Agriculture and Rural Communities (Scotland) Bill – Supporting Evidence and Analysis

September 2023

Scottish Government
Riaghaltas na h-Alba

Agriculture and Rural Communities (Scotland) Bill – Supporting Evidence and Analysis

This supporting evidence and analysis outlines the current position of the Scottish agricultural sector, with evidence aligned to the objectives in our Vision for Agriculture. This sets the scene for why the powers in the new Agriculture and Rural Communities (Scotland) Bill are required. It also provides information on the Scottish Government's approach to assessing new policy proposals as they are taken through secondary legislation, to ensure they are balanced, coherent and deliver against intended objectives.

Rural and Environment Science and Analytical Services (RESAS), Scottish Government

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1 Introduction

1.1 Purpose

The evidence and analysis in this report outlines the current position of the Scottish agricultural sector, with evidence aligned to the objectives in our Vision for Agriculture. This sets the scene for why the powers in the new Agriculture and Rural Communities (Scotland) Bill are required. It also provides information on the Scottish Government's approach to assessing new policy proposals as they are taken through secondary legislation, to ensure they are balanced, coherent and deliver against intended objectives.

1.2 Context

Following the UK's withdrawal from the European Union (EU) in January 2020, the Scottish Government's priority for agriculture and rural development was to provide stability and security for producers, land managers, and businesses. To this end, legislation was enacted that ensured EU Common Agricultural Policy (CAP) payments and schemes would continue for a period of stability and simplicity after EU Exit.

In March 2022, the Scottish Government published a Vision for Agriculture. This outlined the Scottish Government's long-term aspirations for Scottish agriculture and made the following commitment:

> "We will transform how we support farming and food production in Scotland to become a global leader in sustainable and regenerative agriculture. This commitment will sit at the heart of a robust and coherent framework to underpin Scotland's future agriculture support regime from 2025 onwards. Scotland will have a support framework that delivers high quality food production, climate mitigation and adaptation, and nature restoration."
>
> Source: Scottish Government's Vision for Agriculture

The Scottish Government consulted on proposals to support the values and principles outlined in the Vision for Agriculture, publishing analysis of responses to the consultation in June 2023. This feedback has informed the new Agriculture and Rural Communities (Scotland) Bill, which will give Scottish Ministers the necessary powers to support Scottish agriculture following the UK's withdrawal from the EU, and help deliver the Vision for Agriculture.

For more than 50 years, Scottish agricultural policy has been led by the EU through the CAP. Article 39 of the Treaty on the Functioning of the European Union sets out the specific objectives of the 2014-2020 EU CAP that is currently operating in Scotland:

- to increase agricultural productivity by promoting technical progress and ensuring the optimum use of the factors of production, in particular labour
- to ensure a fair standard of living for farmers

- to stabilise markets
- to ensure the availability of supplies
- to ensure reasonable prices for consumers

The EU has stated that the 2014-2020 CAP has supported a fair standard of living for farmers; helped ensure a stable, safe and healthy food supply; and provided clear food information to consumers.

As a result of the UK leaving the EU, the Scottish Government must create a replacement for the CAP. This has to deliver the objectives set out in the Vision for Agriculture and, where practicable, stay aligned with new EU measures and policy development. This will require different choices to be made compared with the 2014-20 EU CAP. The EU has stated that their new CAP "draws many lessons from the policy during 2014-2020", noting "results [from the 2014-2020 CAP] in enhancing environmental protection and climate action by raising standards and encouraging change were mixed". This concurs with published research into the effectiveness of the CAP (papers outlined in Annex A), which suggests there is scope for a replacement CAP to be more efficient and deliver greater value for money.

1.3 Delivering the Vision for Agriculture

Figure 1 distils the Vision for Agriculture into four clear objectives and outcomes. It also outlines the range of proposed metrics we will use to assess whether policy proposals deliver on our objectives. This analysis will be supplemented by further qualitative analysis to capture other key aspects of the Government's Vision for Agriculture, such as alignment with the EU.

Figure 1. Vision for Agriculture objectives, outcomes and potential metrics

Objective	High quality food production	Just Transition for agriculture	Climate mitigation and adaption	Nature restoration
Outcome	The primary food production sector is a productive and sustainable sector of the economy that helps ensure that Scotland's people can live and work sustainably on our land	The transition to net zero supports the rural economy and supports efforts to reduce rural poverty and inequality, targeting support to those who need it most	Reduced greenhouse gas emissions from the agriculture sector	A substantial regeneration in biodiversity, ecosystem and soil health
Potential Metrics	Calories and protein produced for human consumption	Value of output Employment Profitability	Million tonnes of carbon dioxide equivalent	A suite of indicators, in development

It is essential that careful analysis of policy proposals for a replacement CAP is undertaken to ensure they are focused on activity and outcomes that are rooted in science and tested in the real world. This will help ensure they deliver the outcomes in the Vision for Agriculture in a way that secures value for money.

The Scottish Government's approach to appraising future policy proposals is guided by best practice, as set out in the HM Treasury Green Book and the Scottish Public Finance Manual (SPFM).

"Good appraisal entails being clear about objectives, thinking about alternative ways of meeting them, estimating and presenting the costs and benefits of each potentially worthwhile option, and taking full account of risks."

Source: Scottish Public Finance Manual

The purpose of analysing policy proposals in this way is to ensure that they deliver against Government objectives in a balanced and coherent way. The goal of analysis is to ensure that decisions are informed by, and based on, the best available evidence and in setting out our approach in this way we are being transparent about how we do that.

It is essential to bear in mind that analysis can only be based on models and the best available evidence, so results will be estimates with some margin of error. The intention of analysis is not to dictate an absolute answer; the purpose of appraisal is to support a methodological and consistent development of policy, identifying any key issues and framing outcomes and impacts in ways to help decision makers.

This briefing proceeds with evidence outlining the current position of the agricultural sector, with respect to the four Vision for Agriculture objectives. The Scottish Government has previously published a series of papers providing a wide range of evidence relating to the agriculture sector, which can be found in Annex B.

2 Evidence base

This chapter contains five sections starting with a brief introduction to the Scottish agricultural economy before presenting the evidence related to the four Vision for Agriculture objectives and proposed metrics that will be used to assess future policy proposals.

2.1 Introduction to the Scottish Agricultural Economy

Around 80% of Scottish land is used for agriculture (in the widest sense of being managed for production) according to the agricultural census, although the intensity with which this land is used varies dramatically. The share of land in Scotland used for agriculture has remained fairly stable over the past century, although farming practices and productivity have changed substantially. The utilisable agricultural area in Scotland is 5.5 million hectares of which around 3.7 million hectares are currently claimed on via Basic Payments.

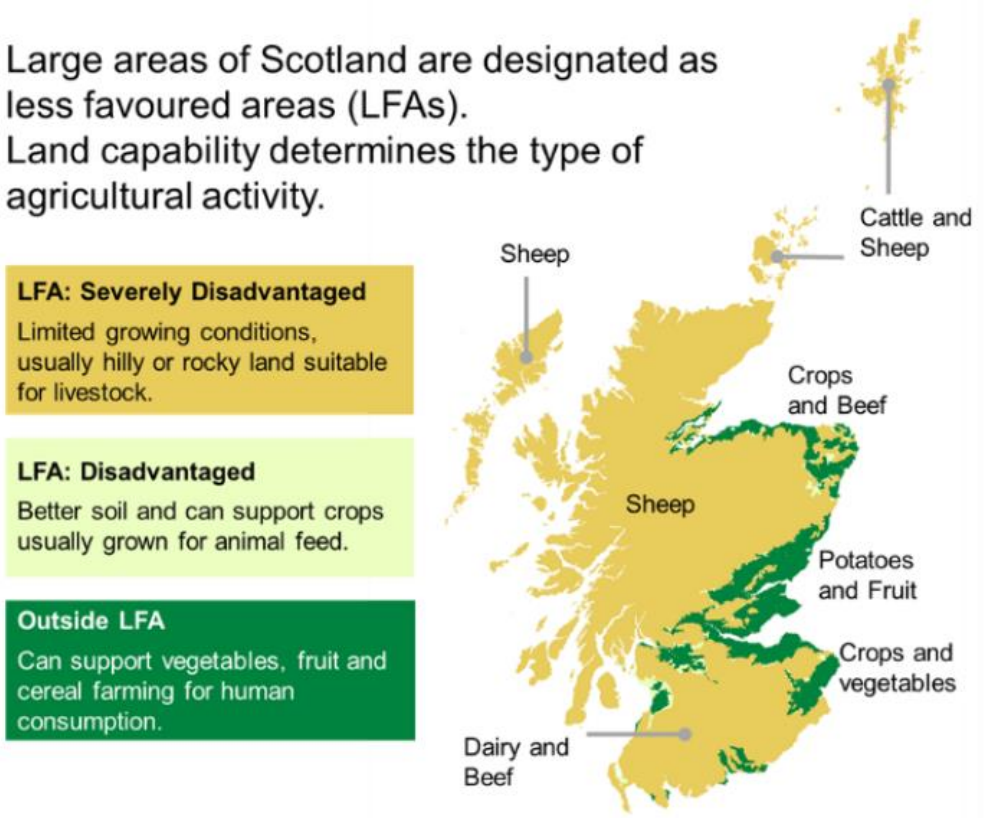
Around 80% of Scottish land is used for agriculture

Agricultural output is generally dependent on land capability. Areas with limited growing conditions are currently designated as Less Favourable Areas (LFAs) in recognition of:

- the presence of land of poor productivity, which is difficult to cultivate and with a limited potential which cannot be increased except at excessive cost, and which is mainly suitable for extensive livestock farming;
- lower than average production, compared to the main indices of economic performance in agriculture;
- a low or dwindling population predominantly dependent on agricultural activity, the accelerated decline of which could cause rural depopulation

Figure 2 shows the primary land use in different areas of Scotland classified by land type. Around 10% of Scottish agricultural land is used to grow cereals, fruit and vegetables. Barley and wheat are the main cereal crops grown in Scotland, accounting for around 85% of the area of crop-land and much of it goes into the production of malting wheat and barley. For example, in 2019 just over half (53%) of Scottish barley was sold to merchants for malting. According to the Scotch Whisky Association, around 90% of barley requirements of the industry are sourced in Scotland.

Figure 2. Map of Scotland by LFA status - agriculture is the predominant land use



Just as the quality of land for different types of agricultural activity varies across Scotland, so too does its potential to store carbon in peat and support the expansion of woodland. These activities can help reduce greenhouse gas emissions. Annex C includes maps showing: land capability for agriculture (1 is the highest quality, 8 is the lowest); peat coverage; sites of scientific interest and conservation areas; and suitability of land for woodland expansion.

The Scottish agricultural workforce was just over 67,000 people in 2021 and accounted for around 1% of Scotland's economy in terms of value added. However, the size of the agriculture sector varies considerably across Scotland and it also underpins other large industries in Scotland including food manufacturing, retail and tourism. For example, outputs of Scotland's agricultural industries provide a key source of inputs for the wider food supply chain. In 2021, Scotland's Food and Drink Growth Sector generated turnover of around £14.7 billion and employed around 129,000 people.

Nearly 70,000 people are employed in agriculture across Scotland

Analysis of Scottish Government input-output tables demonstrates the wider contribution of agriculture to the Scottish economy. Agriculture indirectly supports other industries through supply chain effects and the spending of wages. These are known as multiplier effects. The output multiplier for agriculture in the Scottish input-output tables has typically been around 50% over the past 20 years. This would mean that £10 million in activity in the agricultural sector, would typically generate a further £5 million in activity in other sectors of the Scottish economy.

The agricultural sector receives a significant amount of financial support from the Scottish Government, through the Common Agricultural Policy. The Scottish Government's agricultural support budget consists of £485 million in Pillar 1 payments and around £130 million in Pillar 2 payments in 2023-24. Analysis by SRUC estimated the proportion of direct support payments by agricultural source in 2019. This included the Basic Payment Scheme, Scottish Suckler Beef Support Scheme, Scottish Upland Sheep Support Scheme, the Beef Efficiency Scheme and the Less Favoured Area Support Scheme (over £500 million in total). The estimated share of direct support payments by agricultural source is shown in Table 1.

Table 1. Estimated Share of Direct Support Payments by Agricultural Source

Source	Share of Direct Support
Beef	44%
Crop	25%
Sheep	24%
Dairy	5%
Grazing or fodder without (June) stocking activity	3%
Total	100%

Source: Estimation of sectoral CAP payment 'envelopes' and distribution of agri-environment and forestry support 2019 (SRUC), doesn't sum to 100% due to rounding.

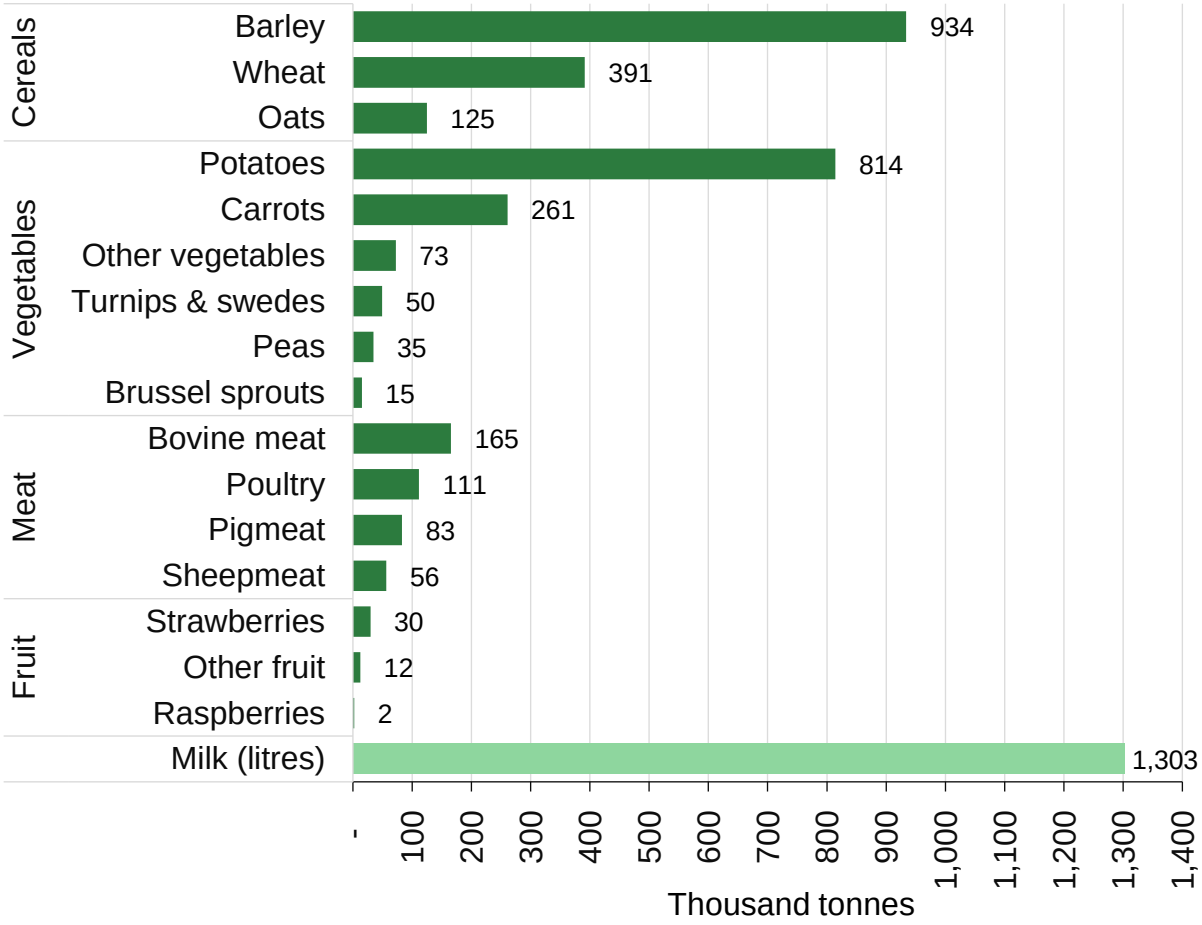
2.2 High Quality Food Production

2.2.1 What food does Scotland produce?

The Scottish agricultural sector produces a wide array of food. Figure 3 displays estimates of the quantity of food produced in Scotland for human consumption in 2019 from the Economic Report on Scottish Agriculture (ERSA), measured by weight[1].

[1] Note, significant amounts of barley are used to produce whisky and a small amount of output will be for a range of industrial purposes, for example production of starch or bioethanol from cereals. These figures exclude seed, animal feed and other output.

Figure 3. Quantity of Agricultural Output Produced in Scotland for Human Consumption by Weight, 2019



Over 1.4 million tonnes of cereals were produced in 2019, of which nearly two-thirds was barley (64%). In 2019 just over half (53%) of Scottish barley was sold to merchants for malting, while over one-third (36%) of barley was used as animal feed. Potatoes and carrots accounted for the vast majority (86%) of the 1.2 million tonnes of vegetables produced; in comparison, a relatively small amount of fruit was produced (44 thousand tonnes). Over 400 thousand tonnes of meat was produced, which was mostly (73%) red meat. The dairy sector produced just over 1.3 billion litres of milk – one litre of milk is just less than one kilogram – and more than 1.7 billion eggs were produced. This is in the region of 86 thousand tonnes (assuming an egg weighs 50 grams).

2.2.2 What is the calorie and protein content of food produced in Scotland?

Many of the calories produced in Scotland will be consumed outside of Scotland and many calories consumed in Scotland will have been produced elsewhere. This is reflected in the estimated breakdown of Scottish agricultural sales by geographic market over 2018-20, shown in Table 2 – this table covers all agricultural output, not just that for human consumption:

Table 2. Estimated breakdown of Scottish agricultural sales by geographic market

Sector	Scottish production (Thousand tonnes)	Proportion sold in Scotland	Proportion sold to England & Wales	Proportion sold to Northern Ireland	Proportion sold to EU	Proportion sold to non-EU
Wheat	852	~95%	<5%	<1%	Neg.	Neg.
Malting barley	944	~90%	<10%	Neg.	Neg.	Neg.
Other barley	854	~90%	<5%	3%	3%	Neg.
Beef	166	25%	~66%	<=2%	7%	<1%
Sheepmeat	63	20%	58%	Neg.	21%	Neg.
Liquid milk	1,312	~83%	~17%	Neg.	Neg.	Neg.
Seed potatoes	282	~21%	~47%	~1%	7%	24%
Other potatoes	807	10-11%	86-88%	~1%	1-2%	Neg.

Source: Analysis on the Impact of Future UK FTA Scenarios on Scotland's Agricultural Food and Drink Sector, report produced on behalf of the Scottish Government by the Andersons Centre. Note 'Neg.' is the abbreviation of negligible.

It is estimated that around 3 trillion Kcal calories and around 142 million kg of protein were produced in Scotland for human consumption in 2019. Table 3 identifies and groups the various outputs produced by farms in Scotland, showing the proportion of total calories (and grams of protein) for human consumption each account for. The share will be determined both by the volume of output and its calorie (or protein) richness.

Around 3 trillion Kcal calories and around 142 million kilograms of protein were produced for human consumption in Scotland in 2019

The methodology used for calculating calorie and protein production is based on, and broadly consistent with, that used in the UK National Food Strategy Report.

As this analysis focusses on estimating those calories (and proteins) produced for human direct consumption, it excludes three forms of agricultural activity. Firstly, it does not capture those calories/proteins from production that serves as inputs for the alcoholic drink industry, a sector which accounts for a large proportion of Scotland's barley and wheat crops. Secondly, it excludes agricultural output destined for other supply chains that sit outside of food production such as biofuels. Finally, it excludes agricultural outputs which indirectly support Scottish food production, such as cereals used as seed or livestock feed.

Calories are generally regarded as the most widely used measure of energy in food. However, it is important to note that neither calories or protein give the full 'nutritional picture'

which is highly complex. Nor is the calorific or protein content of different food products the only consideration when assessing the appropriate level and composition of food production. A wide range of other factors including consumer preferences for different products are also important. However, calorie and protein levels do give a clear measure of the level of food production in Scotland with which to measure changes against. Another consideration is that, aside from variations in protein richness mentioned above, protein needs vary by a number of factors, including age and health levels.

Table 3. Share of total calories and protein for human consumption produced in Scotland by selected agricultural output, 2019

Source	Calories	Protein
Milk & dairy products	29%	34%
Cereals	29%	22%
Potatoes	15%	7%
Pigmeat	8%	6%
Bovine meat	5%	14%
Eggs	4%	7%
Sheepmeat	3%	4%
Other crops	3%	2%
Vegetables (excl. potatoes)	2%	1%
Poultry	1%	3%
Fruit	<1%	<1%
Honey	<1%	<1%
Total	100%	100%

Source: Scottish Government Preliminary Analysis

The estimates in Table 3 suggest that nearly three-quarters (73%) of the calories produced for human consumption in Scotland came from milk & dairy products, cereals and potatoes. All meat combined accounted for a further 18%. In terms of protein, again milk, cereals and potatoes account for around about two-thirds (63%) while all meat combined accounted for a further 26%. These are two ways by which the contribution and relative size of various agricultural output can be measured. Other measures are similarly important to consider, such as economic value added (discussed in section 2.3), and will cause the relative size of outputs and sectors to vary.

It should also be noted that, in many cases, production will be bound by the land's capability, and land used to graze and rear livestock has limits on its alternative agricultural use. Conversely, other land uses – like those to keep dairy herds and grow grain/cereal for human direct consumption – produce a large share of calories (milk & dairy products and cereal production collectively account for 58% of calorie production and 56% protein production), whilst utilising a smaller amount of land.

A similar distribution of calorie production is reflected in farm type as well (see Table 4). A quarter of total calories produced came from Specialist Dairy farms, while a further third is produced by General Cropping and Specialist Cereal farms.

It's important to consider that consumers seek a balanced and varied diet, in addition to meeting their calorie and protein needs. As such an agricultural system focussed exclusively on producing produce with the highest calorific content would not necessarily be one which yields the balance of products that consumers place the greatest value upon. This is reflected in household spending habits. For example, figures from the ONS show that the average household in the UK devoted around 1% of their weekly food expenditure to potatoes in 2021-22. This is despite potatoes accounting for more than one-eighth (15%) of total calories produced in Scotland. This ONS data also shows that just over one-fifth (22%) of the average household's weekly food expenditure was spent on meat products. This includes fresh, chilled or frozen meat, as well as processed and preserved meats.

Table 4. Share of total calories and protein by selected farm type, 2019

Farm type	Calories	Protein
Specialist Dairy	25%	29%
General Cropping	20%	13%
Mixed Holdings	13%	12%
Specialist Cereals	12%	9%
LFA Cattle & Sheep	12%	17%
Specialist Pigs	6%	4%
Specialist Poultry	5%	9%
Remaining	6%	6%
Total	100%	100%

Source: Scottish Government Preliminary Analysis, doesn't sum to 100% due to rounding

To give a more comprehensive picture of the value of Scottish food production, the Scottish Government is exploring the feasibility of mapping the nutrient density of Scottish food production. This will complement existing calorie and protein mapping, adding another dimension with which to assess future policy proposals against.

2.3 Just Transition for Agriculture

A just transition is both an outcome – a fairer, greener future for all – and the process that must be undertaken in partnership with those impacted by the transition to net zero. Just transition is how we get to a net zero and climate resilient economy, in a way that delivers fairness and tackles inequality and injustice. This means agriculture plays its part in delivering a fairer, greener Scotland for all and that government policies must be developed in partnership with those we are asking to transition (i.e. farmers) so they deliver fairness and help to tackle inequality and injustice on the way to net zero.

2.3.1 Gross economic output from Scottish agriculture

As shown in Table 5, arable farming contributed the largest share of Scottish agricultural output in 2020, with a value of £742 million, or 27% of total output. Within arable farming, the largest components were barley and potatoes, at approximately £250 million each. The remaining output associated with arable was from wheat, oats, oilseed rape and other crops.

The next largest sectors were beef and dairy, with outputs of £584 million (21% of total output) and £425 million (15% of total output) respectively. Milk and milk production accounted for £367 million, or 13%, of Scotland's agricultural output in 2020, which is roughly equivalent to the combined output associated with Scottish wheat and barley in 2020.

Table 5. Output[2] by subsector in 2020

Sub-Sector	2020 Output (£m)	% of total
Arable	742	27%
Beef	584	21%
Dairy	425	15%
Horticulture	410	15%
Sheep	229	8%
Other	151	5%
Pigs	139	5%
Poultry	79	3%
Total	2,760	100%

Source: Total Income from Farming Estimates: 2018-2020

The value of Scottish agricultural output was worth over £2.7 billion in 2020

Specialist horticulture farms are those where more than two-thirds of their output is from fruit, vegetables, flowers, nursery stock or mushrooms. Total output from horticulture was £410 million in 2020, or 15% of Scotland's total agricultural output, with the largest shares coming from vegetables (£197 million) and fruit (£171 million). Sheep contributed £229 million, or 8% of Scotland's agricultural output in 2020, followed by other agricultural output (which includes other livestock / livestock products, eggs and clipwool), pigs and poultry.

2.3.2 Employment in Scottish Agriculture

Agriculture provided around 2% of total employment in Scotland in 2021, figures from the Business Register and Employment Survey show. This proportion varies across Scotland: agriculture accounted for 15% of employment in remote rural areas and 12% in accessible rural areas. Table 6 shows the agricultural workforce broken down by farm type.

[2] Beef and dairy – provisionally adjusted based on SRUC analysis which found around 9% of Scotland's finishing herd was kept on specialist dairy holdings. Note: Total output above excludes certain elements of TIFF like capital outlays, store animals and income from other agricultural activity.

Table 6. Agricultural workforce by farm type, June 2021

Category	Holdings	Workforce*	Ratio of workforce to holdings	% of agricultural workforce
Total Scottish agricultural workforce	**27,634**	**67,409**	**2.4**	**100%**
Specialist sheep (LFA) farms	7,281	14,069	1.9	21%
Specialist beef (LFA) farms**	4,179	10,604	2.5	16%
Other farm types	5,835	9,463	1.6	14%
Mixed type farms	2,107	6,087	2.9	9%
Specialist horticulture & permanent crops farms	565	5,891	10.4	9%
Non-LFA cattle & sheep farms	2,238	4,906	2.2	7%
General cropping farms	1,296	4,174	3.2	6%
Other cattle & sheep (LFA) farms	1,390	3,678	2.6	5%
Specialist cereal farms	1,463	3,408	2.3	5%
Specialist dairy farms***	607	2,999	4.9	4%
Specialist poultry farms	482	1,592	3.3	2%
Specialist pigs farms	191	538	2.8	1%

Source: Scottish agricultural census, 2021
*Workforce numbers do not adjust for full time equivalent (FTE)
** Labour data was not available for all 4,568 specialist beef farms
*** Labour data was not available for all 635 specialist dairy farms

Specialist sheep (LFA) farms are the largest employer in terms of workforce numbers, with 21% of the Scottish agricultural workforce, whilst having the second lowest average workforce of just under 2 employees per holding. However, on specialist sheep (LFA) farms only 1% of the workforce are full-time employees, spread across 10% of holdings. 73% of specialist sheep (LFA) farm staff are occupiers and spouses.

In contrast, 79% of specialist dairy farms employ full-time staff, who make up 65% of the workforce. A relatively lower proportion of the workforce on specialist dairy farms (10%) are occupiers and spouses. Specialist beef farms are less likely to employ full time staff (31%), who represent 22% of the workforce. 58% of specialist beef farm staff are occupiers and spouses.

Different crops have different labour requirements. Specialist cereal holdings rely on a mix of occupiers and spouses, accounting for 55% of the workforce, and employees, for 45%. On general cropping holdings 42% of labour is from occupiers and spouses and 58% from hired employees. Horticulture is more reliant on hired labour: 24% of the workforce are full- or part-time employees, while 62% are casual or seasonal staff.

Table 7. Agricultural workforce by employment type, June 2021

Category	Holdings	Workforce*	Average Workforce	% of Scottish agricultural workforce
Total Scottish agricultural workforce	**27,634**	**67,409**	**2.4**	**100%**
Occupiers & spouses working less than half time	19,796	26,586	1.3	39%
Total full-time employees	5,915	13,386	2.3	20%
Occupiers & spouses working more than half time	10,108	11,722	1.2	17%
Total casual and seasonal employees	2,419	8,003	3.3	12%

Source: Scottish agricultural census, 2021
*Workforce numbers do not adjust for full time equivalent (FTE)

Based on the 2021 June agricultural census, there were 13,386 regular full-time staff, 7,712 regular part-time staff, 8,003 casual and seasonal staff, and 38,308 working occupiers / spouses.

2.3.3 Profitability in Scottish Agriculture

The average farm income[3], a measure of farm profit after costs, is estimated to be £50,000 in 2021-22 when support payment income is included. This is slightly above the average farm income level over the past nine years, as summarised in Figure 4. When support payments are excluded, average farm profits have mostly been negative over this period.

Figure 4. Average farm incomes with and without subsidy 2012-13 to 2021-22

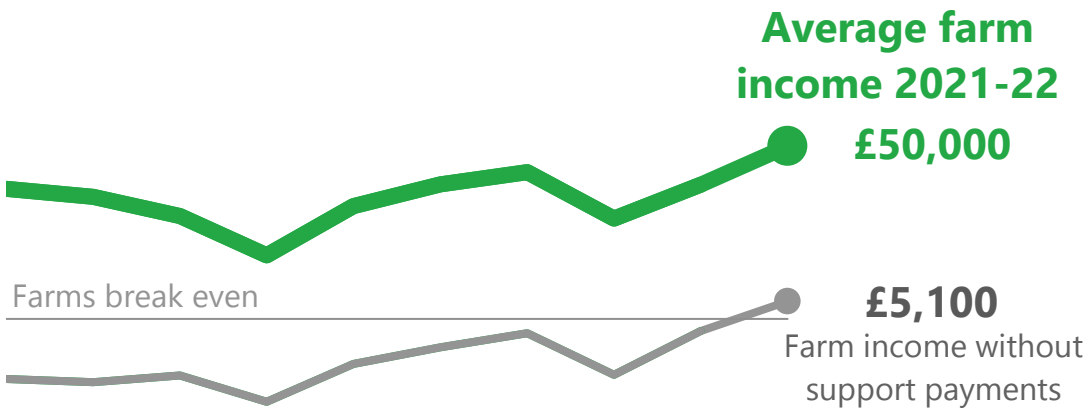
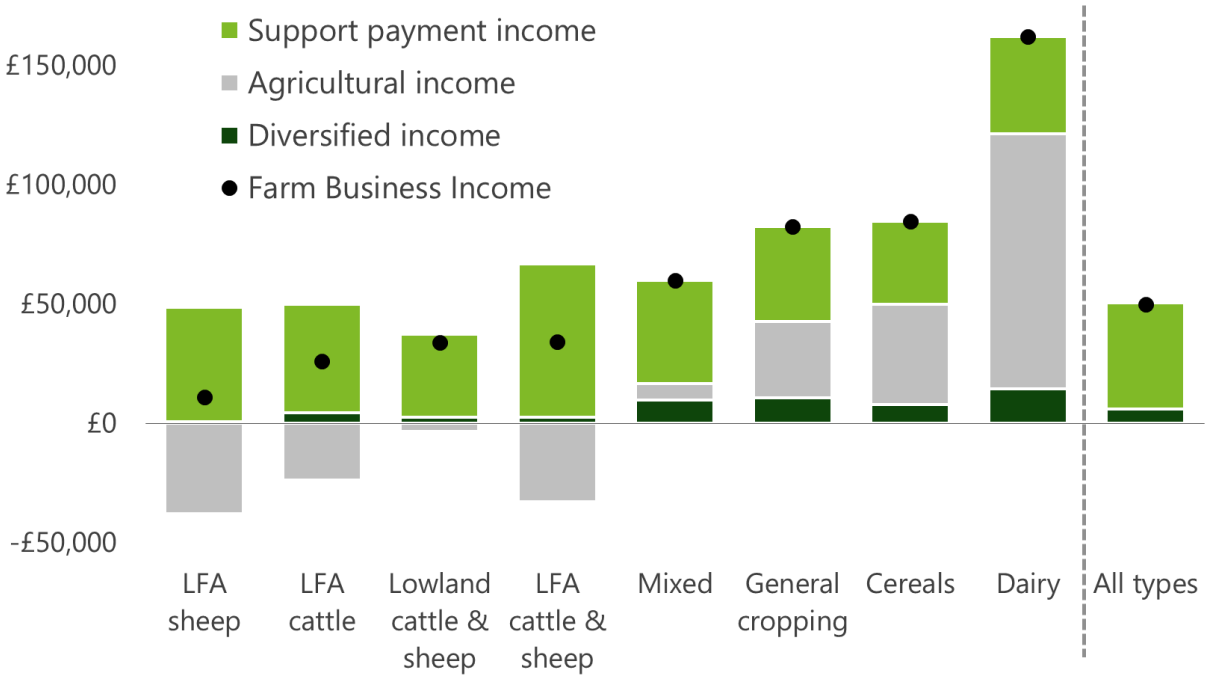


Figure 5 shows average level of farm income by farm type. The dots indicate the average overall farm business income. The grey, dark green and light green bars denote the

[3] Note, figures are taken from the Farm Business Survey based on a sample of farms with economic activity of over £20,000 and excludes farms not in receipt of support payments such as pigs, poultry or horticulture.

contribution to overall farm business income from agricultural activity, diversified income and support payments. The figures show that in 2021-22, average profits were highest in commercial dairy farms (£162,100) and lowest in LFA sheep farms (£11,000). The chart also illustrates that in many areas of agriculture, primarily from sheep and cattle farms in both LFA and lowland areas, average income from agricultural activity, as denoted by the grey bars in the chart, was negative.

Figure 5. Average farm business income, by income category and farm type, 2021-22

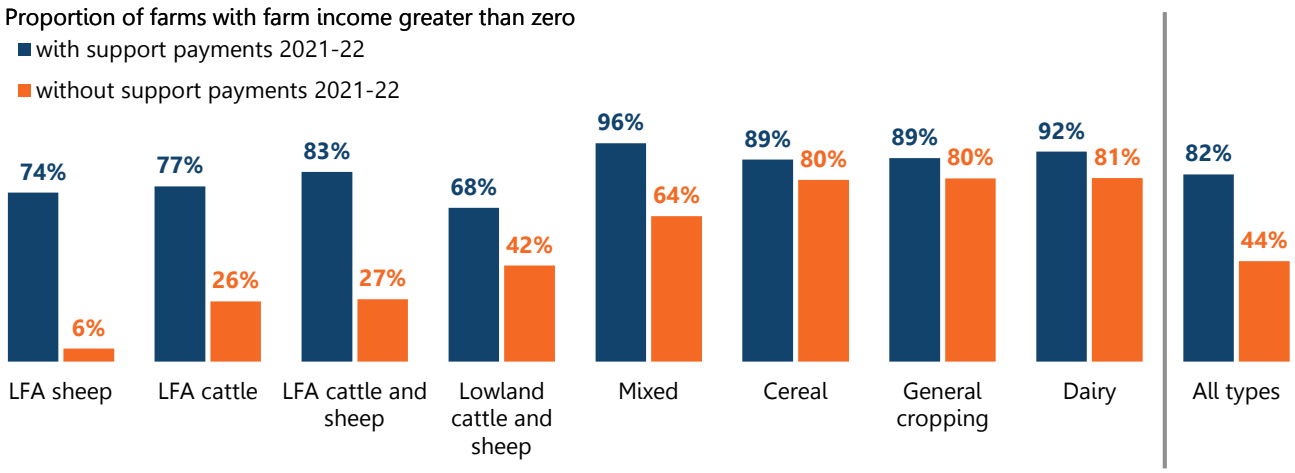


Support payments play an important role in farm income. Around 82% of all farms made a profit in 2021-22. Without support this would decrease to 44% of all farms.

Less than half of farms would have made a profit without support payments in 2021-22

The importance of support payments varies by farm type. It is of greatest importance to LFA cattle and sheep farms, whilst sectors such as cereals and dairy are comparatively less reliant on such payments to remain profitable.

Figure 6. Proportion of farms with agricultural output greater than input, 2021-22

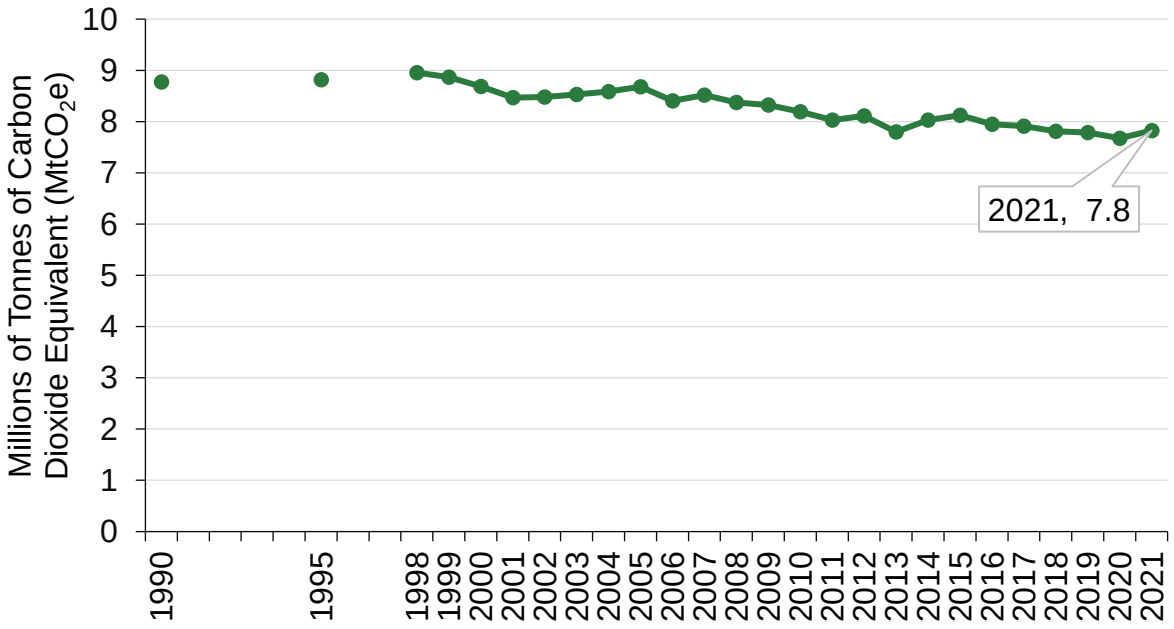


2.4 Climate Mitigation and Adaption

Agriculture has an important role to play in reducing Scotland's greenhouse gas emissions. Agricultural greenhouse gas emissions originate from a range of different sources and activities, including but not limited to: enteric fermentation in the digestive system of livestock; manure management; soil emissions; and agricultural machinery. As a result, different farm sectors and farm types inevitably produce different emissions requiring a different approach to emission reductions.

Scottish agriculture generated 7.8 $MtCO_2e$ (million tonnes of carbon dioxide equivalent) in 2021, equivalent to 19% of total Scottish emissions. Agricultural emissions have fallen by 0.9 $MtCO_2e$, or 11%, since 1990, which is the base year from which the government's emission targets are set. This long-term decrease was driven primarily by a decrease in the number of cattle and sheep driven by market factors.

Figure 7. Scottish agricultural emissions



Agriculture is the fourth highest greenhouse gas emitting sector in Scotland, out of the seven Climate Change Plan Update sectors (Figure 8). The reduction in agricultural emissions is smaller than emission reductions recorded across other sectors (Figure 9), and across Scotland as a whole, where total emissions have nearly halved during the same period. The Scottish Government's Climate Change Plan update requires agricultural emissions to reduce by a further 2.5 $MtCO_2e$ to 5.3 $MtCO_2e$ by 2032, the equivalent of a 32% reduction from 2021 levels. For context, this means achieving close to triple the reduction in emissions recorded over the past 30 years, in one-third of the time.

Agricultural emissions need to fall by around a third by 2032

Figure 8. Sources of Scottish greenhouse gas emissions, 2021

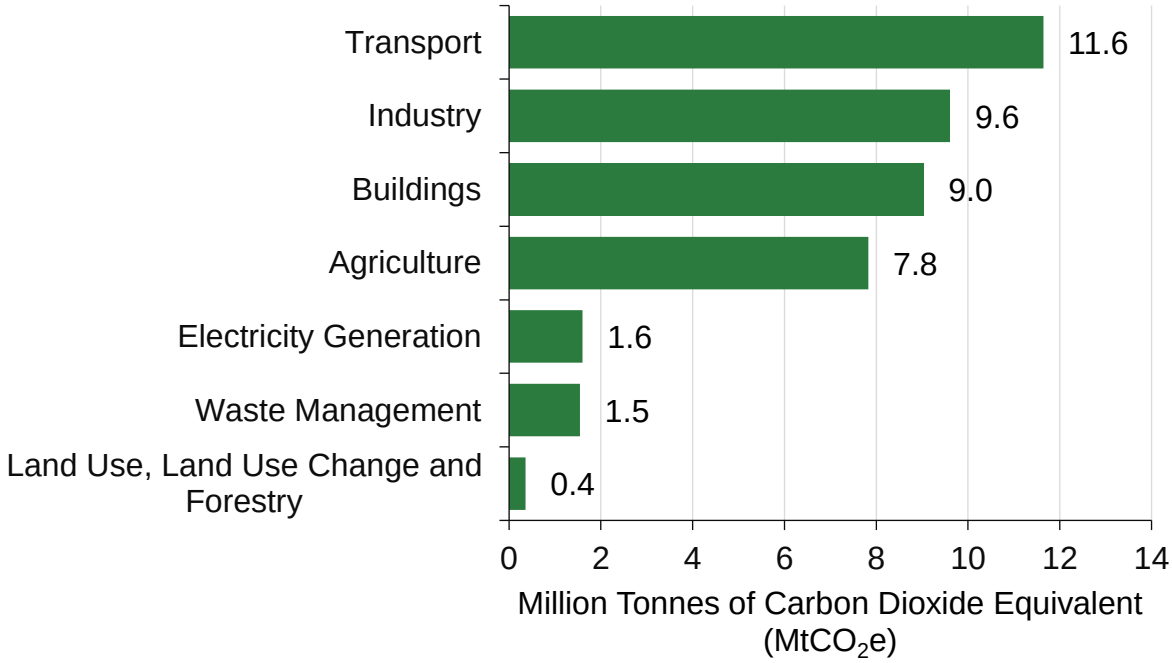
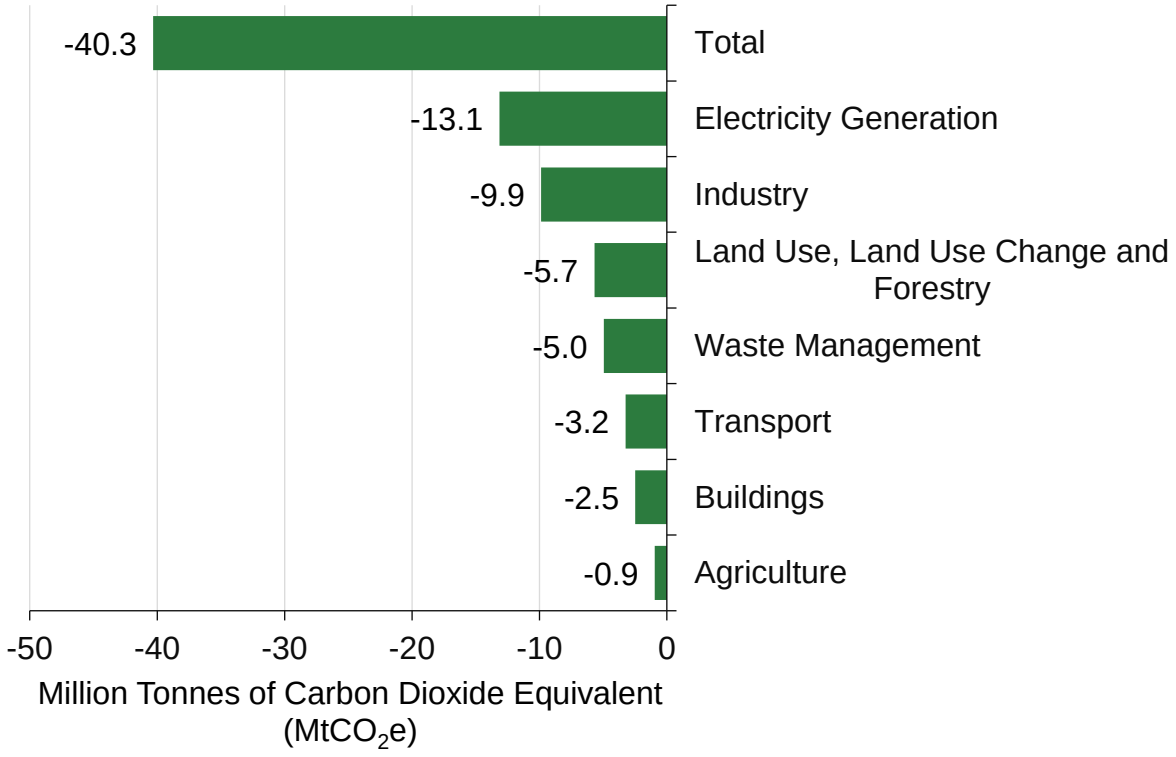


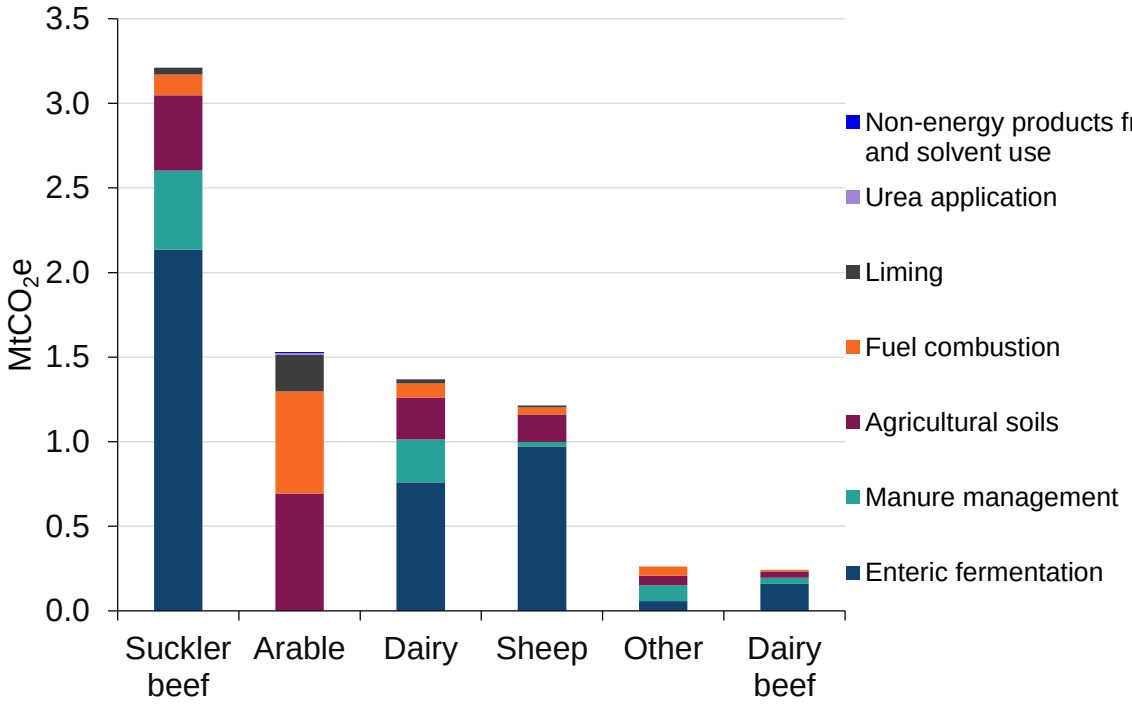
Figure 9. Change in Scottish emissions by Climate Change Plan update sectors, 1990 to 2021



As noted in the Update to the Climate Change Plan, agriculture and food production rely on natural processes, and will therefore always cause some degree of greenhouse gas emissions; in particular, ruminant livestock will always emit some greenhouse gases. Therefore, a balance must be found to ensure greenhouse gas reductions can take place while Scotland continues to produce high quality and sustainable food. However, with changes in farming practices, and by utilising new technology and innovative tools, a substantial reduction in emissions can be achieved. Analysis produced for the Scottish Government assessed a wide range of mitigation measures that could be employed in Scotland. This includes measures that provide high emission reduction potential that also save farmers money or cost very little to implement in most scenarios, for example: growing clover-grass mix instead of pure grass; using genomics in dairy breeding; increasing the beef output from dairy herds using sexed semen; finishing beef animals faster; and using nitrate as a feed additive for beef.

Ruminant livestock produces high levels of methane, a particularly potent greenhouse gas, from enteric fermentation, and both methane and nitrous oxide from manure management. It is estimated that the beef, sheep and dairy sectors collectively produce around three-quarters (77%) of total agricultural emissions (Figure 10) while arable farming accounts for a further 19% of total emissions, primarily associated with nitrous oxide from inorganic fertilizer application.

Figure 10. Emissions from Scottish agricultural sub-sectors in 2021



Source: Scottish Government analysis of the greenhouse gas inventory and "Disaggregating headline Smart Inventory figures for Scottish Agriculture" by Andrew Moxey and Steven Thomson

Agriculture also has an important role to play in reducing emissions in the Land Use, Land Use Change and Forestry (LULUCF) sector in the Climate Change Plan Update. This covers emissions and removals of greenhouse gases resulting from direct human-induced land use, land-use change and forestry activities. Just one example of this is the Integrating Trees Network, a farmer and crofter led initiative showcasing the multiple benefits of increasing the integration of trees on farmland for climate change and wider environmental priorities.

The soil can sequester, or capture and store, atmospheric carbon dioxide. Through a process called photosynthesis, carbon dioxide is fixed into plants. When the plant dies, it decomposes and the carbon it fixed becomes part of the soil organic matter. Estimates of the additional carbon storage potential of Scottish soils are highly uncertain and extremely variable across geographical area, land use and soil type. It is estimated that there is the potential to store an additional 60 mega tonnes of carbon in Scottish topsoils under grassland soils and 88 mega tonnes of carbon in topsoils under arable land. But there is also the risk that up to 112 mega tonnes of stored soil organic carbon could be lost. Scottish soils generally have high soil organic carbon contents, so it may be difficult to further increase the carbon content of Scottish soils under current land use practices.

Climate change is also a severe risk to the agricultural sector. The Farm Advisory Service notes that summers have become hotter and drier, winters milder and wetter, and heavy rainfall events have increased in frequency. Extreme weather events have become less predictable but far more intense. These changes are having a number of impacts on Scottish agriculture in areas such as productivity, soil quality, pests and diseases, water availability and quality, and flooding. Some parts of Scotland's agricultural sector are expected to experience some positive changes, however, in most cases these are largely outweighed by the negative impacts.

2.5 Nature Restoration

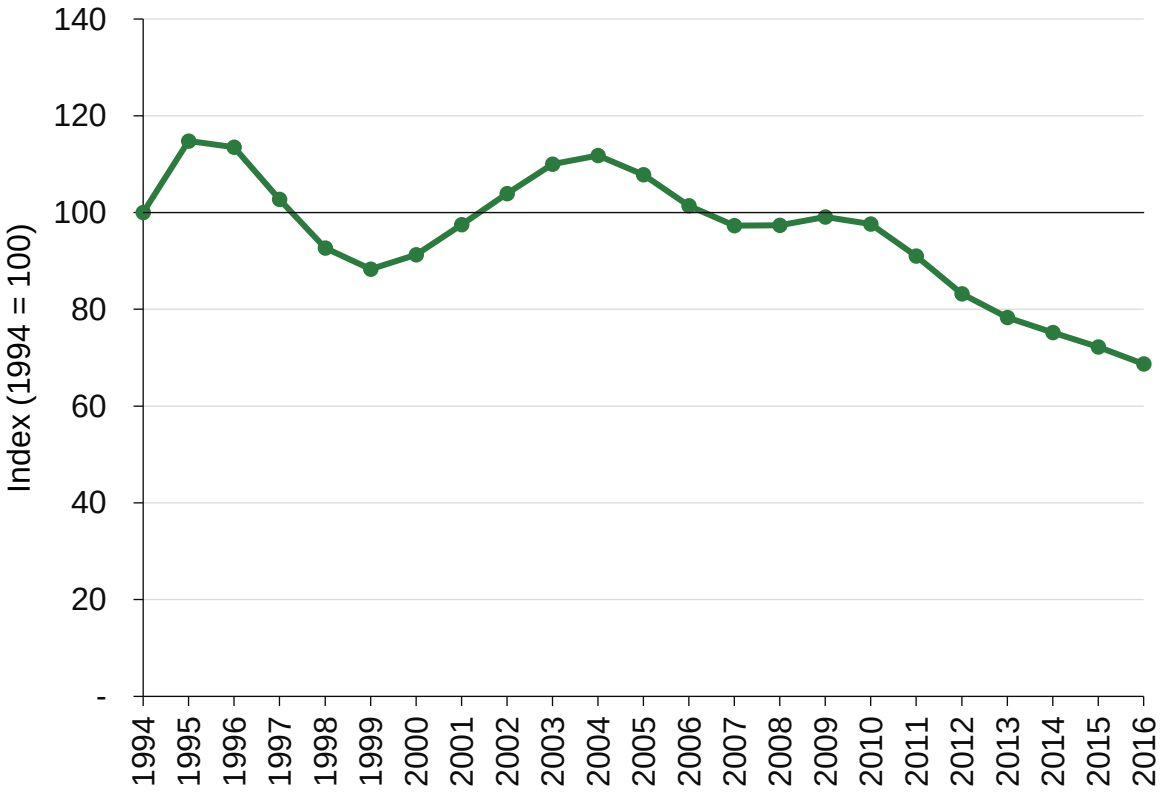
Biodiversity is the variety of all living things and ecosystems. This web of relationships between inter-dependent organisms and the environment provides the benefits that people get from nature, such as food, medicines, fibre, and other natural materials. Simply put, we need biodiversity to survive.

Agriculture has a vital role to play in the health of terrestrial biodiversity and the services that it provides given that around 80% of Scotland's land is agricultural. In some cases, historical agricultural activity has created the habitat that promotes some of the unique biodiversity that is found in Scotland (e.g. machair).

Declining biodiversity has been observed both globally and in Scotland for several decades

Declining biodiversity has been observed both globally and in Scotland for several decades. The latest State of Nature report for Scotland showed that the abundance of half of the species measured decreased between 1994 and 2016, with a 24% decrease in average species abundance over the same period, much of which has occurred since 2010 (illustrated by the terrestrial species abundance index in Figure 11 – note, the 1994 baseline represents a point in time where changes had already occurred so the results must be viewed in the context of an already depleted baseline). The distribution of species has also declined, with a 14% reduction in average distribution of the species measures since 1970.

Figure 11. Scotland terrestrial species abundance 1994 to 2016



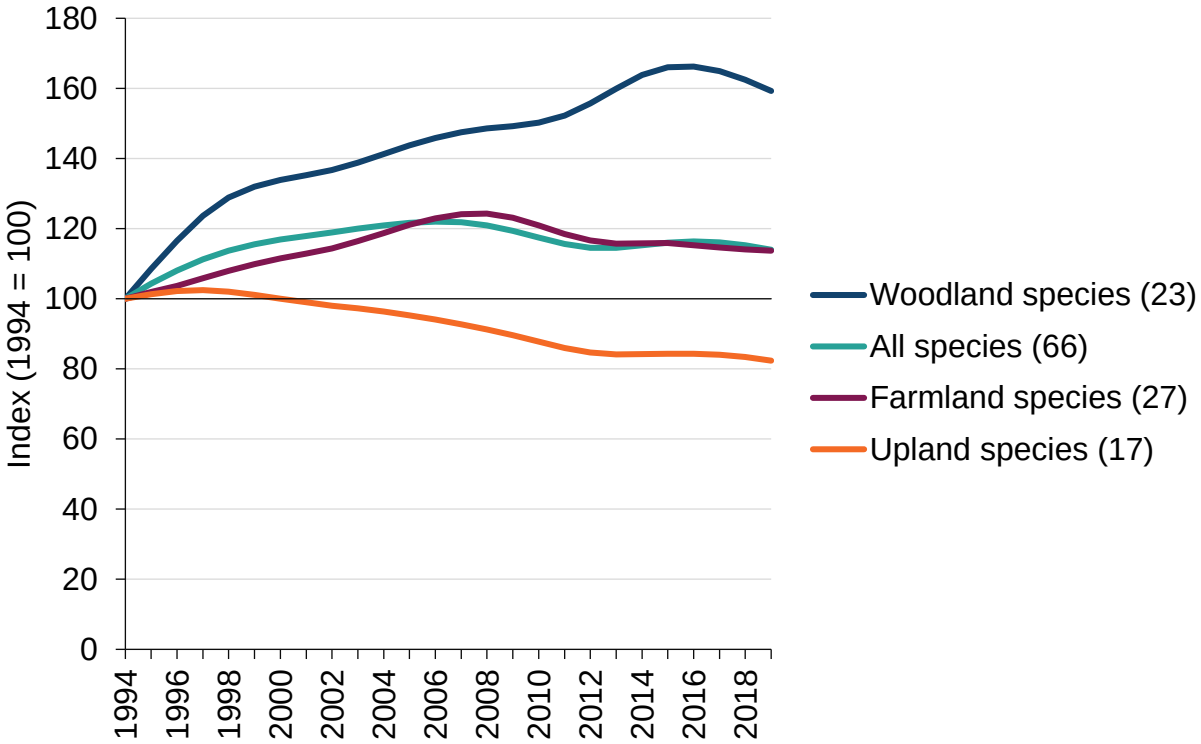
The United Nations Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) identified five direct drivers of biodiversity decline in its 2019 Global Assessment Report, these are:

- changing use of the land and sea especially for agriculture, forestry, fish farming and coastal infrastructure
- direct exploitation of organisms via harvesting, logging, hunting and fishing
- climate change
- pollution
- invasive non-native species

Agriculture is a contributing factor to all five drivers of biodiversity decline and given the extent of agricultural land in Scotland and it has undeniably played a key role in biodiversity decline across the country. In broad terms, the impacts of agriculture on biodiversity are largely a result of the historical move from low input-low output agricultural systems towards agricultural intensification. Increasing intensification, whether in arable or livestock systems, whilst boosting agricultural productivity, aligns with a greater control over natural processes, often at the detriment of nature. For example, in arable systems intensification has generally lead to the increased use of pesticides and fertilisers, continuous cropping, changed sowing seasons, and the loss of non-cropped habitats. In livestock systems it is linked to higher nutrient inputs into and out from improved grasslands, the greater use of veterinary medicines, and the removal and suppression of habitat. These practices impact on biodiversity both directly (e.g. direct loss of habitat from agricultural practices) and indirectly (e.g. increased nutrients in runoff causing eutrophication in aquatic ecosystems).

To address these impacts, agri-environment schemes and measures to improve targeted species and designated habitats have been put in place over the last couple of decades. There have been some successes, but on the whole results have been difficult to assess, all while set against a backdrop of continuing biodiversity decline at the national scale. The Scottish Terrestrial Breeding Birds indicator highlights the difficulty and complexity in understanding biodiversity impacts and improvements. Figure 12 shows that the overall picture for the indicator is a stable trend since 1994. However, breaking down the indicator into its constituent parts shows that upland birds have decreased, farmland birds have remained relatively stable and woodland birds have increased in abundance over this period. It is also important to note that many of these trends only start in recent decades, meaning their baseline is likely not a true reflection of an unimpacted state.

Figure 12. Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2019



To address the biodiversity crisis the Scottish Government has published a new draft Biodiversity Strategy. The strategy sets out the vision that:

“By 2045, Scotland will have restored and regenerated biodiversity across our land, freshwater and seas. Our natural environment, our habitats, ecosystems and species, will be diverse, thriving, resilient and adapting to climate change. Regenerated biodiversity will drive a sustainable economy and support thriving communities, and people will play their part in the stewardship of nature for future generations”

To achieve this vision two milestones have been set:

- to be nature positive by 2030 (in line with the Leaders’ Pledge for Nature) and
- restored and regenerated biodiversity across the country by 2045

For agriculture to contribute towards meeting these milestones, the evidence suggests that a number of changes that address the drivers of biodiversity decline from agriculture are needed. These could include: a move to farming practices that promote high diversity, nature rich, high soil carbon, low intensity methods to address the direct impacts on biodiversity, all whilst sustaining high quality food production. There are also broader actions needed to increase the spatial extent of nature networks and improve overall ecosystem health and functioning so that ecosystems are connected and more resilient to other pressures (e.g. climate change).

Given the breadth of the nature restoration objective, we will develop a suite of indicators when assessing proposed policy changes, drawing on the information and issues highlighted in this section.

Annex A. Published Research into the Effectiveness of the CAP

This Annex sets out a summary of the published evaluation evidence on the Common Agricultural Policy (CAP).

We have reviewed over 20 evaluations and assessments, including from the European Court of Auditors, Scottish & UK Governments and academic institutions, to understand the strengths and weaknesses of the CAP (these are listed below).

While the CAP has helped farmers deliver economic, social and environmental benefits, the literature and, indeed, the EU, acknowledge shortcomings of the previous rounds of CAP. The published evaluations and assessments find:

- most CAP funding under the 2014-20 round did not deliver the intended benefits or value for public money because:
    - direct payments were not targeted or means tested
    - the benefit did not necessarily go directly to the farmer
    - direct payments were found to reduce innovation, structural development, and productivity growth
    - direct payments had little environmental benefit, and in some cases may have had a negative impact
- Greening and Less Favoured Area Support Scheme have been found not to deliver as effectively as possible on their stated objectives
- some small schemes, such as Agri-Environment Climate Scheme, have been found to have a positive impact, though limited by budget or uptake
- clear SMART objectives should be defined in future, to allow development of a future policy based on evidence and lessons learned from previous schemes

The replacement for the CAP will deliver the objectives set out in the Vision for Agriculture and, where practicable, stay aligned with new EU measures and policy development. This will require different choices to be made compared with the 2014-20 EU CAP.

CAP evaluations

- AgriFood Economics Centre AgriFood_Rapport_20172.pdf
- European Court of Auditors Common Agricultural Policy and Climate
- European Court of Auditors Special Report 21/2017: Sustainable land use (Greening)
- European Court of Auditors Special Report 13/2020: Biodiversity on Farmland
- International Agricultural Trade Research Consortium Trade Impacts of Agricultural Support in the EU
- James Hutton Institute Identifying Gaps in the Current Agri-Environment and Climate Scheme
- Scottish Government Evaluation of less favoured area support scheme
- Scottish Government Farm Advisory Service: enhanced monitoring and evaluation
- Scottish Government Food Processing, Marketing and Co-operation Fund 2014-2020: evaluation
- UK Government Agriculture Bill: Analysis and Economic Rationales for Government Intervention

CAP discussion and research

- Applied Economic Perspectives and Policy Journal Coupled Agricultural Subsidies in the EU Undermine Climate Efforts

- European Parliament Possible effects on EU Land Markets of new CAP Payments
- Scottish Government CAP Greening Group Discussion Paper
- Scottish Government A future strategy for Scottish agriculture: final report

Further information

- SRUC Boosting Productivity in Scottish Agriculture
- Scottish Government FBS Survey 2018-19: profitability of Scottish farming
- Scottish Government Just Transition Commission Interim Report
- RPID Basic Payment Scheme
- NatureScot State of Nature Scotland 2019 Report
- European Commission The common agricultural policy at a glance
- HM Treasury The Green Book

Annex B. Evidence Relating to the Agriculture Sector

This annex contains the full list of RESAS and external reports commissioned or published for the Farmer-led Groups process as well as some other key evidence reports.

Agricultural Reform Programme

- Evidence to Support the Development of a New Rural Support Scheme for Scotland

Climate change evidence reports

- Dairy Farmer-led Group: climate change evidence
- Arable Farmer-led Group: climate change evidence
- Hill, Upland and Crofting Farmer-led Group: climate change evidence
- Pig Sector Farmer-Led Climate Change Group: climate change and greenhouse gas evidence

Greenhouse Gas Inventory reports

- Greenhouse gas inventory: estimated sheep emissions and their mitigation
- Greenhouse gas inventory: estimated dairy emissions and their mitigation
- Greenhouse gas inventory: estimated arable emissions and their mitigation
- Greenhouse gas emissions - agricultural: disaggregating headline figures

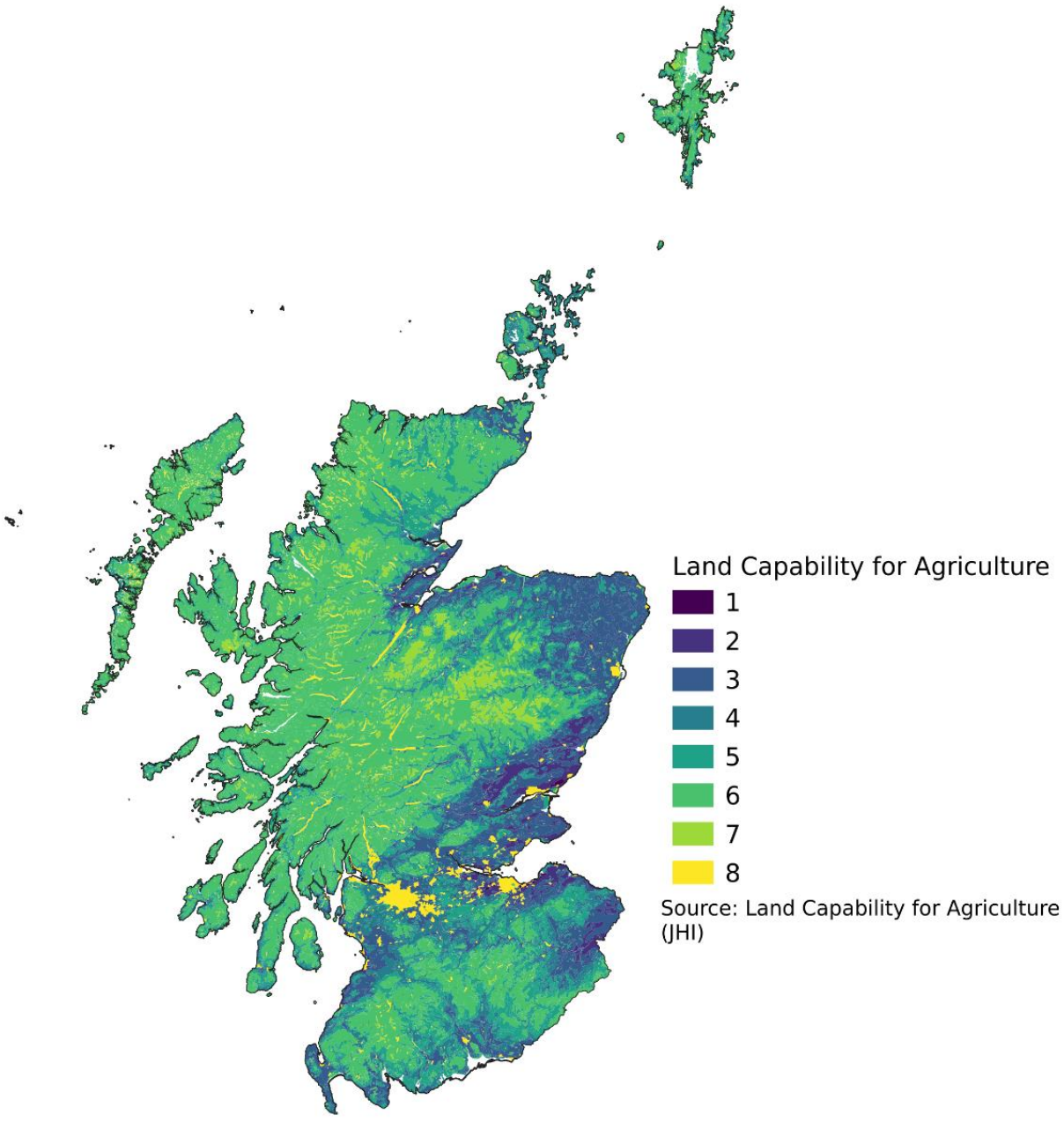
Suckler Beef Climate Scheme research papers

- Estimated Suckler Beef Climate Scheme effects within the National greenhouse gas 'Smart' Inventory
- Suckler Beef Climate Scheme: Draft metrics
- Suckler Beef Climate Scheme: Broader issues
- Structure and Efficiency of the Scottish Beef Herd - Cattle Tracing System Insights
- Implementation issues for the Suckler Beef Climate Group Scheme
- Estimated Suckler Beef Climate Scheme implications for cattle numbers
- Environmental Conditionality on Direct Payment to Land Managers
- Structure and support of the Scottish Beef Sector 2019 - impact of CAP 2015 reforms
- Suckler Beef Climate Scheme: Advisory Support and Accreditation

Annex C. Maps

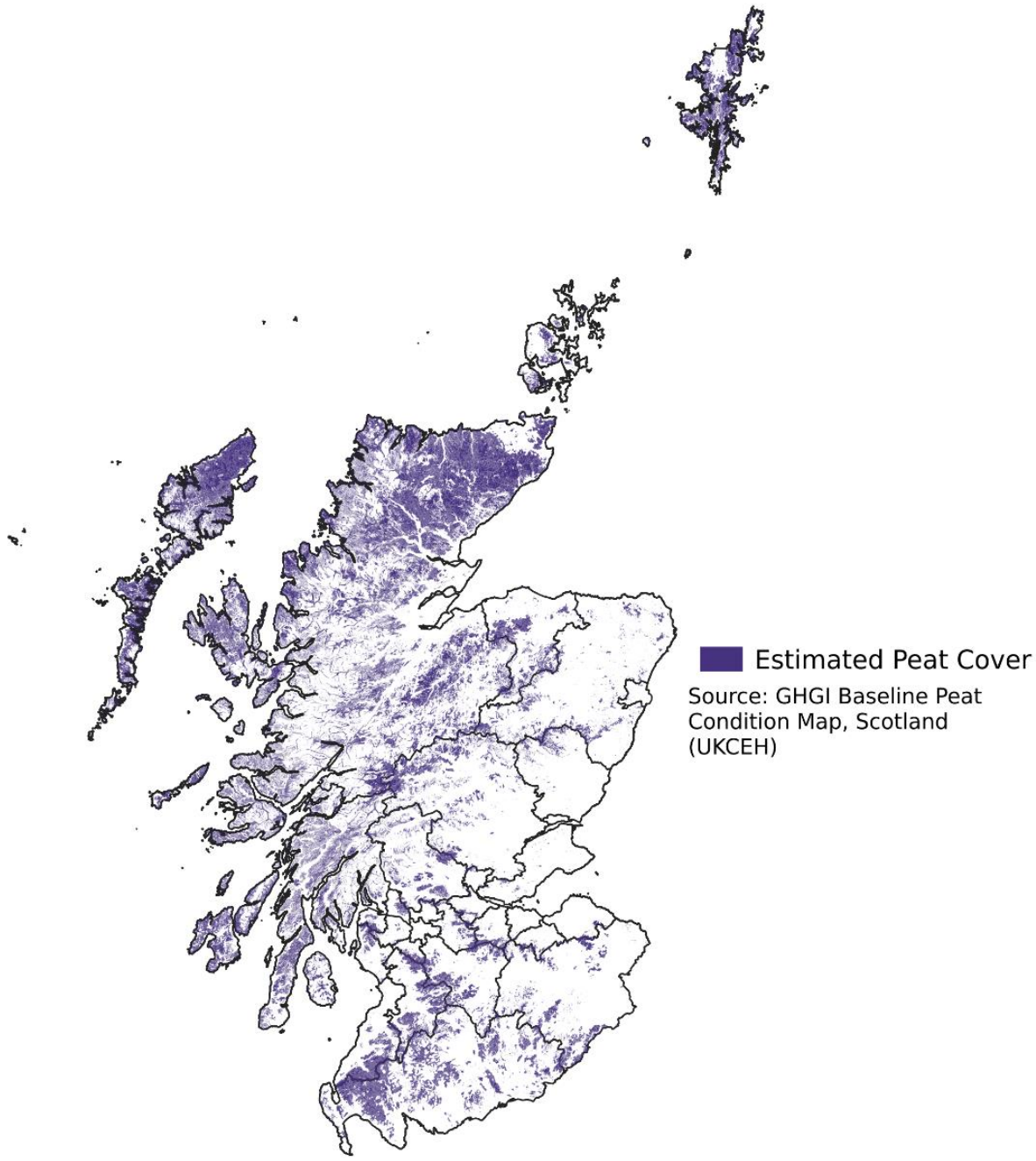
Maps showing: land capability for agriculture (1 is the highest quality, 8 is the lowest); peat coverage; sites of scientific interest and conservation areas; and suitability of land for woodland expansion.

Figure 13. Map of Scotland and land capability for agriculture



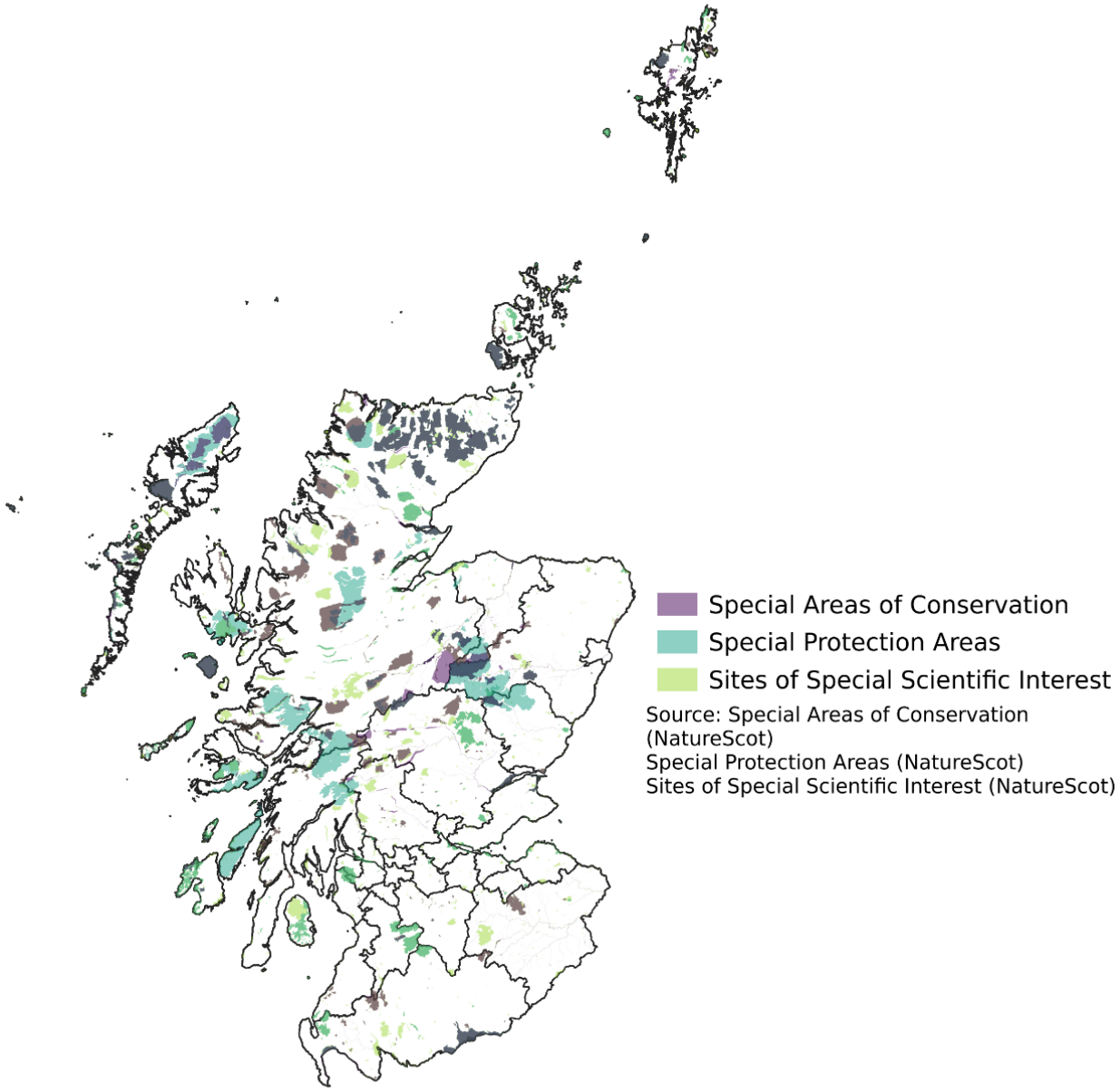
This map shows that the east coast of Scotland generally has a greater proportion of land in LCA 1, 2 and 3, while the Scottish borders and highlands and islands generally have a greater proportion of land in LCA 5, 6 and 7. Around two-thirds of Scottish land is LCA 5 or 6.

Figure 14. Map of Scotland and estimated peat cover



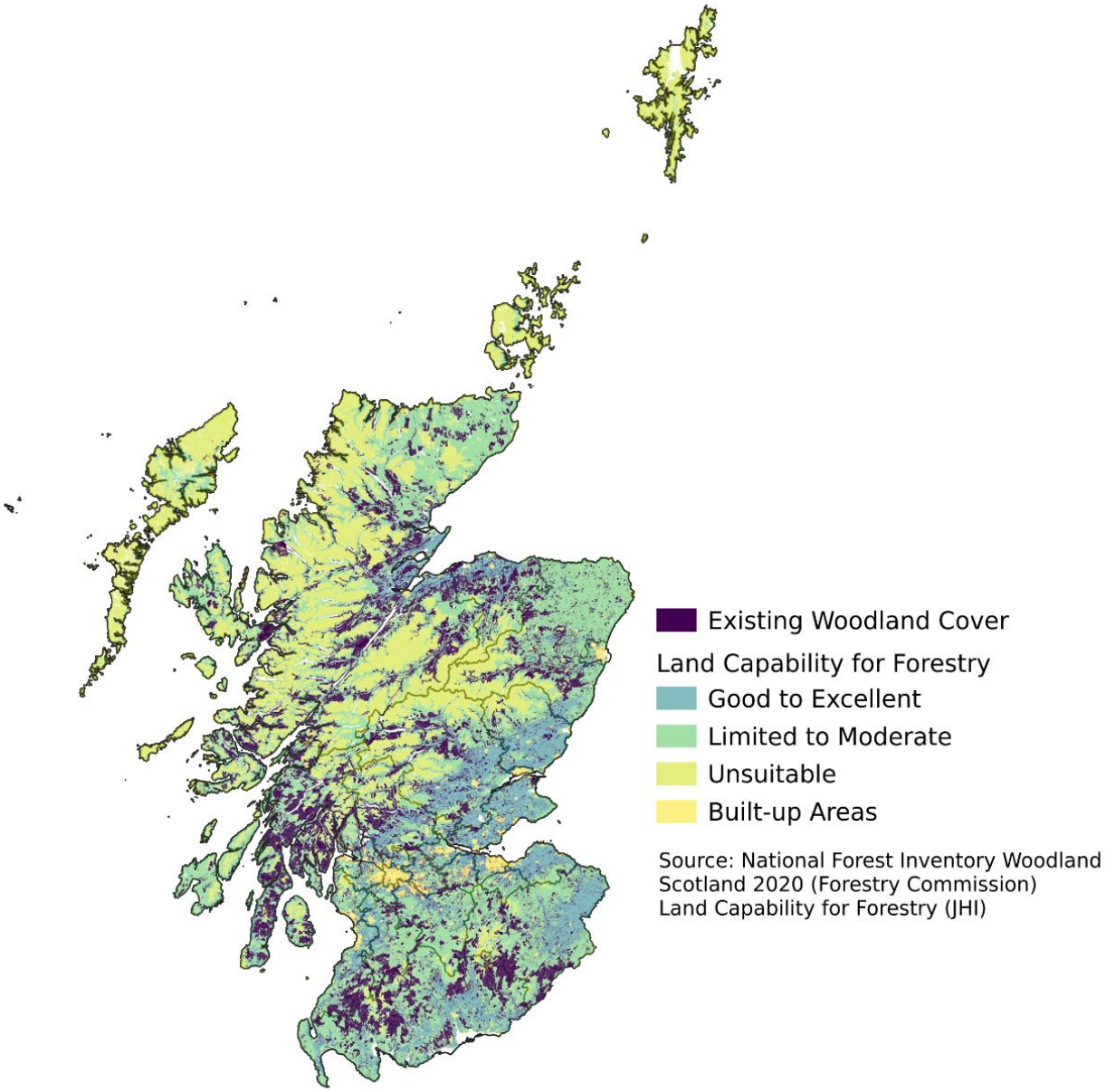
This map shows that estimated peat cover is highest in the north highlands and western and northern Isles. This is all types of peat, including near natural bog and degraded peat.

Figure 15. Map of Scotland and sites of scientific interest and conservation areas



This map shows the location of sites of scientific interest and conservation areas, which are largely north of the central belt.

Figure 16. Map of Scotland and suitability of land for woodland expansion



This map shows that land in the Tayside, Central and Fife region, as well as East Lothian and the south of Scotland, is good to excellent suitability for woodland expansion. It also shows that land in the highlands and islands is typically either existing woodland cover or is unsuitable for woodland expansion.

The Land Capability for Agriculture map produced by the James Hutton Institute (JHI) is a useful way of understanding the potential agricultural utility of land. The map itself is based on data from the 1960s and developed in the 1980s, however, the potential applications of land based on soil type and climate are not expected to have changed substantially over that time. JHI are currently working on a revised map of Land Capability for Agriculture that will improve the accuracy of the existing map.

The composite peat map developed by the UK Centre for Ecology and Hydrology is the most comprehensive available map of peat in Scotland, taking into account the JHI 1:250,000 scale Soils of Scotland map (1981) and data from the British Geological Survey 1:50,000 geological map of Britain (2011). While this composite map is the first unified map showing peat presence and absence across Scotland and is an improvement on existing peat mapping accuracy, it still has some limitations. The map is around 68% accurate at predicting the actual locations of peat and 84% accurate at predicting areas without peat. There is significant uncertainty surrounding the location of peat in Scotland, particularly in grassland areas.

The scientific interest map only covers onshore areas.

The National Forest Inventory only accounts for woodland and forests of greater than 0.5 hectares, so it is possible that smaller areas of woodland are not accounted for in the inventory. The Land Capability for Forestry map is built based on data collected in the Soil Survey of Scotland in 1988, and the map was built with limited field validation, so it is possible the boundaries between some polygons may be inaccurate. The Land Capability Map takes into account climate, wind throw, soil nutrients, topography, droughtiness, wetness, and soil when estimating suitability, much of which is not expected to have changed substantially since the data was collected.

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

Any enquiries regarding this publication should be sent to us at

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