Wageningen University and Research (WUR). The initiatives remained fragmented however, so a Circular Economy Taskforce including Rabobank, the Ministry of Agriculture, Nature and Food Quality, McDonald's Netherlands, Voedingscentrum, Hutten Catering, Protix and WUR was formed in 2017 to develop and accelerate a coherent and ambitious policy framework with defined and deliverable objectives.

Progress

There are approximately 55,000 Dutch businesses in the agricultural sector, several hundred in the fishing industry and over 4,000 in the food and food processing sectors. Of these, around 1,200 (two per cent) are dedicated bio-based businesses. The intention is to grow bio-based businesses to 20 per cent of the sector by 2030. There are also a series of green protein accelerator facilities and protein competence centres which provide expertise and experimental facilities to support development and commercialisation of innovative and sustainable protein ingredients and products. The Netherlands have also initiated a programme to help protein innovators and producers access EU funding through Horizon 2020, regional participation funds, innovation grants and other sustainability incentives.



Key lessons

- Food production and consumption patterns are intrinsically linked hence **an integrated holistic approach to sustainable protein must also consider consumerism and behaviour change at a national level**
- Consumer and industry understanding of food systems and the potential benefits of transitioning to sustainable proteins remains limited hence **coherent messaging and education on sustainable food choices and behaviours was critical to initiate and maintain change**
- **Working closely with innovative industries and stakeholders helped to identify and understand regulatory barriers**
- **Creating a supportive legislative framework helped accelerate circular innovation and investment** across the value chain
- Linking food systems to other biomass sectors, and **developing supportive policies and regulations offers many more opportunities for high-value synergies**
- **Recognising residual biomass including food waste as a valuable raw material supports higher-value usage** while repositioning bio-waste to energy as the least-best option
- **Better utilisation of food and biomass including the side streams is critical to realising energy and climate policy commitments**
- Developing a **framework which identifies and considers the characteristics of specific waste materials helped identify applications for valorisation** and use as new raw materials
- Access to **supportive financing initiatives is critical to overcoming barriers to adopting circular business models**, including higher capital investment and longer return on investment
- **Reflecting the environmental and social benefits and costs of products has created a demand for recyclates and promoted transition** towards more closed loop food production

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MPA

Background

In 2019, Manitoba launched the Manitoba Protein Advantage (MPA) to advance sustainable plant and animal protein production; and reduce the environmental footprint of food supply chains including greenhouse gas, water usage, energy use, and waste in production and processing. This is the first sector-specific strategy published under the province's Economic Growth Action Plan.

Aims

- **Ensure** Manitoba producers and processors are well positioned to remain leaders in plant and animal protein production, and capitalise on increasing global demand
- **Support** sustainable intensification of livestock production
- **Implement** targeted strategies to foster competitiveness, facilitate growth, identify investment opportunities, and address economic barriers
- **Optimise** protein supply and processing capacity to maximise domestic value added

Objectives and measures

Plant Protein

Mobilisation of sustainable protein innovation and partnerships targeting protein development, enhancement of production and processing, ingredients, co-product value and spin-off opportunities

- **Align strategic projects with sustainable protein targets** through initiating consortium to coordinate academic and innovation institutions and industry groups
- **Consolidate and optimise plant protein production and processing** through £618m invested in new infrastructure creating 850 new jobs

Animal protein

Ensuring livestock sectors are well positioned for growing global market by expanding livestock and breeding herds and increasing processing capacity

- **New added value for producers from innovation and value chain collaboration** through £309m to be invested in new primary production and processing investment, resulting in 700 direct and indirect jobs
- **35 per cent increase in animal protein production in 2025**, compared with the 2017 baseline
- **35 per cent increase in animal protein processing in 2025**, compared with the 2017 baseline

Sustainability

Facilitating government-industry-academic partnerships to reduce energy, waste and emissions throughout supply chain, support early adoption of innovative management practices, enhance water quality, biodiversity and carbon sequestration, and increase public trust and market acceptance through science-based regulatory decisions and strong assurance systems

- **15 per cent reduction in carbon intensity per kilogram of animal protein** produced in Manitoba
- **15 per cent increase in productivity** of grassland and forages
- **Support early adoption of innovative beneficial management practices** to enhance water quality, biodiversity, ecosystem services and carbon sequestration

Commercialisation and competitiveness

- **Supporting innovation by removing or reducing regulatory barriers** through supportive policies and regulations
- **Increasing public trust and market acceptance** through evidence-led and science-based regulatory decisions and assurance systems
- **Maximising value added opportunities** through facilitating multi-stakeholder value chain collaboration and alignment with consumer needs/market
- **Align skills and training strategies with sustainable protein industry needs** to develop a skilled workforce
- Support targeted **innovation in protein ingredients and co-product value**
- **Enhance protein market intelligence and information sharing** amongst industry and stakeholders
- **Support industry-led market development and targeted missions to expand opportunities**

Development process

Manitoba launched its Economic Growth Action Plan in 2018 after consultation with more than 500 representatives of business, industry, economic development organisations and academia. They held 77 individual meetings with more than 300 participants and received more than two dozen written submissions that helped inform the strategy. This resulted in several regional and strategic partnerships to deliver economic development programmes and frontline services. The Manitoba Protein Advantage is the first of the sector-specific strategies under the plan, announced by Agriculture Minister Ralph Eichler in February 2019. The final strategy was presented at the Manitoba Protein Summit in September 2019. Notably, the summit also marked the signing of a memorandum of understanding for Manitoba to join the Protein Highway which was developed by the Consulate General of Canada in Minneapolis. This initiative encompasses three Canadian provinces (Alberta, Manitoba and Saskatchewan) and US states (Iowa, Minnesota, Montana, Nebraska, North Dakota and South Dakota).

Progress

The Bioscience Association of Manitoba (BAM) is leading development of the plant-based food and ingredient sector in the province. Protein Industries Canada (PIC) are an industry-led supercluster comprised of leading Canadian agriculture technology corporations, food and food ingredient manufacturers, agriculture and food service companies, economic development agencies, and academic and financial institutions. PIC has assembled over £180m cash, £57m in-kind support and venture capital commitments of £122m. Roquette, a global leader in plant-based ingredients for the food, nutrition and health markets, is building a £406m plant protein research and processing facility in Portage la Prairie and contracting significant acreage for plant protein (pea) production in Saskatchewan and Manitoba. Burcon NutraScience is planning to open a £398m 20k tonne processing facility in mid-2020. PIC and industry partners will soon be commercialising a new processing technology that will yield a variety of new oil and protein products from key crops including canola (rape) and hemp. HyLife Foods has invested £108m to expand its processing facility in Neepawa and increase pig production in its vertically integrated operation. Manitoba Dairy Ingredients Ltd. has invested £62m in a dairy protein processing facility in Winnipeg. Merit Functional Foods has invested £40m in pea and canola protein processing near Winnipeg in the Rural Municipality of Rosser. Richardson International has invested £19m in the Richardson Innovation Centre to facilitate agri-food research and product innovation.

Key lessons

- The transition towards **sustainable feed and food production presents significant economic, environmental and social opportunities**
- Manitoba **acted upon a region-specific opportunity to improve sustainable food production and support growth in the agricultural sectors**
- **Integrating animal protein in the strategy helped reduce friction** between conflicting sectors and organisations
- **Widespread industry involvement ensured buy-in and engagement** during development and implementation

3 Why it is time for a Scottish sustainable protein plan

Since 1990, Scottish agriculture and related land use emissions have fallen by nearly 30 per cent, from 13.7MtCO₂e to 9.7MtCO₂e. However, they've still grown as a share of the nation's total emissions during this period, having been outpaced by the welcome and much greater reductions in other sectors of the economy.

As a result, agriculture causes almost a quarter of Scotland's total emissions (24 per cent) – which is more than any other Scottish sector except transport (Fig. 1), giving Scotland one of the highest agricultural carbon footprints in the EU (Fig. 2).

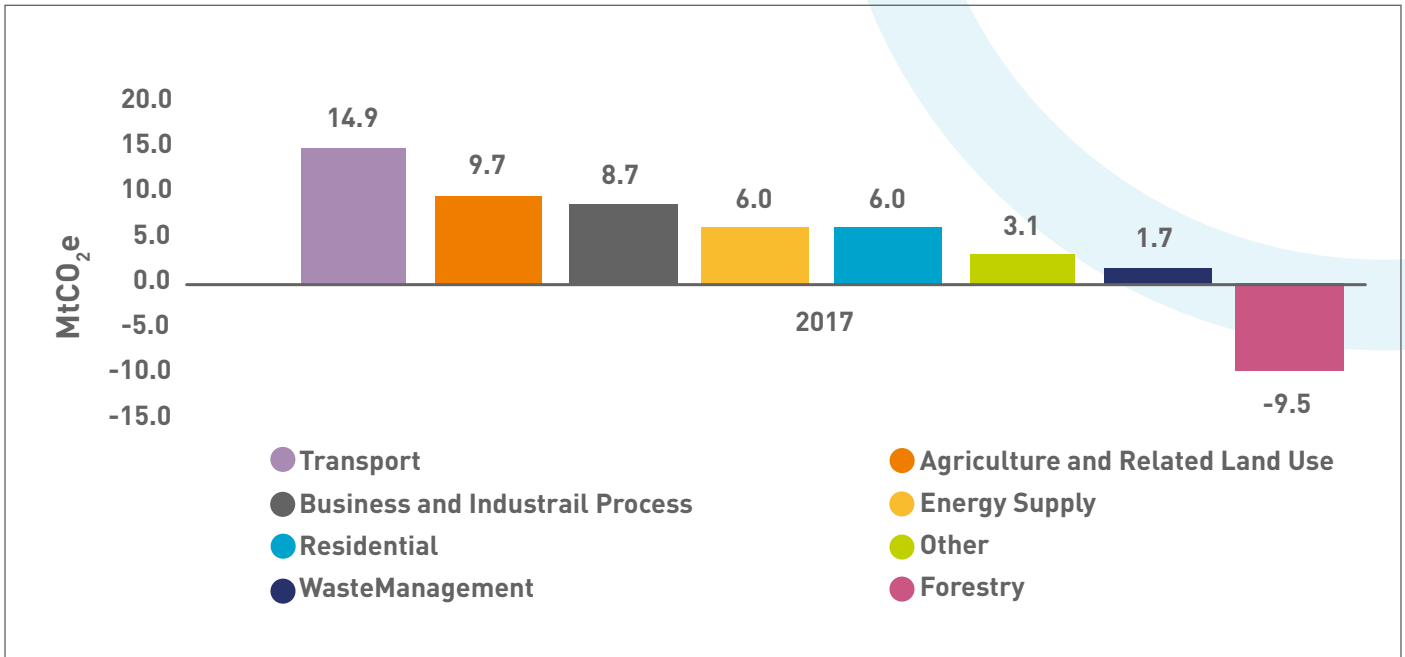


Figure 1. 2017 Scottish greenhouse gas emissions by sector¹⁰

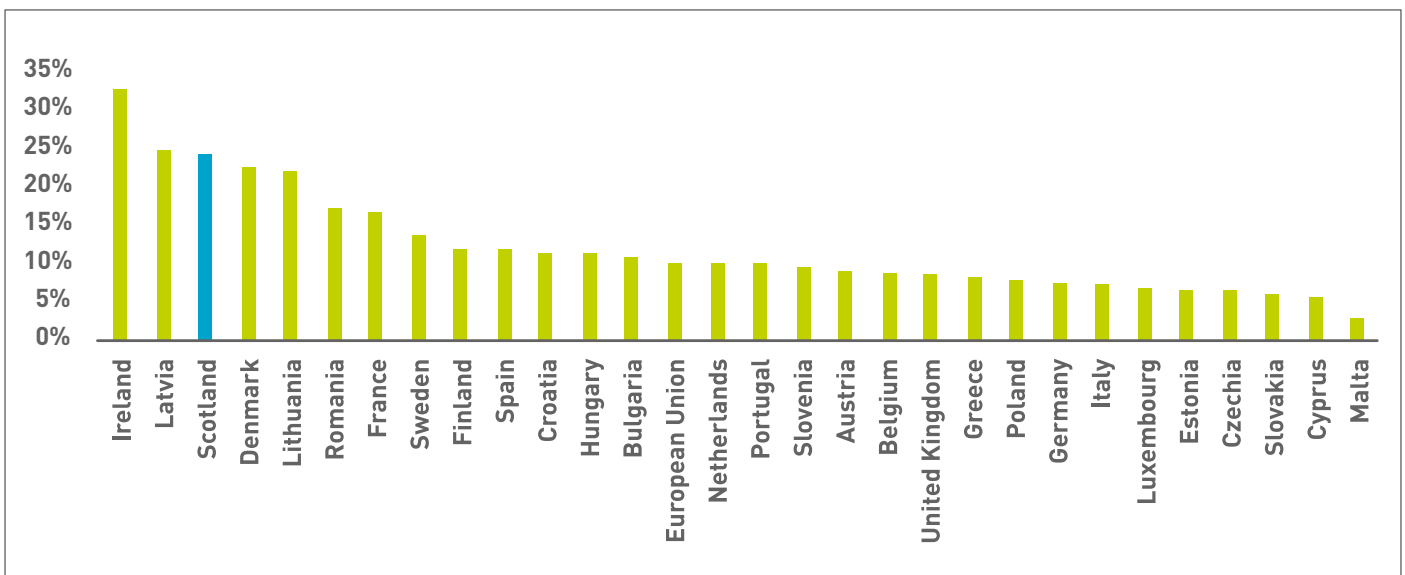


Figure 2. 2018 Agricultural emissions as proportion of total emissions across EU¹¹

¹⁰Scottish Government [2019]

¹¹Eurostat [2019] [accessed 19/11/2019]

Without a concerted effort to reduce these emissions, Scottish agriculture will generate an ever greater proportion of the nation's carbon footprint as other sectors continue to successfully accelerate their decarbonisation.

Every four years, the Scottish Government is obliged under the Climate Change (Scotland) Act, to develop and publish an emissions reduction strategy covering all sectors of the economy. These strategies, entitled Reports on Policies and Proposals (RPPs), lay out how the government aims to achieve its legally binding emissions reduction target in 2050.

The latest of these is RPP3, which is more commonly known as Scotland's Climate Change Plan. While it was generally well received when it was published in 2018, the chapter covering agricultural emissions and reduction measures was widely criticised for lack of ambition:

"The ambition for agriculture is disappointing [...] it is really not enough as far as that sector is concerned. We need to move more quickly in that respect."

Jim Densham, Campaigns and Policy Manager, RSPB Scotland

"I hate to say that agriculture is getting off lightly... but the tone suggests that agriculture is getting an easy ride."

Graeme Dey, MSP, Convener of Environment, Climate Change and Land Reform Committee, Scottish Parliament.

Since the publication of Scotland's Climate Change Plan, the Scottish Government has increased its emissions reduction target, committing to halving emissions by 2030, and to net-zero by 2045. This target simply cannot be achieved without dramatic reductions in Scottish agricultural emissions. Reducing those emissions is vital to ending the climate emergency. It is also a vital opportunity to reap the social and economic benefits of implementing the systemic change needed to deliver a sustainable, secure and prosperous future.

Now is the time for new ideas

This report shows that many governments around the world have already come to the same conclusion – that sustainable agriculture and food systems are key to solving the climate crisis. In response, many countries and regions have developed, or are in the process of developing, sustainable protein plans which aim to guide the transition towards low carbon agriculture.

These plans provide a blueprint which Scotland could choose to follow, adapting and improving on these strategies to meet our own national needs.

We would very much welcome questions, thoughts and feedback on the case studies presented herein, and further discussions on future protein production in Scotland.

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