The Future Farming and Environment Evidence Compendium

September 2019 - Update

Industry Overview

Farm accounts

Farm Performance

Productivity

Environment

Department for Environment Food & Rural Affairs

Government Statistical Service

The Future Farming and Environment Evidence Compendium brings together existing statistics on agriculture to summarise the current state of the agricultural industry, to enable better decisions to be made on the future of farming

Contents

Summary pages 4-21 provide an overview of all the evidence in this document, with statements linked to detailed pages, indicated by an accompanying page number. The analysis is then structured around the following 5 sections:

Data sources for each page can be found pp118-122

Agricultural Policy is devolved. The Agriculture Bill will be England focused, with common UK frameworks only being sought where needed, to make sure we can meet our trade and international obligations. As the evidence is England focused, all figures quoted in relation to farm profit are for England only.

The research and analysis in this evidence pack is taken from a variety of analytical disciplines – including scientific research, statistics, economics and social research. This publication is voluntarily compliant with the Code of Practice for Statistics. See the Statement of Voluntary Compliance for further information. For more information on Defra's evidence strategy please visit:
https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/about/research
For any enquiries please contact: farming-statistics@defra.gov.uk

Please note that due to rounding, the summation throughout the compendium may not appear correct.

Why is agriculture important?

Agriculture contributes around 0.5% to the United Kingdom's economy, but provides half of the food we eat, employs almost half a million people and is a key part of the food and drink sector, which contributed £122bn to the economy in 2017.

It is farmers and land managers who manage 71% of the UK's land, and through them we can safeguard our natural environment and ensure the highest standards of animal and plant health.

How does agriculture contribute to the UK economy?

How much does agriculture contribute to the UK economy?

In 2018, agriculture contributed £9.6bn (about 0.5%) of the total net UK economy. England provided 71% of this value, Wales contributed 7%, Scotland 14% and Northern Ireland 8%.

23

What overall value of goods and services did agriculture produce and consume in 2018?

In 2018, agriculture generated £27bn worth of produce while consuming £17bn worth of goods and services, giving a net contribution to the UK economy of £9.6bn.

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If you are viewing on an electronic device, press this number to take you straight to the corresponding detailed slide

If you are reading a paper version please turn to page 24.

What is the total income (profit) from farming in the UK?

In the UK in 2018, the total profit of all farm businesses (Total Income from Farming) was £4.7bn. This is the gross value added (£9.6bn) minus depreciation of farm assets (£4.3bn), payment of wages, rent, interest and taxes (£3.8bn) and addition of farm subsidies (£3.3bn).

25

How does the total income (profit) from farming vary from year to year?

The Total Income from Farming (TIFF) (profit) can vary hugely from year to year and therefore it is important to consider more than just one year when interpreting the performance of agriculture.

26

What are the main structures and demographics of agriculture in the UK?

How many people are employed within agriculture in the UK?

In the UK in 2018, agriculture employed almost half a million people in the UK, 1.5% of the UK workforce, who were mainly involved in business ownership or management.

27

How is the UK agriculture industry structured and how is agricultural land used?

The UK agriculture industry is made up of 218,000 farm holdings, using 17.4million hectares of land (71% of the UK land total in 2018).

28

What are the main farming systems?

In the UK, 97% of farmed area is classified as conventional and 3% is classified as organic in 2018.

29

How much woodland is on agricultural land in the UK?

There are 1 million hectares of woodland on agricultural land in the UK (4% of UK land total), of which the majority is found in Scotland (52%) and England (37%).

30

Which products contribute most to the value of UK agricultural output?

61% of the value of the UK's agricultural production comes from livestock (£14.8bn in 2018), of which Dairy and Beef are the largest sectors.

31

How have the prices received by farmers for the main UK agricultural outputs changed over time?

The prices farmers have received for their produce have fluctuated over time, and the factors behind this are often outside of their control.

32

Where is the food consumed in the UK produced and who are our key agricultural product trading partners?

Of the food we can produce in the UK, how much do we produce and what do we produce the most of?

The UK’s food production to supply ratio, an indicator of the ability of UK agriculture to meet domestic consumer demands, stood at 75% for indigenous foods in 2017.

33

What are the origins of food eaten in the UK?

In 2017, half of all food (50%) consumed in the UK was of UK origin, with the majority of the rest of food consumed (30%) of EU origin.

34

What agricultural food products do we import and export most of?

In 2018, we imported more agricultural or lightly-processed food products than we exported, with the exception of offal, milk and cream, milk powder and potatoes.

35

Where does the food we import come from?

In 2018 the UK imported £17.3billion worth of agricultural or lightly-processed food products, with the majority (£12.7billion) coming from the EU.

36

Where does the food we export go to?

In 2018 the UK exported £4.7billion worth of agricultural or lightly-processed food products, with the majority (£3.8billion) going to the EU.

37

Which countries do we trade the most (agricultural and lightly processed foods) with?

In 2018 Ireland, the Netherlands, Spain, France and Germany were the UK’s top trading partners, with a combined import total of £9.4bn and export total of £2.9bn for these 5 countries alone.

38

What are consumer habits in relation to food and how does this affect food prices?

How much of the sale price of food goes to the farmer?

In 2017, the percentage of the sale price of a standard basket of goods that went to farmers was 41%. This has varied over time and between products, depending on several factors, including global supply and demand, consumer behaviour and processor quality requirements.

39

How have food prices and the amount British households spend on food changed over time ?

While food prices have risen over time, overall average household expenditure on food and drink has fallen from 30% in the 1950s to around 11% in 2016/17, however this proportion is higher for lower income households (14%) who are disproportionately affected by food price rises.

40

How have consumer purchasing habits of some of the key agricultural products changed over time?

Purchases of fresh meat, milk and vegetables has decreased over the last 30 years, but we are buying more fruit and more meat in ready meals; this might be driven by trends in convenience and health and fluctuations in food prices.

41

Do British consumers want to buy British food?

When asked, the public say they try to buy British food and believe it is important to support British farmers, but that isn’t wholly reflected in consumer behaviour.

42

What is the current state of UK agricultural productivity?

What was England's Total Income from Farming and how did the contribution by Region vary in 2018?

In England in 2018, after deductions for wages, rent, interest and asset depreciation and taking subsidy contributions into account the total income from farming in England was £3.4bn, with the East of England contributing the most (21%) and the North East the least (2%).

44

How important is agriculture in the rural economy in England?

Agriculture is important for rural areas, especially in the rural uplands, accounting for around 15% of registered businesses and 8% of employment across all rural areas, which rises to 30% and 14% respectively in rural uplands areas.

45

In England how is the economic output distributed across the number of farms?

In England in 2017, a small number of economically large farms (8%) produced over half (57%) the agricultural output using just 33% of the total farmed land area.

46

How does average farm size vary across the English Regions?

In 2017, the average farm size in England was 87ha, however farms in the North East had the largest average farm size of 153ha and farms in the West Midlands were, on average, the smallest at 64ha.

47

How does the output from agricultural production vary across England?

Livestock is the principal output in the West of England, with dairy having the highest value. Crops are generally more prevalent in the East, however pigs and poultry also have high output values.

48

What is the structure and demographics of the agriculture industry in England?

How are farm types classified in England?

Across England, many farms undertake more than one type of farming, and so farms are classified according to their main output within one of nine main farm types.

49

How many of each farm type are there in England and how much land do they use?

In England in 2017, grazing livestock in lowland areas had the greatest number of farms (31% of total), and cereals farms used the largest amount of farmed area (32% of total).

50

In England, how many farms are owner occupied and how many are tenanted?

In England in 2017, the majority of farms (52%) are owner occupied and the North East has the greatest proportion of holdings that are wholly tenanted.

51

What are the characteristics of farmers and employees?

The majority of farm holders in England in 2016 were male (84%) and over a third were aged 65 or more. Horticulture was the most labour intensive farm type in 2017, with 7.9 workers per holding compared to 2 or fewer workers per holding for all other farm types.

52

What are the costs of production for farmers?

Around half of costs to farmers are variable, changing depending on the level of production, and the other half are fixed, of which machinery is their largest.

53

How does Farm Business Income (profit) vary across England (Part 1)?

How is Farm Business Income (profit) calculated and what was the average for all farms in England in 2015/16-2017/18?

Farm Business Income (FBI) is a measure of net profit, calculated as Farm Business Outputs (revenue) minus Farm Business Inputs (costs). Between 2015/16 and 2017/18 the average profit for all farms was £43,400, with Direct Payments equivalent to the largest share of this (58%).

54

How does profit vary across the different farm types in England?

Profit (Farm Business Income) varies across the different farm types, and over the period 2015/16 to 2017/18 poultry farms were most profitable and grazing livestock and mixed farms the least.

55

How does profit vary according to different farm size in England?

Profit varies by farm size, and over the period 2015/16 to 2017/18 part time and small farms were more reliant on Direct Payments and very large farms the least.

56

How does profit vary by tenure type?

Over the period 2015/16 to 2017/18 Mixed – mainly tenanted farms had the highest farm business income (£63,700) and Tenanted farms the lowest (£28,400).

57

How does profit vary by region?

Farm Business Income (FBI) varies across the different regions of England, and on average over the period 2015/16 to 2017/18 the East of England had the highest FBI (£62,000) and the South West the least (£34,400).

58

How does profit vary between the Uplands and Lowlands?

On average, over the period 2015/16 to 2017/18, grazing livestock farms in Severely Disadvantaged areas (SDA) made a greater loss from farming activities, but overall Farm Business income (FBI) was higher than grazing livestock farms overall due to greater income from Direct Payments and agri-environment schemes.

59

How does Farm Business Income (profit) vary across England (Part 2)?

What are the most profitable farm business types?

Between 2015/16 and 2017/18, 14% of all farms made a profit of more than £75k, with Dairy and Poultry having the greatest proportion of farms in this group and pig, mixed and grazing livestock farms more likely to make a loss.

60

How does agriculture contribute to farm business profit in England?

In 2015/16 to 2017/18, only the top 25% of farms made a profit from agriculture (£50,600). The bottom 25% of farms made a loss of £32,000 from agriculture, and overall made a loss of £9,600. The middle 50% of farms made losses on agriculture, but made a profit overall due to agri-environment, diversification and Direct Payments.

61

What factors are contributing to some farmers in England continuing to farm while making a loss?

Income from agriculture can be volatile, as farm businesses are price-takers and the determinants of the prices they receive can be out of their control. Income from Direct Payments, agri-environment schemes and diversification tends to be more stable.

62

How much income do farmers generate from providing non-agricultural products using their farm resources?

In 2017/18, 2/3rds of farms used farm resources to deliver non-agricultural activities, generating around £680million additional profit (£18,700 average per farm).

63

What factors are contributing to some farmers in England continuing to farm while making a loss?

Many farmers put the farming lifestyle as being more important to them than maximising profits. Many farms are also asset rich, with owner occupied farms averaging a net worth of £1.9m.

64

What is the impact of removing Direct Payments?

What are Direct Payments and how much do farm businesses currently receive?

Direct Payments are an EU Subsidy paid to farm businesses based on the amount of agricultural land they maintain. In England in 2017, £1.775bn of payments were made across 85,000 farms and 10% of claimants received half of this total. 33% of farms received less than £5,000 each.

65

What is the rationale for removing Direct Payments?

Evidence suggests that Direct Payments offer poor value for money and inhibit the development of a productive and competitive agricultural sector that delivers optimal environmental outcomes. From 2021, Direct Payments will be phased out during a 7 year agricultural transition.

66

How have inflated farm rents impacted competition and how might the removal of Direct Payments change this?

There is evidence that Direct Payments inflate farm rents. 37% of the farmed area in England is rented and for those that rent all or part of their farm, any fall in rent would help to offset any reduction in Direct Payments.

67

How does the contribution of Direct Payments to revenue vary by sector?

On average, over the period 2015/16 - 2017/18, Direct Payments made up 10% of revenue across all farm types. The importance of Direct Payments to revenue varies by sector, such as for Less Favoured Area Grazing Livestock farms, where they made up an average of 23% of total revenue.

68

How does the contribution Direct Payments make to farm profit vary depending on farm type?

Over the period 2015/16 to 2017/18, 14% of farms had costs exceeding their revenue including Direct Payments, and with Direct Payments excluded from accounts this rises to 38%. Mixed and LFA Grazing Livestock have the greatest additional proportion of farms with negative FBI with Direct Payments removed, with Pigs & Poultry and Dairy the least.

69

What is the impact of removing Direct payments?

How profitable are farms without Direct Payments?

On average, with Direct Payments excluded from their accounts, over the period 2015/16 to 2017/18, for every £100 spent farm businesses made £107, meaning a profit of £7 per £100 inputs.

70

How much would different farm types need to reduce costs by in order to break even without Direct Payments?

Loss making Grazing Livestock in Less Favoured Area farms have the biggest challenge in reducing costs to break even. Half of these farms require cost reductions of less than 15% and half require cost reductions of more than 15%, based on the period 2015/16 to 2017/18.

71

How much would loss making farms need to reduce costs by in order to break even without Direct Payments?

On average, farms who would have made a loss without Direct Payments in their accounts had £89 in outputs for every £100 they spent on inputs. In order for them to break even without Direct Payments they would need to reduce their costs by 11% to £89 to match their output, or increase output as well as reducing costs.

72

How do farmers/farm businesses feel about the agricultural transition and the future of farming?

During 45 farmer-led discussion groups undertaken by Defra over the last 18 months farmers demonstrated they are keen to help shape the future of farming. Most recognised the need for change and identified both opportunities and risks.

73

What is the current state of economic performance of farm businesses in England?

How does economic performance vary between the highest and lowest performing farms in England?

Across all farms types in England in 2017/18, the average performance of the top 25% of farms was 1.8 times better than the bottom 25%. The largest gap was among horticulture and grazing livestock farms, and smallest within poultry and dairy.

75

How does the economic size of a farm affect its performance in England?

In England in 2017/18, the highest performing 25% farms have a similar level of performance regardless of farm size. However, the gap between the top and bottom 25% is greater for smaller farms.

76

How has economic performance of all farm businesses changed between 2009/10 and 2017/18?

Average performance has changed little since 2009/10 for the business as a whole. The difference between the top 25% and bottom 25% has grown very slightly.

77

Why does agricultural performance vary so widely and how can lower performing farms improve performance?

Differences achieved in input and outputs values is one reason for differences in farm performance. As a result of differences in input and output values achieved, for every £100 spent by Lowland Grazing Livestock farm, those in the top 20% made on average £165 compared to £87 for farms in the bottom 20%.

78

What are the routes to improving farm performance?

Routes to improving farm performance include reducing inputs, such as by feed efficiency or nutrient management, maximising the value of outputs by improving animal and plant health or the marketability of outputs, or alternative routes such as diversification.

79

How can farm business economic performance be improved?

How can better input management help to reduce variable costs?

Crop and livestock inputs represent 84% of variable costs to farms. Costs can be reduced by practices such as improving feed efficiency, selective breeding of animals and/or following a detailed crop nutrient management plan developed with a qualified advisor.

80

How can controlling livestock disease improve farm economic performance?

Controlling livestock diseases can help reduce inputs costs, such as veterinary medicines, and allows farmers to maximise outputs. Annual cost estimates due to sheep scab, bovine diarrhoea and porcine reproductive respiratory syndrome alone amount to around £90 million.

81

Why is it important to protect plants from pests and diseases?

The economic, social and environmental value of crops, forests and horticulture is estimated to be around £9.4bn per year in 2017. Targeted and proportionate prevention and control of invertebrate pests and fungal diseases reduces reliance on agrochemical inputs.

82

How can farms maximise their outputs?

Farms can maximise their outputs by responding to the market, such as by ensuring their outputs conform to processor safety requirements and quality specifications, therefore reducing wastage and increase prices achieved.

83

How can diversification help to increase farm profitability?

Between 2015/16 to 2017/18, half of farms (54%) in the bottom 10% by profitability undertook a diversified activity, compared with three quarters (77%) in the top 10%. Of those farms that had a diversified activity, the bottom 10% made, on average, £31/ha, compared with £137/ha for farms in the top 10%.

84

What is the current state of UK agricultural productivity?

What is productivity and how has UK agricultural productivity changed over time?

Productivity is a measure of the efficiency that businesses turn inputs into outputs, indicating the economic competitiveness of a sector. Total factor productivity in agriculture has increased by 53% since 1973 (1% per year), due to a 36% increase in outputs and a 12% decrease in inputs.

86

How does agricultural productivity compare to other sectors in the UK economy?

In 2018, the agriculture sector had an average labour productivity of £15 output per hour, the lowest figure of all sectors and £20 less per hour than the average for the whole economy (£36).

87

How does UK agricultural productivity compare with international competitors?

International comparisons of Total Factor Productivity (TFP) show that the UK has seen smaller improvements than some competitors over the past 30 years, however due to limitations with aggregate calculations it is important to also consider comparisons on a sector level.

88

How does UK agricultural competitiveness on cost compare internationally by sector?

Although aggregate comparisons suggest lagging UK agricultural productivity growth, other data shows that certain UK sectors have costs of production that are competitive on a global scale, such as for wheat and milk production.

89

How can the drivers of productivity improve farm performance?

What drives productivity growth in the agriculture sector?

People, innovation, competitive pressures and capital are the four key drivers of productivity growth in UK agriculture, underpinned by the wider business environment including the trade regime, infrastructure and regulatory frameworks. Productivity growth must also be balanced with environmental outcomes.

90

What is innovation, how is the UK performing?

Innovation is central to productivity growth and evidence suggests there should be high returns from public support for Research and Development (R&D) for agriculture.

91

How many farmers innovate and what are their motivations?

The strong agricultural research base needs to be mirrored by uptake of innovative practices by farmers. In autumn 2018, 54% of farms had introduced a significant change to their business in the previous year. Increased productivity, lowering costs and making things easier for self and staff were the most commonly cited motivations.

92

How could improving farm business and technical skills improve productivity?

Improving farm business and technical skills can enable more efficient working and greater resilience. In England, farms with higher economic performance are more likely to undertake farm business management practices such as business planning and benchmarking.

93

How do farmers manage price risks to their business?

In 2018, 88% of farms said they positively managed price risks, however 40% indicated they didn't have all the risk management tools they needed, with the high cost of tools and insurance, a lack of knowledge and difficulty in implementation tools stated as the main reasons for this.

94

How does investment drive productivity and what barriers can stop farmers from investing?

Capital investment drives productivity improvements by enabling workers to be better able to do their jobs and produce output more efficiently. Uncertainty about the future is a key barrier to investment decisions.

95

How does competition drive productivity and what competition is there in the agriculture sector?

Competition, as measured by entry and exit rates, is much lower for agriculture than for the wider economy. Removing Direct Payments could drive productivity improvement through greater entry and exit and reallocation of resources.

96

How does agricultural R&D improve performance and deliver environmental benefits?

What agricultural R&D does Defra fund and why?

Defra research delivers evidence to underpin policy making. Our work focuses on issues that other funders are unable or unwilling to address to enhance delivery of public goods by improving the productivity, resilience and sustainability of UK agriculture.

97

How can R&D help the livestock sector become more efficient, productive and competitive?

Improvements to livestock genetics, feed efficiency and other practices can make livestock farming both more profitable and reduce negative impacts on the environment.

98

How can R&D help arable and crop sectors become more resilient?

Resistance to pests, disease and the potential impacts of climate change can be improved through breeding programmes, while exploring approaches to integrated pest management helps reduce reliance on agrochemical inputs.

99

How do we support farmers and land managers to make informed decisions?

Defra funded R&D has developed a range of tools to understand, model and compare the full impact of different agricultural production methods, including the economic, environmental and social costs.

100

How can R&D help farming systems balance farm sustainability with productivity?

Improvements in the understanding of sustainable intensification (SI) help increase farm productivity whilst enhancing the environment, economy and society.

101

What is the environmental opportunity of agriculture?

What is the environmental opportunity of agriculture?

A number of public goods arise from a well-managed landscape, including recreational and environmental benefits.

103

What is the environmental opportunity of agriculture in relation to maintaining landscapes?

Farming is important to the maintenance of our diverse and distinctive landscapes, including the historic environment and archaeological features.

104

What is the environmental opportunity of agriculture in relation to flood risk?

There are many land management practices that can reduce flood risk as well as provide wider environmental outcomes.

105

What is the environmental opportunity of forests/woodland?

Forests and woodlands provide economic, environmental and social benefits, including £1.2bn worth of carbon sequestration and £1.3bn worth of recreation and landscape benefits.

106

What is the environmental and public goods opportunity of improving animal welfare?

The public values high animal welfare standards and wants government to support farmers to improve animal welfare. 78% of UK consumers said it is ‘very important’ to protect the welfare of farmed animals.

107

What is the environmental challenge of agriculture?

What is the environmental and public goods challenge of poor animal welfare?

As well as being detrimental to the welfare of animals on the farm, livestock diseases can impact on wildlife and human health and is detrimental to the environment, due to factors such as higher greenhouse gas emissions from diarrhoea.

108

What is the environmental challenge of agriculture in relation to water quality?

Water quality can be adversely affected by farming through run-off of fertilisers, pesticides and slurry and through erosion of soil, which is washed off farmland.

109

What is the environmental challenge of agriculture in relation to soil health?

Soil is an essential natural resource, with poor management causing erosion, compaction, and depletion of nutrients, organic matter and biodiversity.

110

What is the environmental challenge of agriculture in relation to biodiversity?

Farming practices can have many impacts that can lead to a reduction in wildlife biodiversity (including loss of habitats and food sources). The UK farmland bird index, an indicator of the state of wildlife generally, has fallen to less than half its 1970 value.

111

What is the environmental challenge of agriculture in relation to greenhouse gas emissions?

Agriculture is responsible for 10% of the UK's greenhouse gas emissions, mainly through emissions of methane and nitrous oxide from grazing livestock and fertilisers.

112

What is the environmental challenge of agriculture in relation to ammonia emissions?

Agriculture is responsible for 87% of UK emissions of ammonia in 2017, mainly from livestock farming and fertiliser use.

113

What impacts have environmental stewardship schemes had to date in England?

What recent environmental stewardship schemes have there been in England?

Countryside Stewardship is open to all farmers and land managers and allows them to select from a range of options that can be tailored to different farm types and desired outcomes.

114

What positive impacts have environmental stewardship schemes had to date in England?

Environmental stewardship schemes have been beneficial to habitats and species, landscape character and water quality, with at least £3.20 of public goods returned for every £1 put in.

115

What issues have there been with environmental stewardship schemes in England?

Environmental stewardship schemes have had a number of issues impacting on environmental outcomes delivered, related to the coverage of schemes and management options, the effectiveness of management options and the effectiveness of schemes.

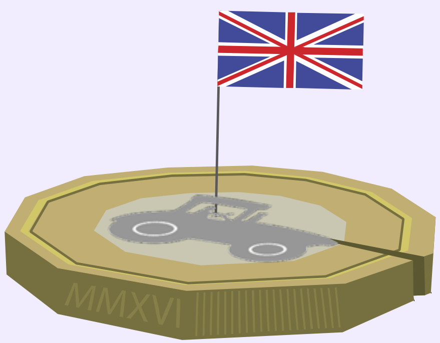
116

How will a new Environmental Land Management scheme contribute to the delivery of key environmental public goods?

The Environmental Land Management scheme (ELM) will contribute to the delivery of the six key environmental public goods set out in the 25 Year Environment Plan by encouraging positive farming practices.

117

UK Agriculture Industry Overview



Economics

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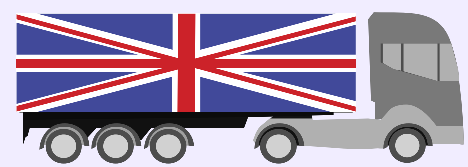
Structure and Demographics

P27-30

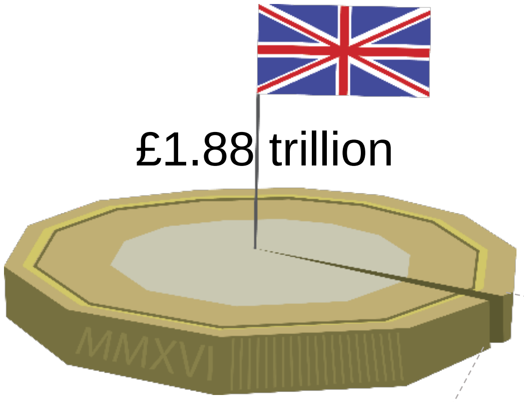


Food Production and Trade

P31-41

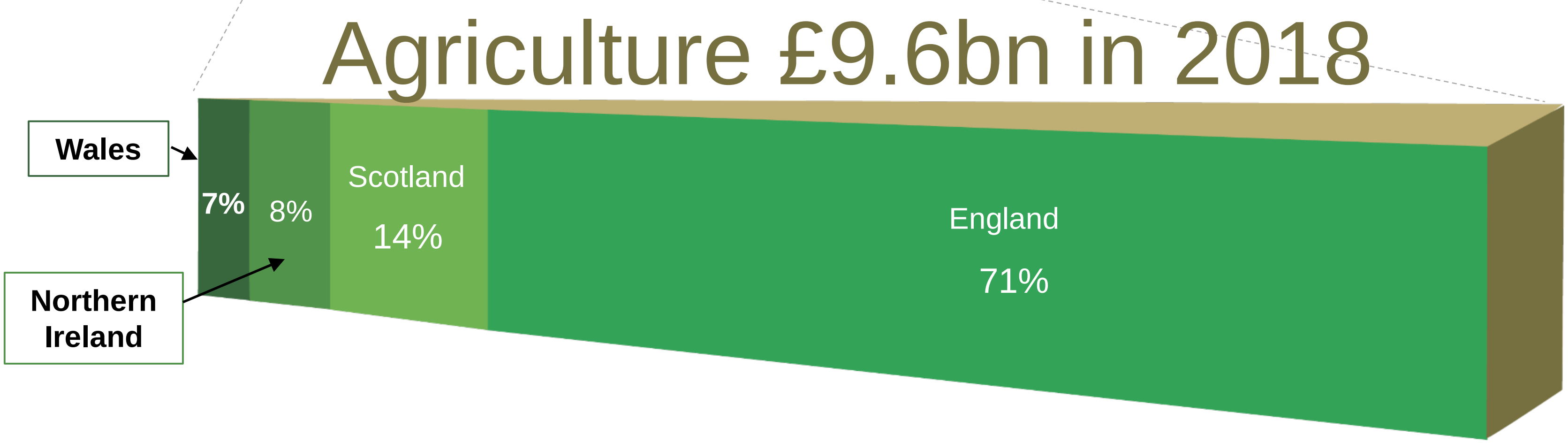
How much does agriculture contribute to the UK economy?

In 2018, agriculture contributed £9.6bn (0.5%) of the total net UK economy. England provided 71% of this value, Wales contributed 7%, Scotland 14% and Northern Ireland 8%.



The total net UK economy was worth a total of £1.88trillion in 2018, of which agriculture contributed 0.5% (£9.6bn). The amount that agriculture contributes to the UK economy has varied little over time.

In 2018, as in previous years, England contributed the largest share (71%).

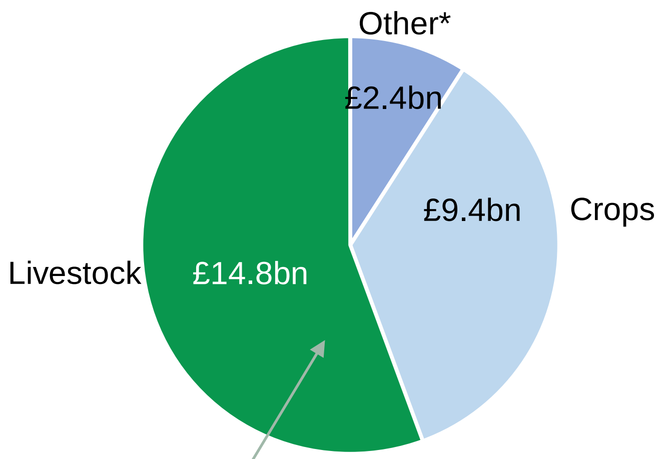


What overall value of goods and services did agriculture produce and consume in 2018?

In 2018, agriculture generated £26.7bn worth of produce while consuming £17.1bn worth of goods and services, giving a net contribution to the UK economy of £9.6bn.

£26.7bn

Total economic activity in the **production** of new agricultural goods and services

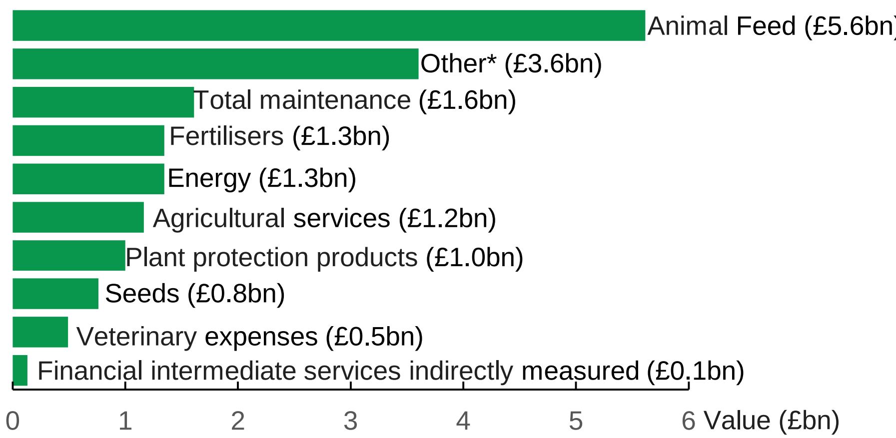


*Other includes inseparable non-agricultural activities

57% of livestock output is in the form of meat, 30% through milk, 8% through acquiring farming stock and 4% through eggs.

£17.1bn

Intermediate **consumption** of goods and services to produce agricultural output



*Other includes water costs, insurance, bank charges and other farming costs

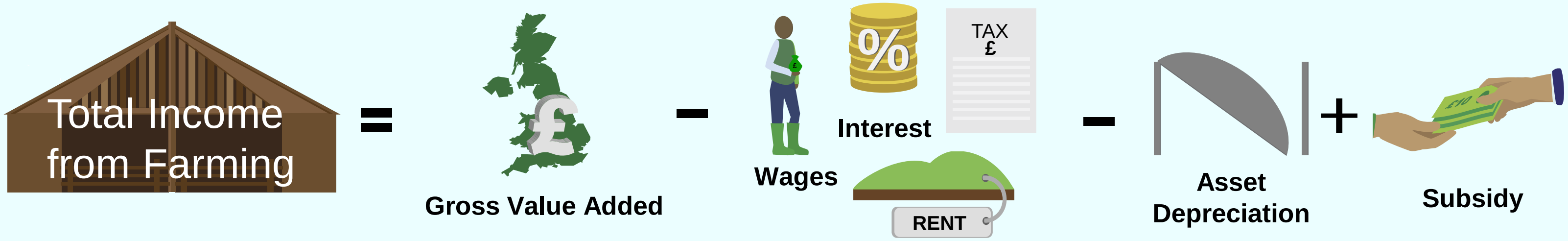
Producing agricultural products generates a demand for goods and services from other industries in the wider economy.

Gross Output (£26.7bn) less Intermediate Consumption (£17.1bn) = Gross Value Added (£9.6bn)

What is the total income (profit) from farming in the UK?

In the UK in 2018, the total profit of all farm businesses (Total Income from Farming) was £4.7bn. This is the gross value added (£9.6bn) minus depreciation of farm assets (£4.3bn), payment of wages, rent, interest and taxes (£3.8bn) and addition of farm subsidies (£3.3bn).

How is Total Income from Farming calculated?



In 2018 these values were:

Wages, rent, interest & taxation
Total value: £3.8bn

Breakdown by type:

Wages (including pensions)	£2.7bn
Rent	£0.6bn
Interest	£0.4bn
Taxes on production	£0.1bn

Asset Depreciation
Total value: £4.3bn

Breakdown by type:

Equipment	£2.0bn
Livestock[a]	£1.3bn
Buildings	£1.0bn

[a] includes those held for draft, breeding, or dairy purposes

Subsidies on production[b]
Total value: £3.3bn

Breakdown by type:

Scheme	£bn
Basic Payment Scheme	£2.75
Agri-environment payments	£0.44
Less favoured areas support scheme	£0.07
Animal disease compensation	£0.02

[b] "Subsidies on production" comes from the breakdown of UK agricultural accounts, and does not reflect the nature of payments, but is used here for consistency with other publications relating to Total Income from Farming; for example, agri-environmental schemes are not a subsidy and are based on income forgone.

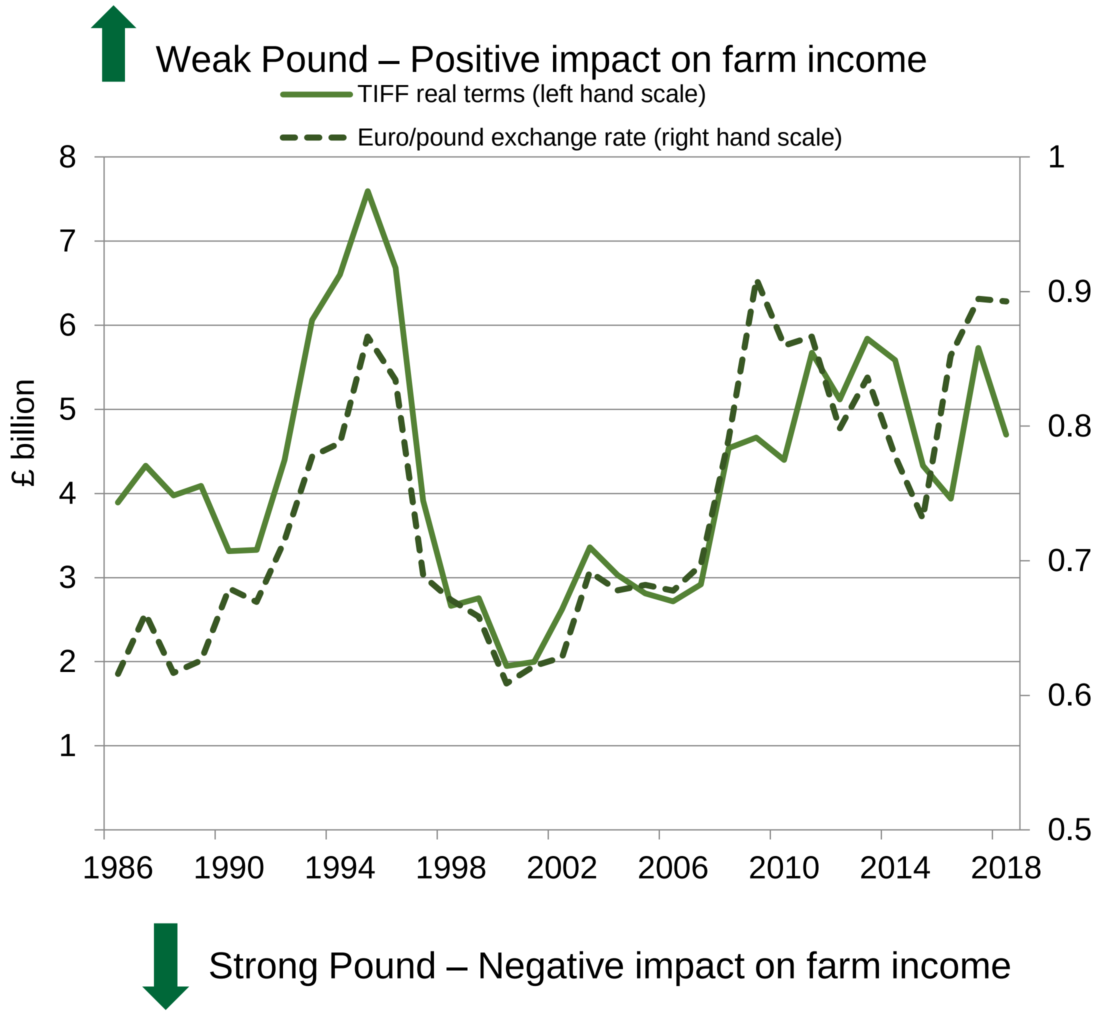
How does the total income (profit) from farming vary from year to year?

The Total Income from Farming (TIFF) (profit) can vary hugely from year to year and therefore it is important to consider more than just one year when interpreting the performance of agriculture.

Exchange Rates
Farm income is exposed to variations in exchange rates. A weak pound is generally good for farming as UK agricultural goods become more competitive on the world market and imports become more expensive and less attractive.

Direct Payments
£/€ exchange rate affects income from Direct Payments, which is calculated in Euros. A weakening of the pound against the Euro increases the value of subsidy payment paid in pounds sterling.

Volatility
Income can be quite volatile with year-on-year rises and falls of over 40% over the last 20 years.



External shocks
Many products are traded globally, and droughts or disease in other countries cause shortages in production that can influence world commodity prices, impacting on the domestic market.

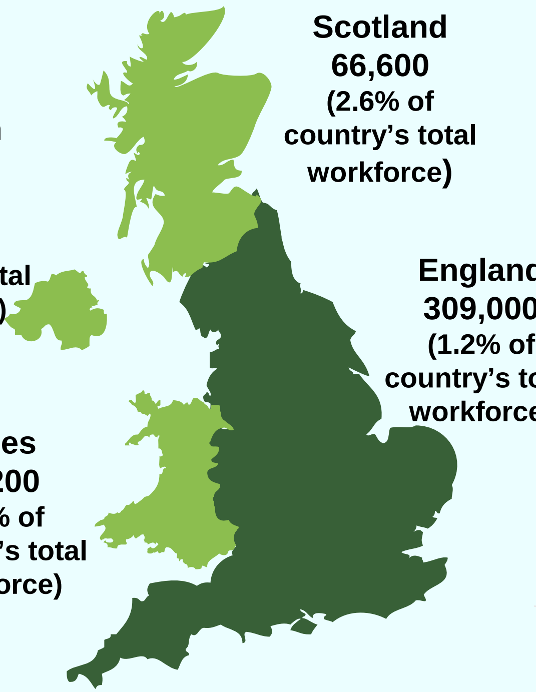
Production
Year on year, volumes of outputs remain relatively unchanged, whereas the prices farmers receive for what they produce can vary considerably, meaning incomes can rise and fall by up to 50%.

Weak Sterling
Reduces the pressure on farms to find efficiency gains which impact on growth.

How many people are employed within agriculture in the UK?

In the UK in 2018, agriculture employed almost half a million people in the UK, 1.5% of the UK workforce, who were mainly involved in business ownership or management.

477,100 people were employed in the agricultural sector in the UK in 2018.



Scotland 66,600 (2.6% of country's total workforce)

Northern Ireland 49,200 (6.1% of country's total workforce)

England 309,000 (1.2% of country's total workforce)

Wales 52,200 (3.7% of country's total workforce)

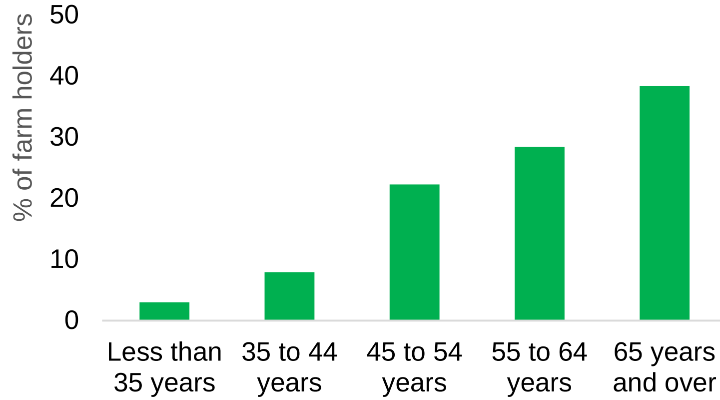
The size of the UK agricultural labour force has remained largely stable over the past decade ranging between 464,000 and 483,000 people.

In 2018, 62% of those employed in the agricultural sector in the UK were either as farmers, business partners, directors or the spouse.

All agriculture workers (477,100)

- Farmers, business partners, directors, spouses 62% (296,400)
- Regular employees, salaried managers, casual workers (180,600)

Agriculture typically has an ageing workforce. In 2016, over a third of all farm holders in the UK were over the age of 64 years. Just 3% of holders were aged less than 35 years.



85% of farm holders in the UK in 2016 were male

15% of farm holders in the UK in 2016 were female

We capture information on the age and gender of farm holders less frequently. The most up to date data available is for 2016.

How is the UK agriculture industry structured and how is agricultural land used?

The UK agriculture industry is made up of 218,000 farm holdings, using 17.4 million hectares of land (71% of the UK land total in 2018).

The Utilised Agricultural Area (UAA) includes arable and horticultural crops, uncropped arable land, land for outdoor pigs, temporary and permanent grassland and common rough grazing.

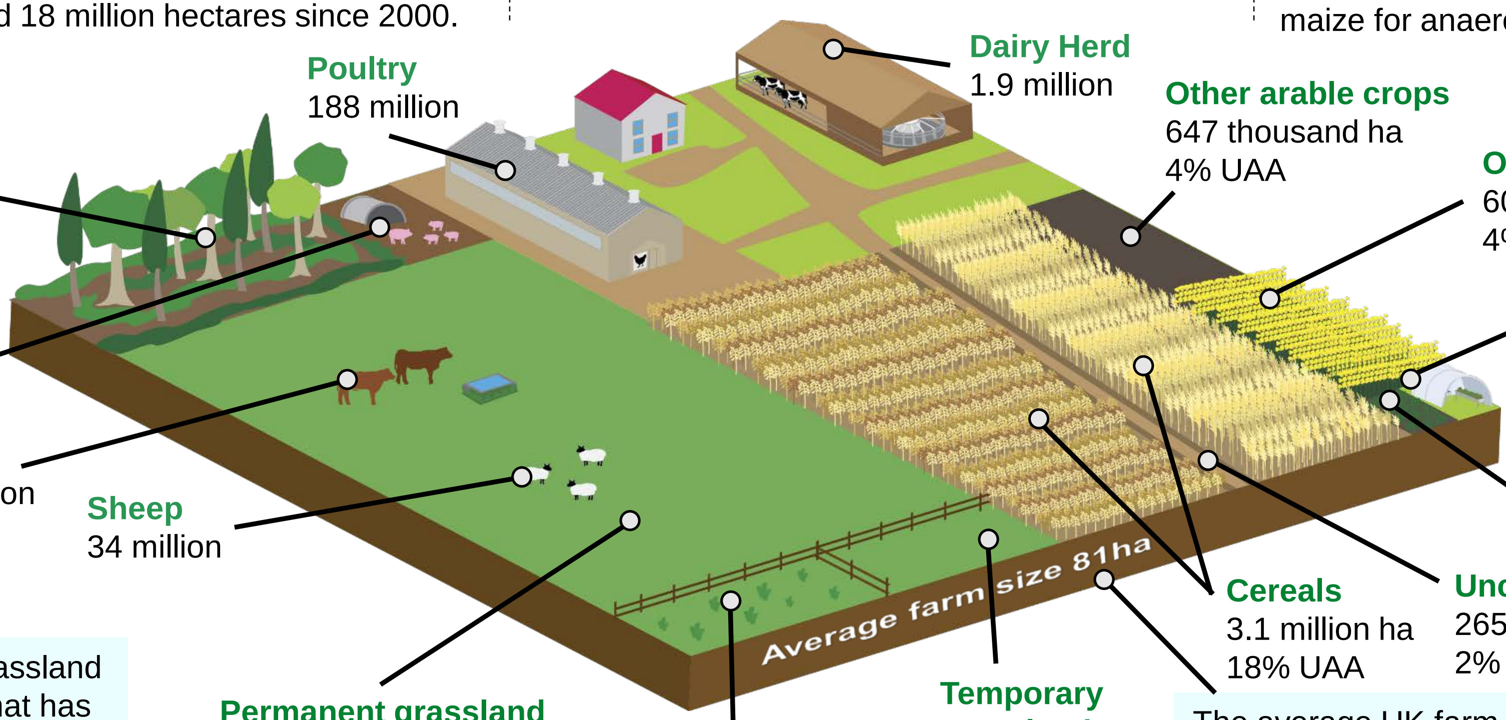
Total utilised agricultural area has remained between 17 and 18 million hectares since 2000.

Total croppable area consists of cereals, oilseed, potatoes, other arable crops, horticultural crops, uncropped arable land and temporary grass.

In 2018, the total croppable area was 6.1 million ha, or 1/3 of the UAA.

In 2017, 2% of UK arable land was used to produce bioenergy crops, an increase of around 40% since 2015.

Around 43% of this land was used to grow wheat for biofuel and 44% for maize for anaerobic digestion.



Woodlands
1.0 million hectares on farmland

Poultry
188 million

Dairy Herd
1.9 million

Other arable crops
647 thousand ha
4% UAA

Oilseeds
609 thousand ha
4% UAA

Horticulture
165 thousand ha
1% UAA

Pigs
5.0 million

Cattle
9.9 million

Sheep
34 million

Potatoes
140 thousand ha
1% UAA

Cereals
3.1 million ha
18% UAA

Uncropped arable land
265 thousand ha
2% UAA

Permanent grassland
10.1 million ha
58% UAA

Common rough grazing
1.2 million ha
7% UAA

Temporary grassland
1.2 million ha
7% UAA

Permanent grassland is grassland that has not been sown in the last 5 years.

The average UK farm size is 81 hectares. However, almost half of all farms are less than 20 hectares in size.

What are the main farming systems?

In the UK 97% of farmed area is classified as conventional and 3% is classified as organic in 2018.

Conventional

97% Total Farmed Area

The majority of land in the UK is farmed conventionally. There are two types of conventional agriculture:

Intensive Farming

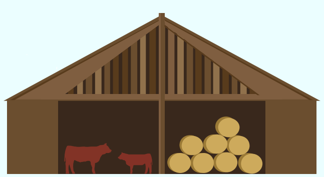
increases productivity through increasing inputs. Inputs, such as capital, labour, and chemicals are high relative to land area. Output per hectare tends to be high.

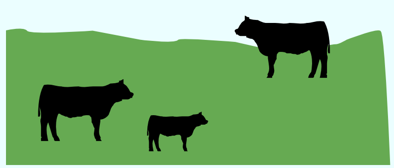
For example intensively farmed livestock may be housed indoors and fed on arable by-products.

Extensive Farming

increases productivity through farming more land. Inputs are relatively low, as is output per hectare. More land is therefore needed to produce the same amount of food as intensive farming.

For example extensively reared livestock may be kept on pasture and grass fed for most of the year.





Organic

3% Total Farmed Area

474,000 ha are farmed organically, using natural methods to control pests and disease to minimise damage to the environment and wildlife. Herbicides, synthetic pesticides and antibiotics are banned. All foods sold as organic must go through a certification process.

83%
of organically farmed land in the UK is pasture (permanent and temporary)

8%
of organically farmed land in the UK is for cereals. (37k ha)

61%
of the total UK organic area is in England

How many animals are reared organically, and what proportion of total UK livestock do they represent?

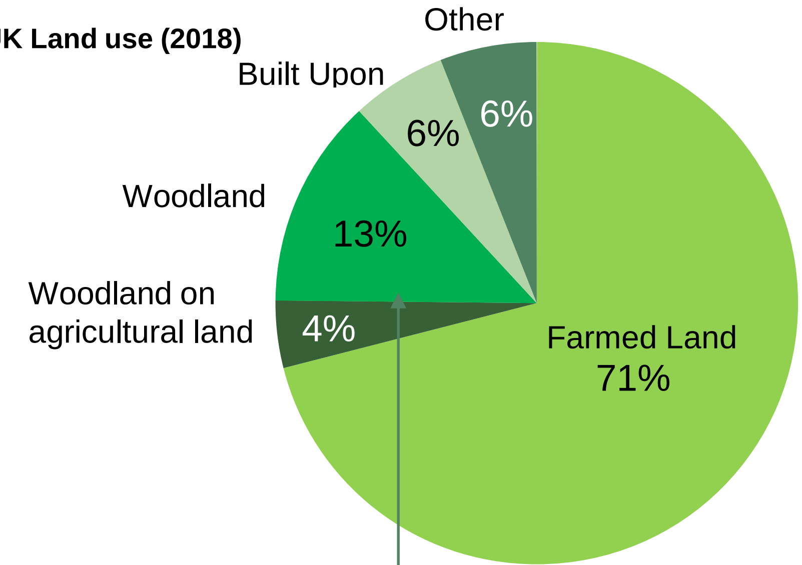
How much woodland is on agricultural land in the UK?

There are 1 million hectares of woodland on agricultural land in the UK (4% of UK land total), of which the majority is found in Scotland (52%) and England (37%).

The woodland area of the UK in 2018 was 3.17 million hectares, covering 13% of total UK land area. There are 1 million hectares of woodland on agricultural land.

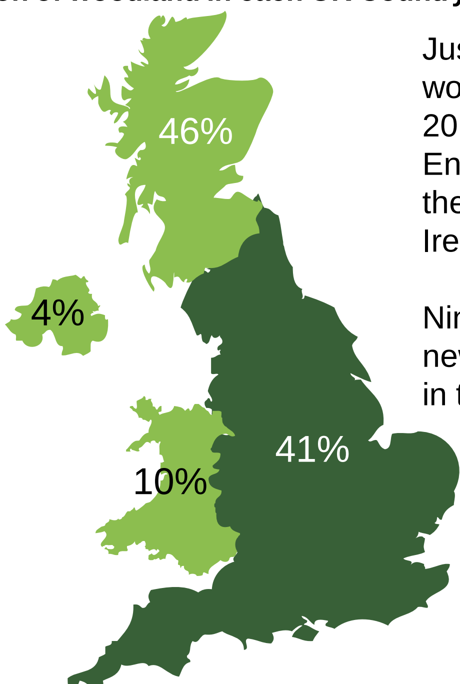
The UK woodland area has risen by around 250 thousand hectares since 1998, an increase of 9% over the period. The area of farm woodland in the UK has increased from 0.66 million hectares in 2007 to 1 million hectares in 2018.

UK Land use (2018)



Slightly over half (52%) of all farm woodland was in Scotland in 2018, with a further 37% in England, 10% in Wales and the remaining 2% in Northern Ireland.

Proportion of woodland in each UK Country



Just under a half (46%) of all woodland was in Scotland in 2018, with a further 41% in England, 10% in Wales and the remaining 4% in Northern Ireland.

Nine thousand hectares of new woodland were created in the UK in 2017-18.

How does forestry contribute to the UK economy?

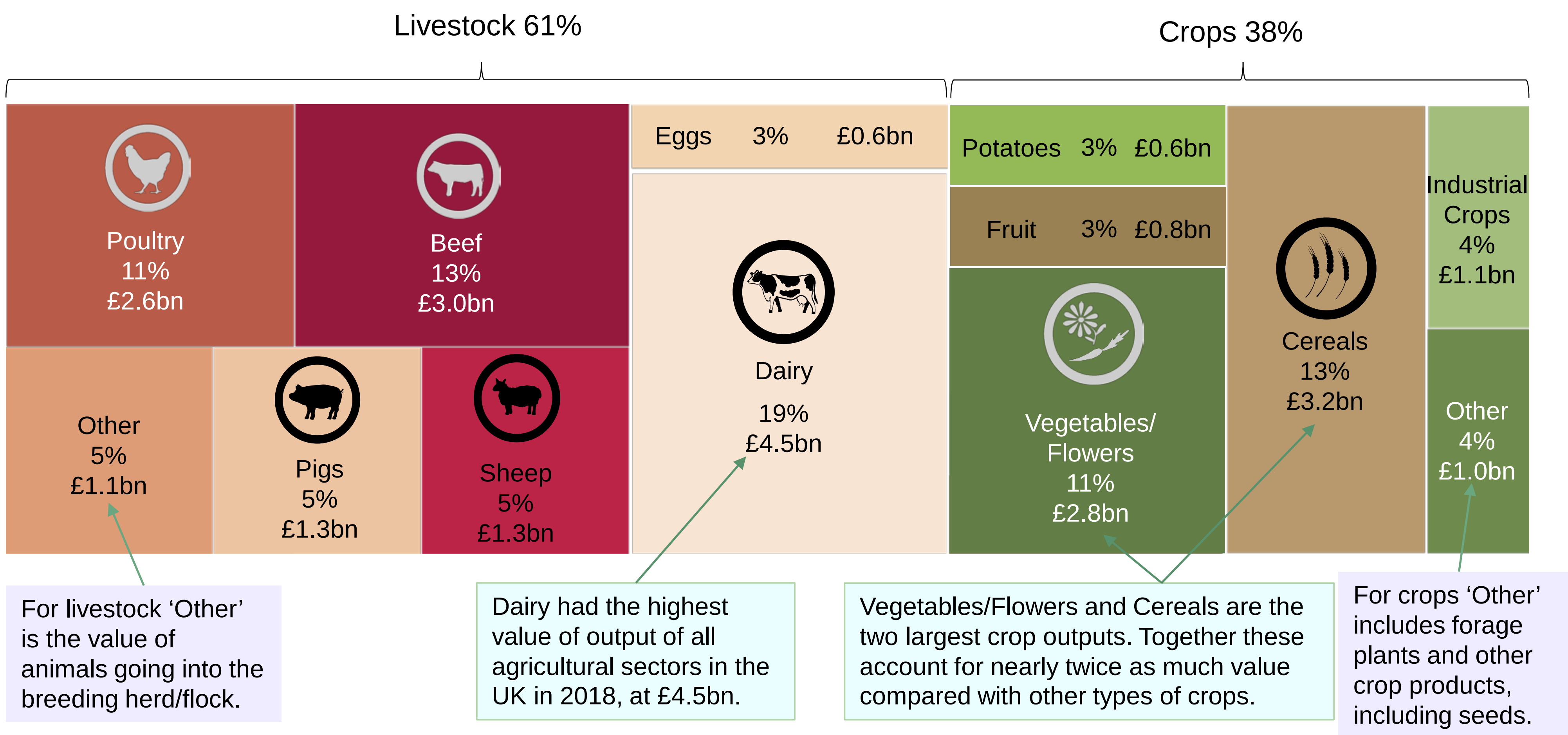
The contribution of all forestry (including woodland on agricultural land) to the UK economy was £588 million in 2016.

The industry supported 17,000 jobs in forestry and 27,000 jobs in primary wood processing in 2016.

Which products contribute most to the value of UK agricultural output?

61% of the value of the UK's agricultural production comes from livestock (£14.8bn in 2018), of which Dairy and Beef are the largest sectors.

Value of UK crop and livestock products*

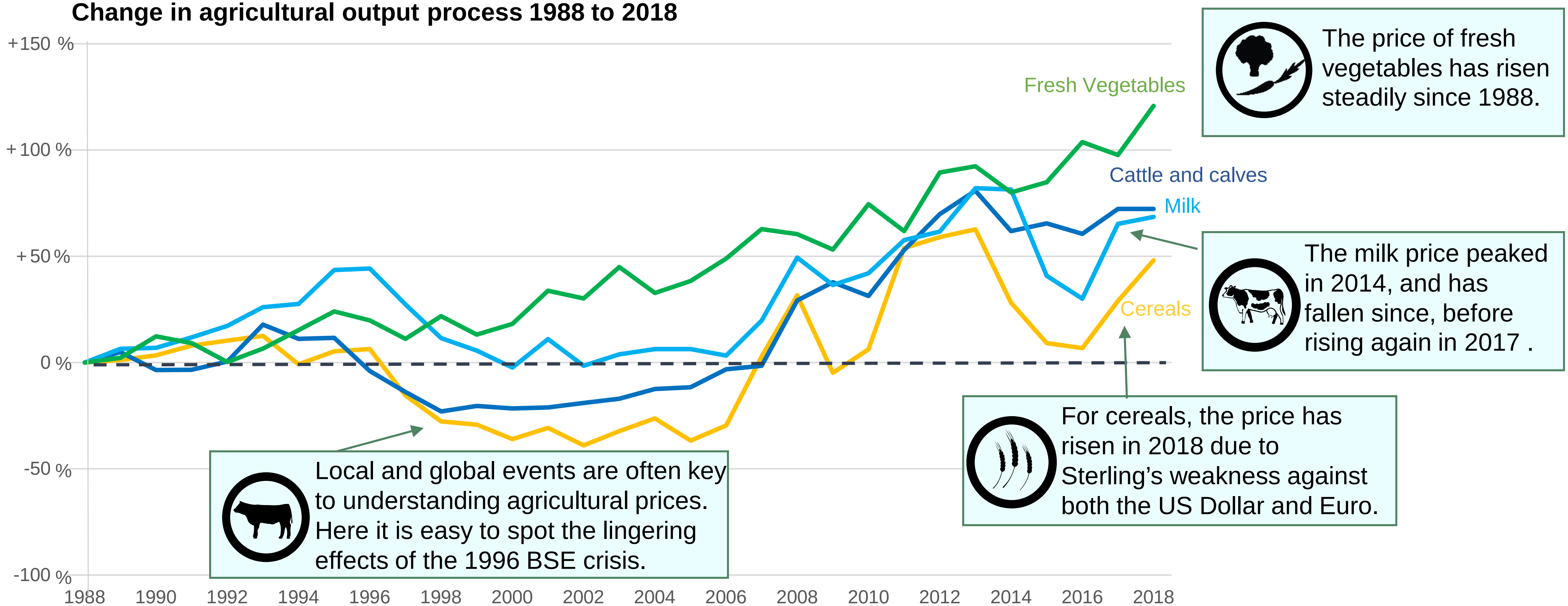


*This table shows only the main contributors to crops and livestock product value.

How have the prices received by farmers for the main UK agricultural outputs changed over time?

The prices farmers have received for their produce have fluctuated over time, and the factors behind this are often outside of their control.

Change in agricultural output process 1988 to 2018



These indices have a base year of 2015=100. Price indices measure relative price changes compared to a reference point or base year which is given a value of 100. The base year and the basket of goods used to calculate the index needs to be updated over time to reflect changing market trends, and for the Agricultural Price Index is updated every five years in accordance with the standardised methodology agreed across the EU.

Many determinants of output prices are outside the control of farmers. Increased global supply, changing consumer tastes and weather patterns are key external price determinants, particularly in heavily traded sectors like cereals (see page 26 for more detail).

Of the food we can produce in the UK, how much do we produce and what do we produce the most of?

The UK's food production to supply ratio, an indicator of the ability of UK agriculture to meet domestic consumer demands, stood at 75% for indigenous foods in 2018.

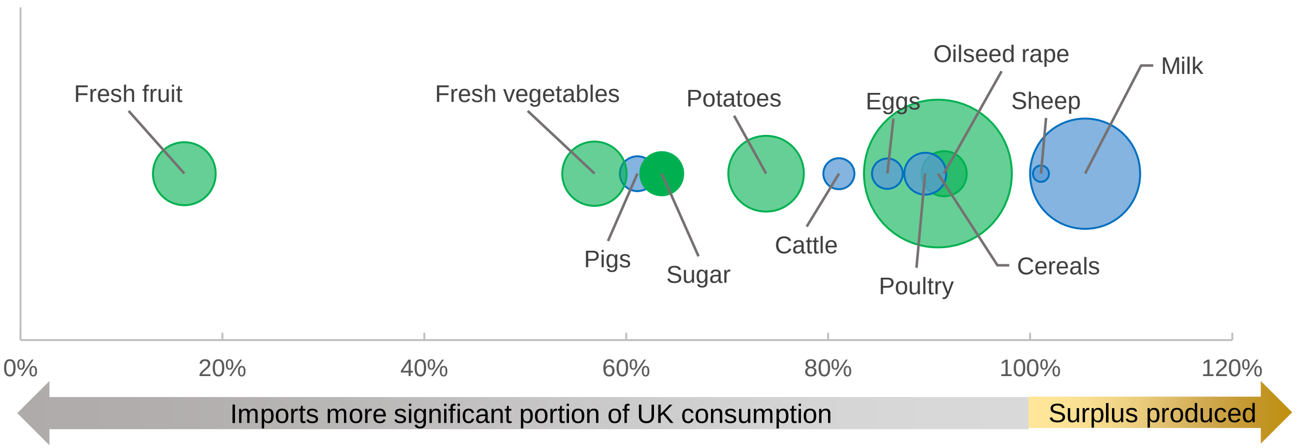
75% the Food Production to Supply Ratio of indigenous food in 2018

The Food Production to Supply Ratio provides a broad indicator of the ability of UK agriculture to meet domestic consumer demands and is calculated using the following formula:

$$\frac{\textit{Total production (including for export)}}{\textit{The total produced, plus imports, minus exports}}$$

Indigenous food excludes those foods not commercially grown in the UK, such as bananas, which could not reasonably be grown in our climate.

Historically, the UK has been a large net importer of food. To have a resilient food chain, it is advantageous to have a diverse range of food sources, including imports from a wide range of stable economies. The chart below shows some of our most important products, where circle size indicates sector size (£).



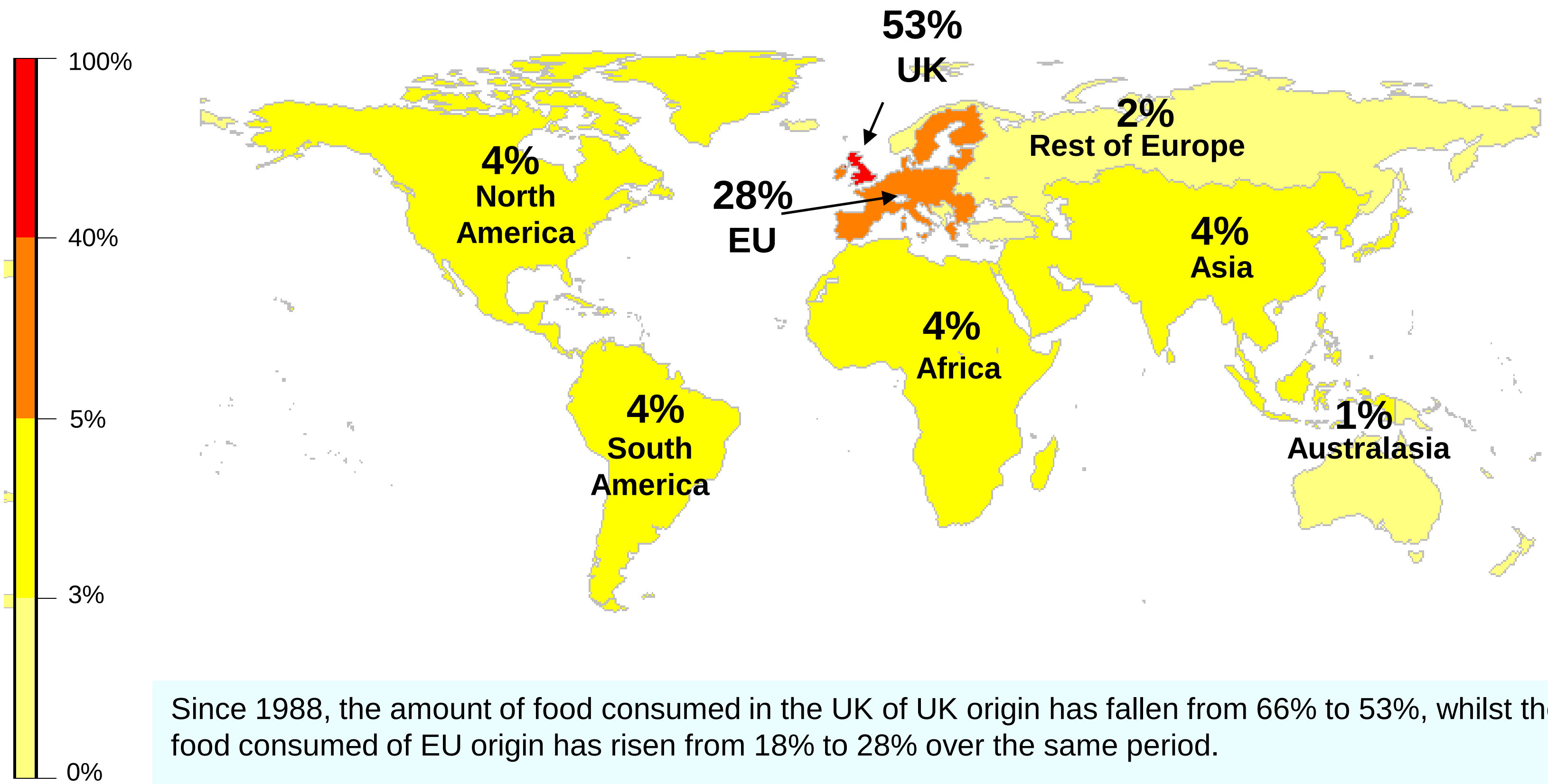
For fresh fruit, the food production to supply ratio was just 17% in 2018, highlighting the need for imports to meet domestic demand.

The food production to supply ratios of sheep and milk were 100% and 106% respectively in 2018 showing that domestic production more than met domestic consumer demand.

What are the origins of food consumed in the UK?

In 2018, half of all food (53%) consumed in the UK was of UK origin, with the majority of the rest of food consumed (28%) of EU origin.

Origins of food consumed in the United Kingdom, based on the farm-gate value of raw food.



Since 1988, the amount of food consumed in the UK of UK origin has fallen from 66% to 53%, whilst the amount of food consumed of EU origin has risen from 18% to 28% over the same period.

The amount of food consumed from each region outside the UK and EU has remained stable over time.

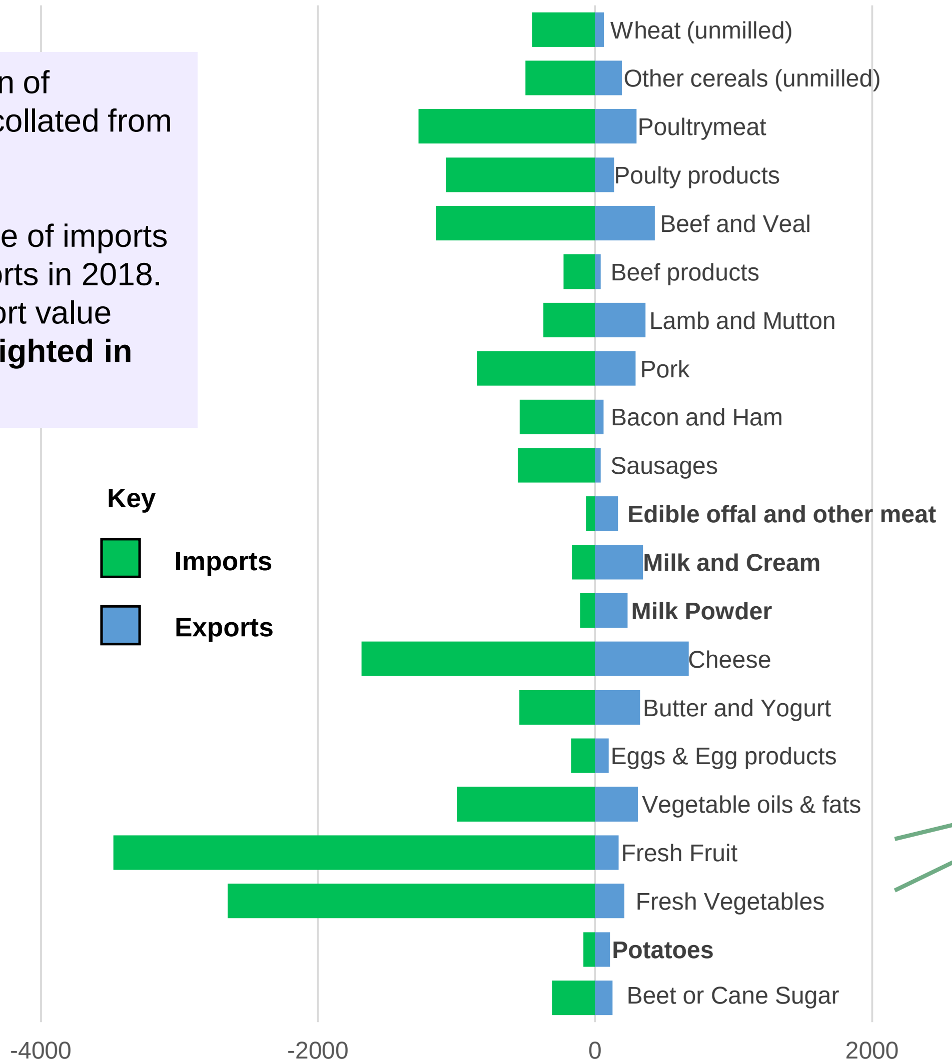
Please note: The origins of food consumed in the UK looks purely at the breakdown of food that the UK actually consumes, and should not be confused with the Food Production to Supply Ratio chart ([slide 33]).

What agricultural food products do we import and export most of?

In 2018, we imported more agricultural or lightly-processed food products than we exported, with the exception of offal, milk and cream, milk powder and potatoes.

This chart shows a selection of agricultural food products, collated from HMRC trade statistics.

For most products, the value of imports was much higher than exports in 2018. Products with a higher export value than import value are **highlighted in bold.**



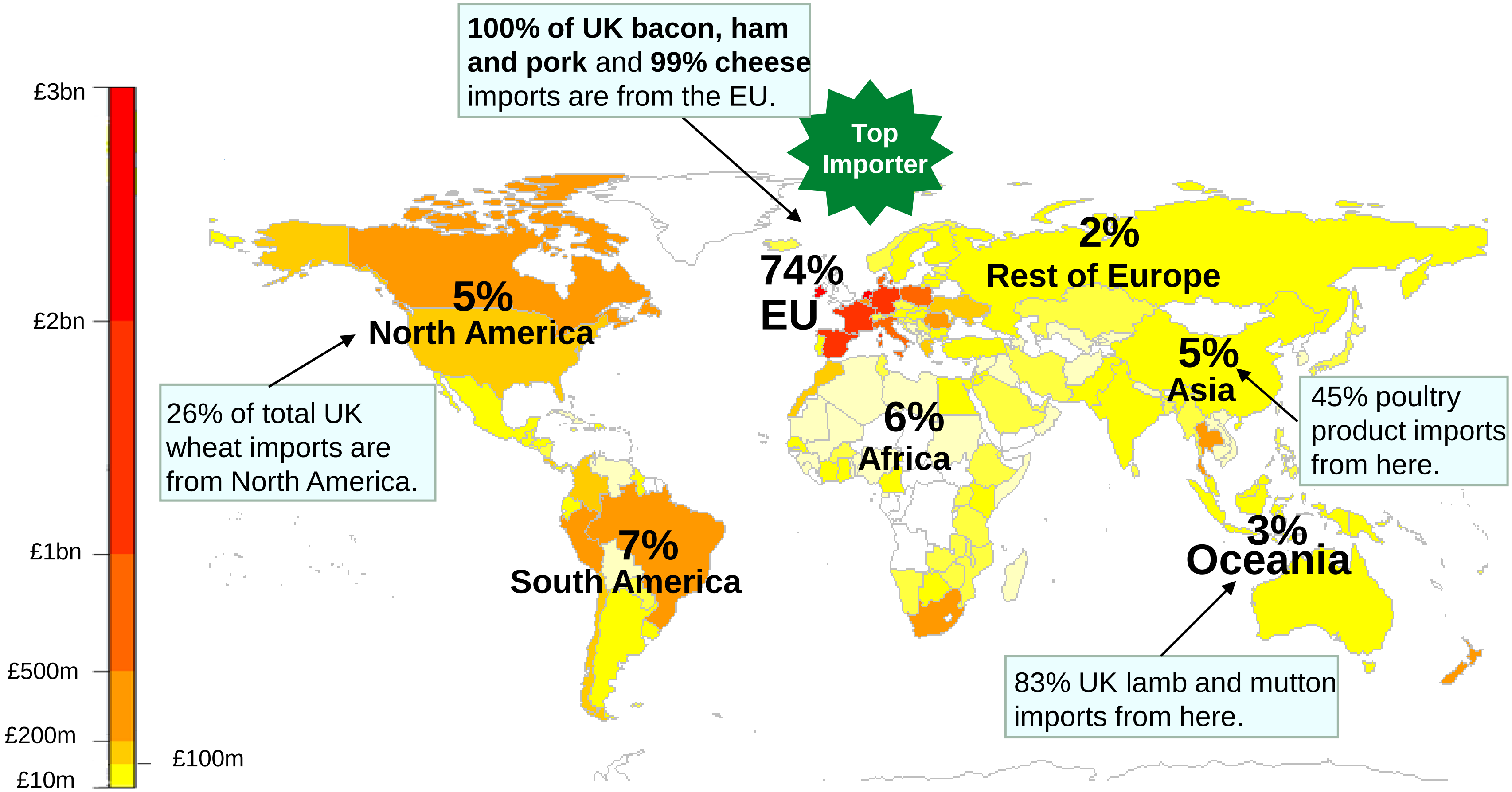
Meat & meat products
We imported more of all meats and meat products in 2018, other than edible offal and other meat (which includes goat, for example).

Fruit & vegetables
The highest value import categories were fresh fruit and fresh vegetables.

Where does the food we import come from?

In 2018, the UK imported £17.3billion worth of agricultural or lightly-processed food products, with the majority (£12.7billion) coming from the EU.

Source of imports to the United Kingdom of agricultural or lightly processed food products and the proportion imported from each region.



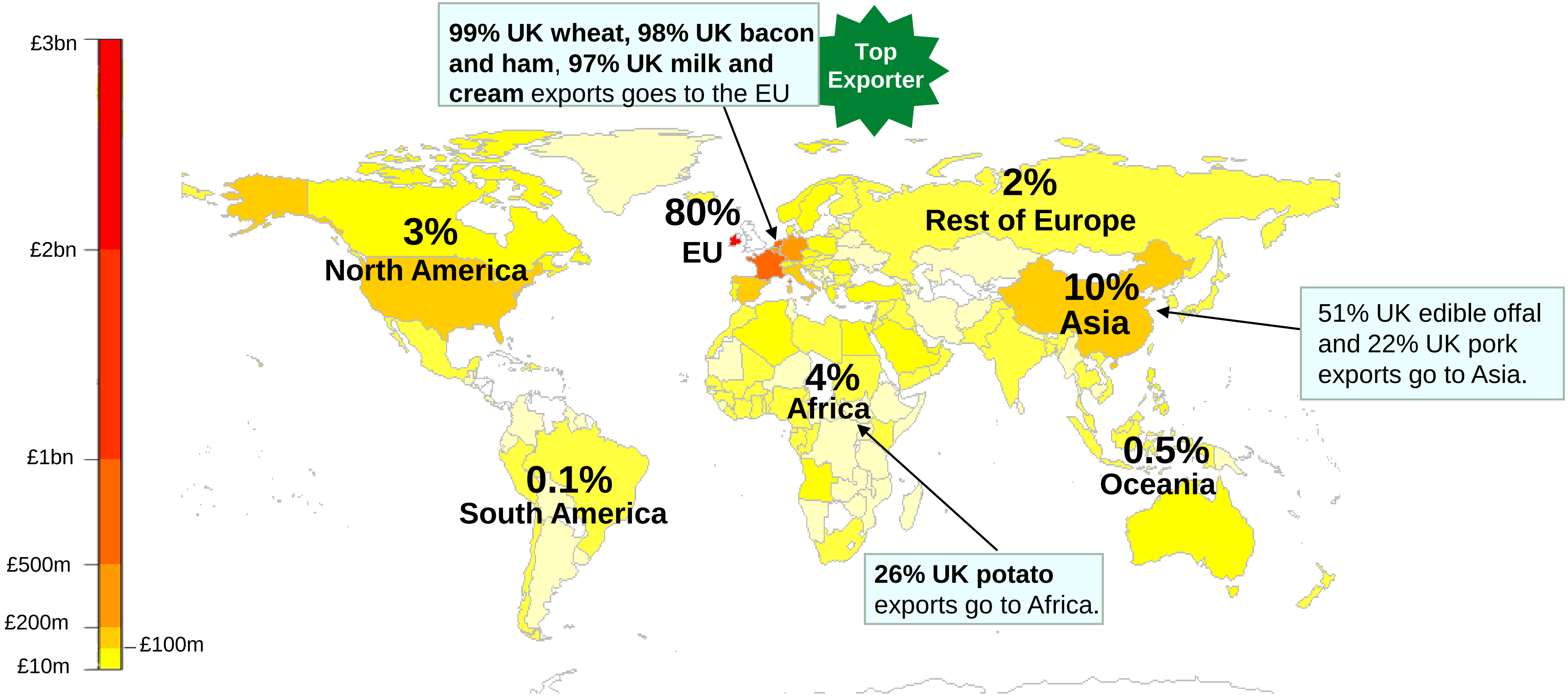
The Rotterdam Effect
The theory that trade with the Netherlands is artificially inflated by goods dispatched from Rotterdam that originated from elsewhere. For example, goods arriving into Rotterdam from China may be distributed to other countries, and potentially be recorded as an import from the Netherlands.

All figures are annual import and export totals for 2018

Where does the food we export go to?

In 2018, the UK exported £4.7billion worth of agricultural or lightly-processed food products, with the majority (£3.8billion) going to the EU.

Destination of exports of agricultural or lightly processed food products from the United Kingdom and the proportion imported into each region.



All figures are annual import and export totals for 2018

Which countries do we trade the most (agricultural and lightly processed foods) with?

In 2018, Ireland, the Netherlands, Spain, France and Germany were the UK's top trading partners, with a combined import total of £9.4bn and export total of £2.9bn for these 5 countries alone.

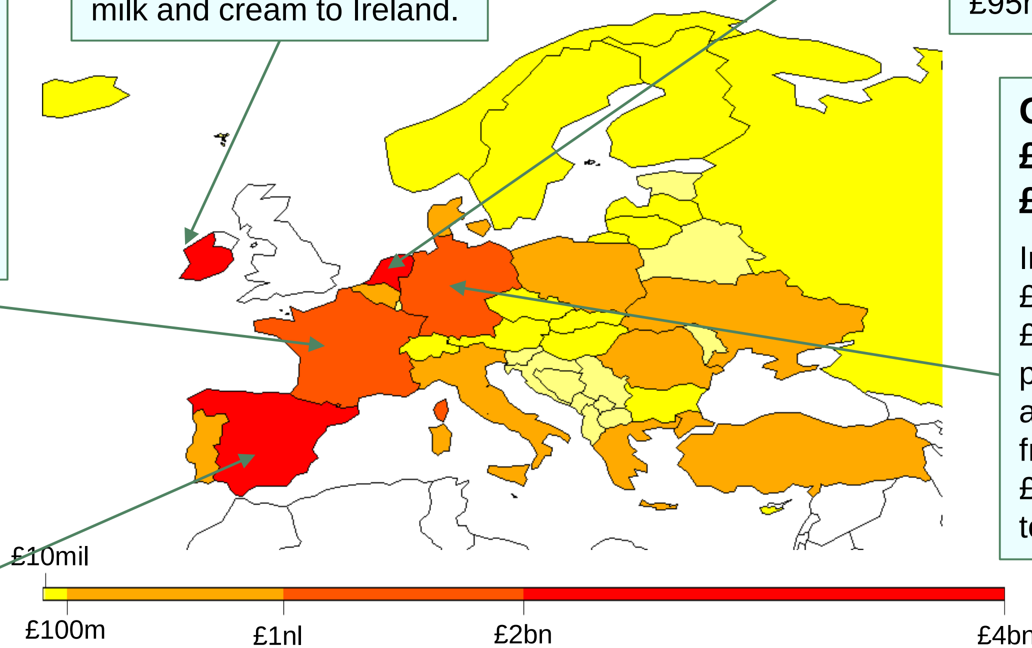
Ireland
£2.4bn total imports
£1.4bn total exports
In particular, the UK imports £820million of beef and veal from Ireland and exports £270million of milk and cream to Ireland.

No. 1 Export Partner

No. 1 Import Partner

Netherlands
£2.6bn total imports
£580m total exports
In particular, the UK imports £660million of fresh vegetables from the Netherlands, and exports £95million of beef and veal.

France
£1.3bn total imports
£520m total exports
In particular, the UK imports £250million of cheese from France and exports £160million of lamb and mutton to France.



Germany
£1.3bn total imports
£310m total exports
In particular, the UK imports £200million of Fresh fruit £200million, £190million of pork, £180million of cheese and £170million of sausages from Germany, and exports £63million of Lamb and mutton to Germany.

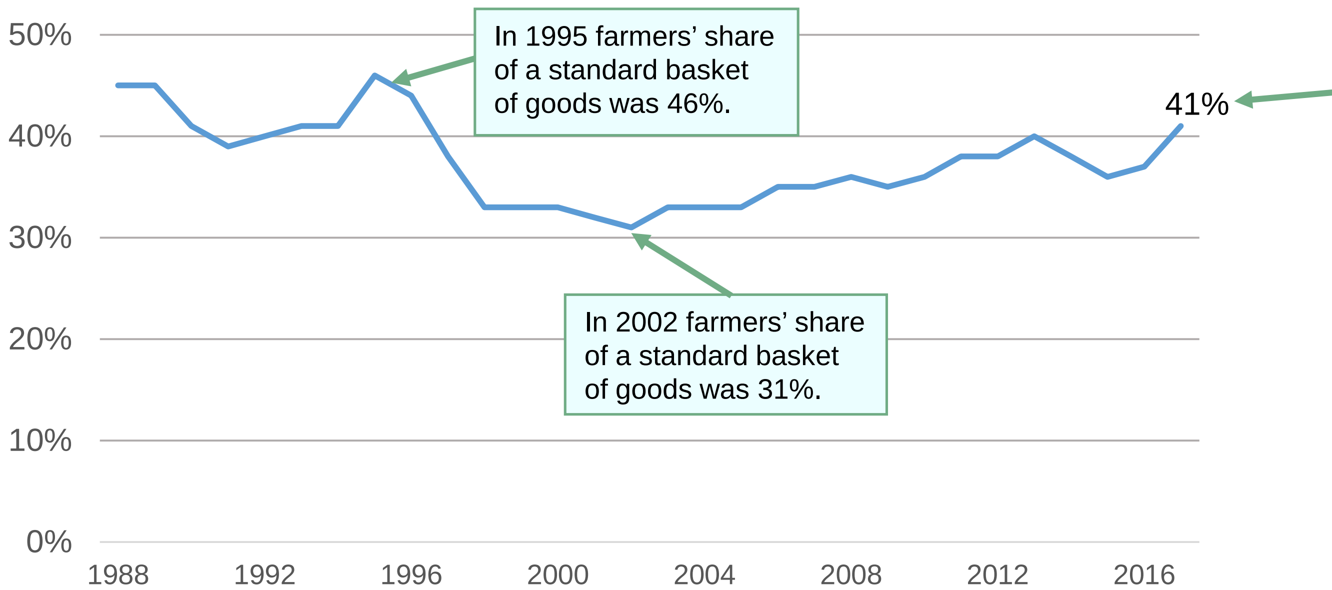
Spain
£1.8bn total imports
In particular, the UK imports £770million of fresh vegetables and £670million of fresh fruit.

All figures are annual import and export totals for 2018

How much of the sale price of food goes to the farmer?

In 2017, the percentage of the sale price of a standard basket of goods that went to farmers was 41%. This has varied over time and between products, depending on several factors, including global supply and demand, consumer behaviour and processor quality requirements.

Farmers' share of standard basket of goods (1988 to 2017)



In 2017, the percentage of the sale price of a standard basket of goods that went to farmers was 41%.

The proportion of the sale price a farmer receives varies from product to product.

For example, in 2017 an average of 51% of the sale price of both beef and lamb went to the farmer, whilst for potatoes it was only 25%.

This is because the impact of the factors discussed below and the scale and costs of production varies by product.

What factors impact the share of the sale price of food farmers receive?

Global supply & demand

Increased demand for UK products abroad can cause the price farmers receive to rise. If other countries start selling lots of the product in demand, then global prices will fall.

Consumer behaviour

The price that UK customers are willing to pay in the shops is shaped by their expectations, attitudes and priorities.

Processor specifications

Food manufacturers and supermarkets require raw produce to meet certain quality standards. Failure to do so will likely receive a lower price, or not being able to sell at all.

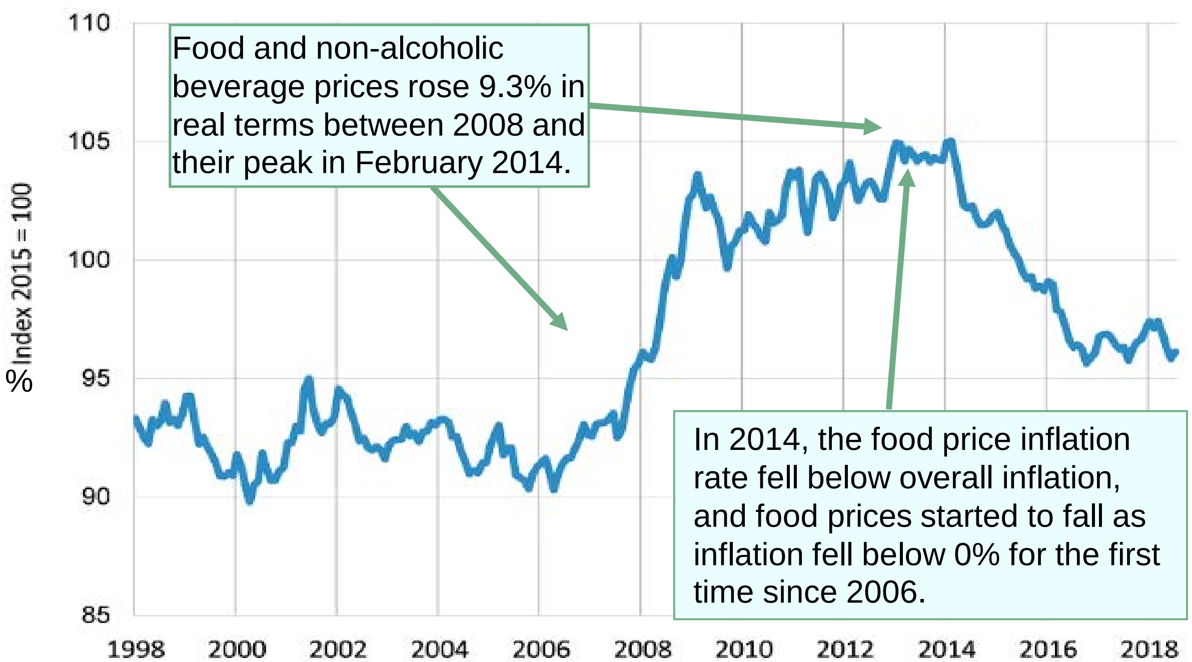
The Food Chain

Agriculture is the start of a complex food chain that determines consumer prices. These prices must also reflect product manufacturing, transport, retail and marketing costs.

How have food prices and the amount British households spend on food changed over time ?

While food prices have risen over time, overall average household expenditure on food and drink has fallen from 30% in the 1950s to around 11% in 2016/17, however this proportion is higher for lower income households (14%) who are disproportionately affected by food price rises.

UK trend in food and non-alcoholic beverage prices in real terms, January 1998 to March 2018



Successive spikes in the price of agricultural commodities since 2007 have led to higher retail food prices. They have not returned to the low price levels of pre-2007. Oil prices also rose over this period, and inflation was higher than historically, but food prices have risen above inflation.

Households can react in many ways to food price increases - they may simply spend more, or buy less of a type of product. They may also ‘trade down’ by switching to purchases of cheaper products within a food grouping.

A rise in food prices is more difficult for low income households to cope with because those on low incomes spend a greater proportion of their income on food - a rise in food prices has a disproportionately large impact on money available to spend elsewhere.

£26

average weekly UK household expenditure per person on food and non-alcoholic drinks in 2016/17 (not including eating out)

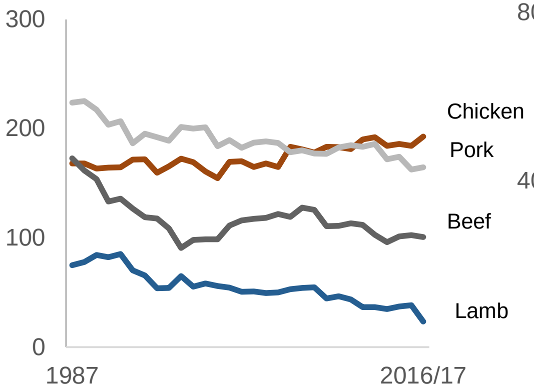
As consumers’ incomes rise they tend to spend a smaller proportion of their family budget on food and drink. While food prices have risen, the share of consumer expenditure on food has fallen from 30% in the 1950’s to around 11% in 2016/17.

Households in the lowest 20% of household income spent a greater proportion of their household expenditure on food and drink (14%) compared with other households (11%) in 2016/17.

How have consumer purchasing habits of some of the key agricultural products changed over time?

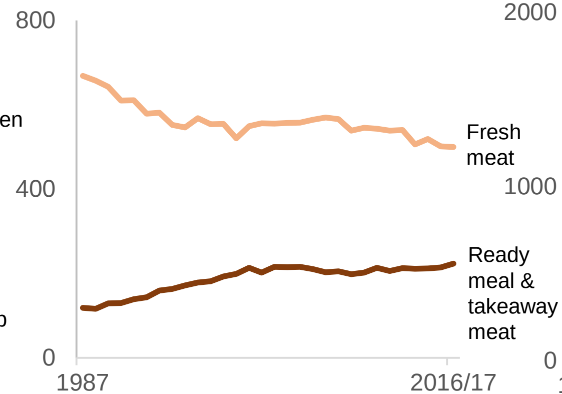
Purchases of fresh meat, milk and vegetables has decreased over the last 30 years, but we are buying more fruit and more meat in ready meals; this might be driven by trends in convenience and health and fluctuations in food prices.

Fresh Meats*
Chicken, Beef, Pork, Lamb



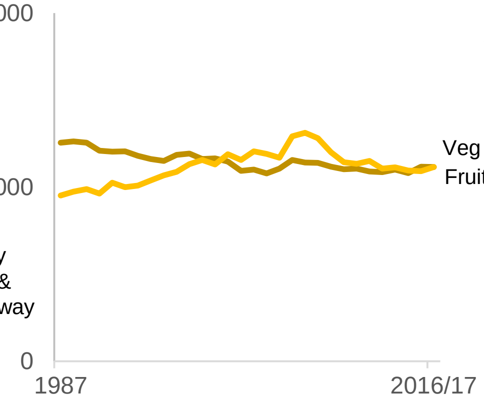
All fresh meats have declined, apart from chicken. UK households purchased 1/3 as much lamb in 2016/17 (23g) as in 1987 (75g).

Fresh & Ready Meats*
Fresh meat, Ready meals & takeaway



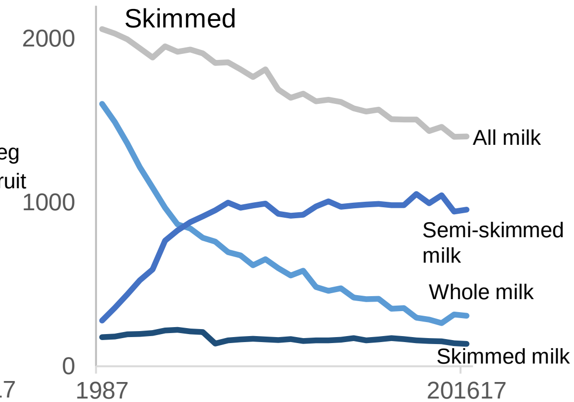
The overall decline in fresh meat is partly offset by meats in ready and takeaway meals, which has increased by 87% since 1987, to 223g.

Vegetables & Fruit*
Vegetables, Fruit



Purchases of both fruit and vegetables jumped in the early 2000s before dropping off again. Both now stand at just over 1kg per week.

Milk*
All milk, Whole, Semi-skimmed, Skimmed



Milk purchases overall have gradually decreased to just over 1400ml in 2016/17. Whilst the purchase of whole milk has been decreasing, semi-skimmed has increased.

What might be driving these changes?

Convenience

Meal preparation time has decreased from 60 minutes in 1980 to 31 minutes in 2015. This is reflected in consumers' choices of meat types and the rise of prepared meats. There has also been an increase in people dining out.

Health

The BSE crisis in 1996 is visible in meat purchases, and recent dietary advice on fats may have influenced purchases of whole milk.

Food Prices Fluctuations

Households can react in many ways to food price increases - they may simply spend more, or buy less of a type of product. They may also 'trade down' by switching to purchases of cheaper products within a food grouping.

*Household food only. Average quantity per person per week (g/ml). The data contain changes in recording periods, so not every year is exactly equivalent.

Do British consumers want to buy British food?

When asked, the British public say they try to buy British food and believe it is important to support British farmers, but that isn't wholly reflected in consumer behaviour.

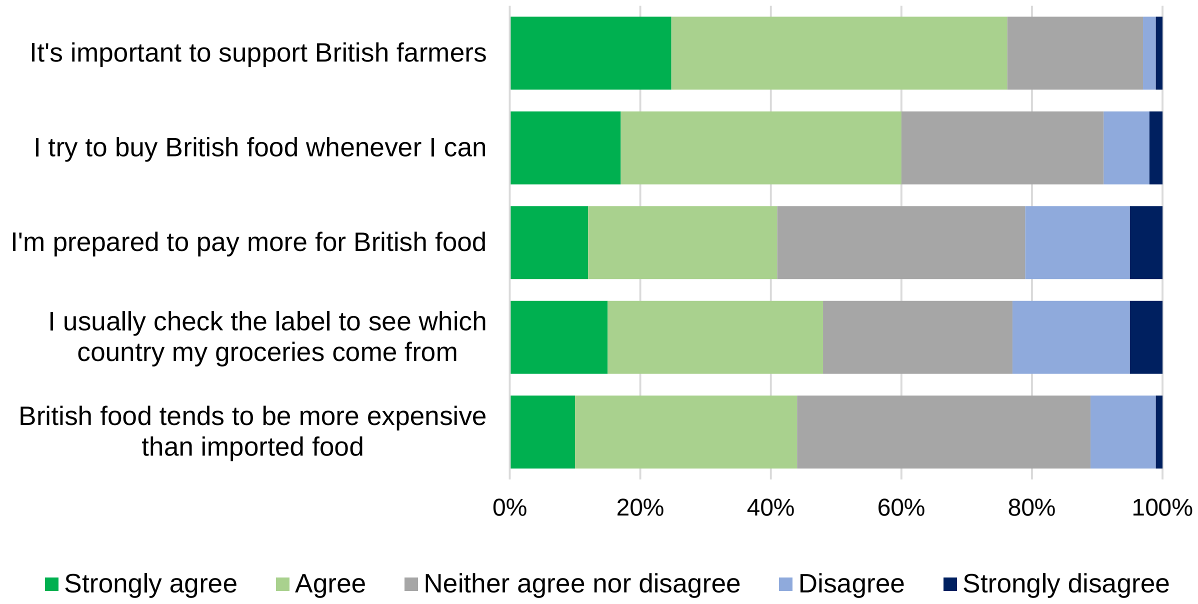
77% of British surveyed consumers believe it is important to support British farmers.

60% say they try to buy British food whenever they can.

However, less than half said they are willing to pay more for British food, or said that they check where their food comes from before buying.

Consistently, price is the key factor determining purchasing for consumers. There is strong evidence from official statistics, Defra funded independent research and retailer research that price is the most important factor influencing consumer choice.

Consumer Attitudes (2016)



How do consumer preferences affect UK food imports and exports?

Although we can produce a wide range of foods in the UK, importing food from different climates means that consumers have the choice of seasonal food all year round.

International trade in meat allows producers, manufacturers and retailers to address deficits in certain cuts of meat:

- imports supplement the supply of those cuts most popular with British consumers such as bacon, leg of lamb, and chicken breast,
- the least popular cuts are exported to countries where there is a stronger demand (for example exporting pigs feet to China).

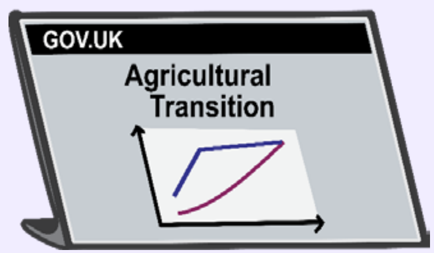
England Farm Economics and Accounts

Agriculture in England Overview

Pp44-52

Farm Business Income (profit)

Pp53-64



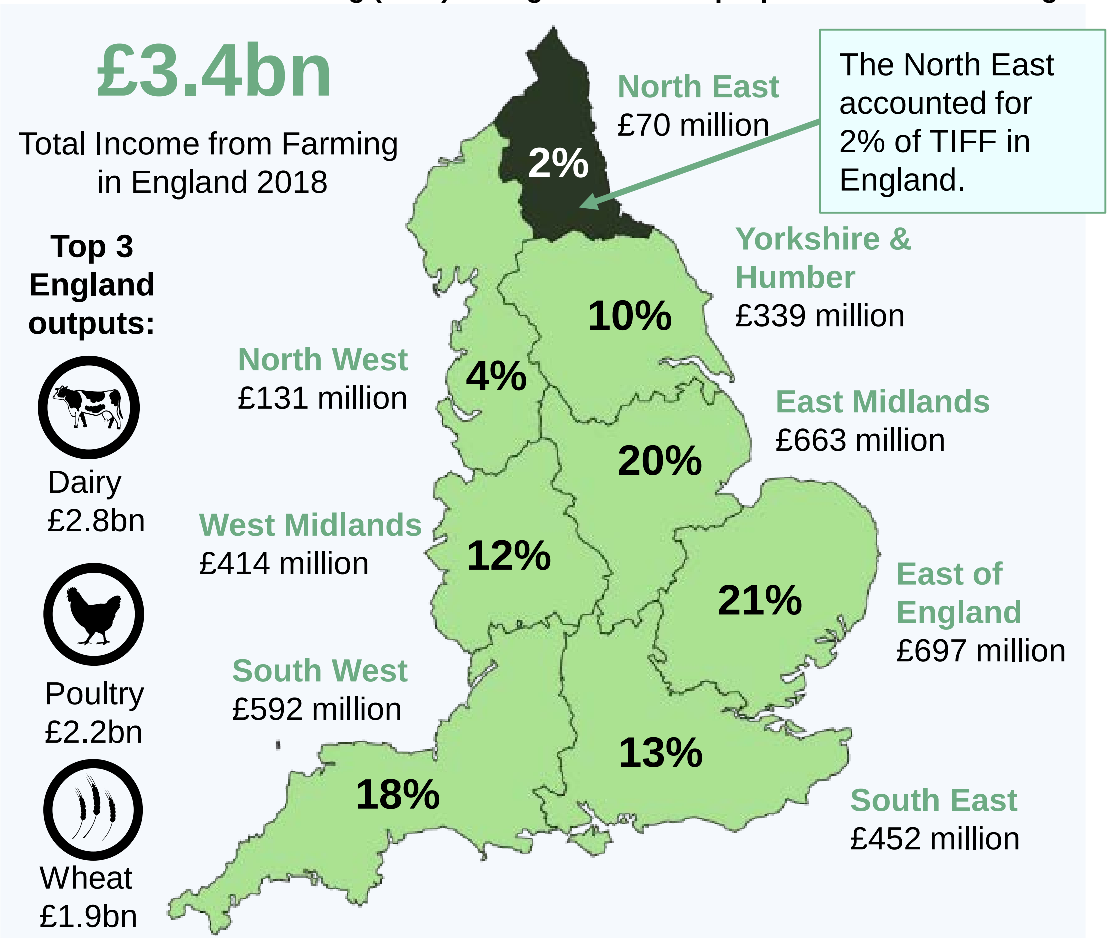
Removing Direct Payments

Pp65-73

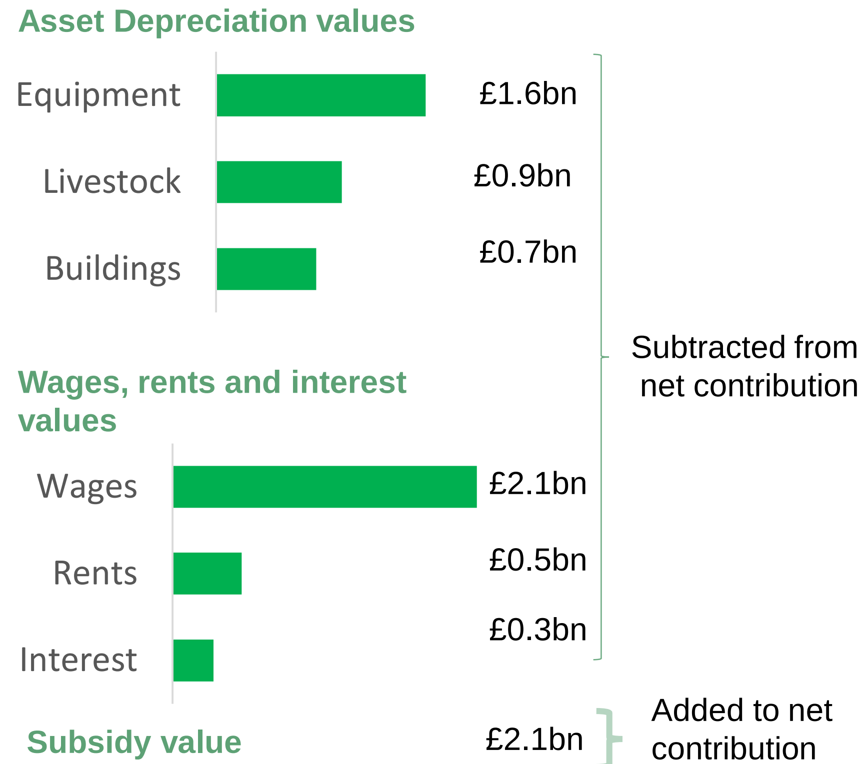
What was England’s Total Income from Farming and how did the contribution by Region vary in 2018?

In England in 2018, after deductions for wages, rent, interest and asset depreciation and taking subsidy contributions into account the total income from farming in England was £3.4bn, with the East of England contributing the most (21%) and the North East the least (2%).

Total Income from Farming (TIFF) in England and the proportion from each Region 2018



England’s net contribution to the UK economy from agriculture was £7.3bn. To calculate TIFF, the following are deducted or added to this:



For more information about how TIFF is calculated, see p25

How important is agriculture in the rural economy?

Agriculture is important for rural areas, especially in the rural uplands, accounting for around 15% of registered businesses and 8% of employment across all rural areas, which rises to 30% and 14% respectively in rural uplands areas.

Agriculture contributes around 2% to the rural economy (in England). It is 0.6% of England's economy overall.

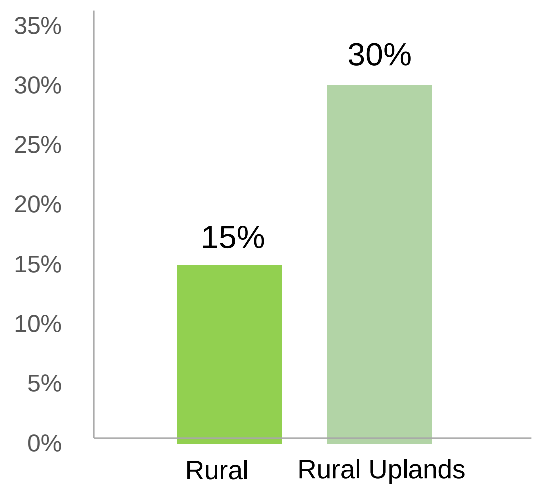
Rural uplands are home to almost 240,000 people, of which 31% (72,000) live within areas that are sparsely populated.

The proportion of **rural employment** in agriculture is greater in smaller settlements and in sparsely populated areas, especially in upland areas.

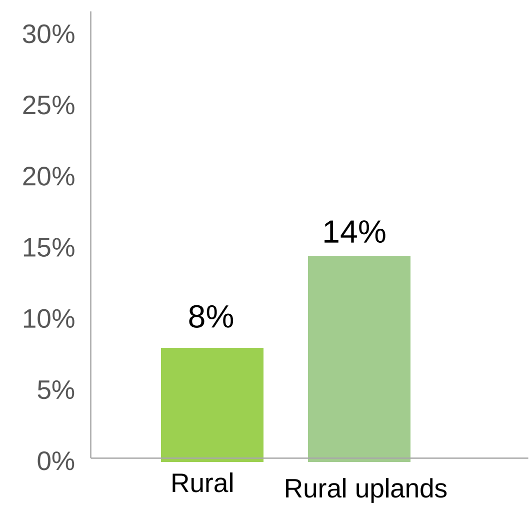
Agriculture accounts for 15% of registered businesses across all rural areas, however this proportion is twice as much in rural uplands areas (30%), making it one of the most important sectors in rural uplands.

Agriculture accounts for 8% of employment in registered businesses across all rural areas, however in rural uplands the proportion of people employed in agriculture is almost twice as high at 14%. Accommodation and food service activities are also important employment sectors in rural uplands.

Proportion of businesses in agriculture, forestry and fishing



Proportion of employment in agriculture, forestry and fishing



Note: * agriculture includes agriculture, forestry and fishing sectors

In England how is the economic output distributed across the number of farms?

In England in 2017, a small number of economically large farms (8%) produced over half (57%) the agricultural output using just 33% of the total farmed land area.

Economic Size Classification	Very Small	Small	Medium	Large	Very Large	
Standard Output	Under €25K	€25K to €125K	€125K to €250K	€250K to €500K	At least €500K	**Total**
% total Farm Businesses	**41%**	**30%**	**12%**	**9%**	**8%**	**93,400** Farm Businesses
Number of farm businesses	38,700	28,200	10,800	8,600	7,100	
% of total Output	**2%**	**11%**	**12%**	**18%**	**57%**	**€16,400** million estimated output
% total Farmed Area (thousand Hectares)	**7%**	**21%**	**18%**	**21%**	**33%**	**9.1** Million hectares

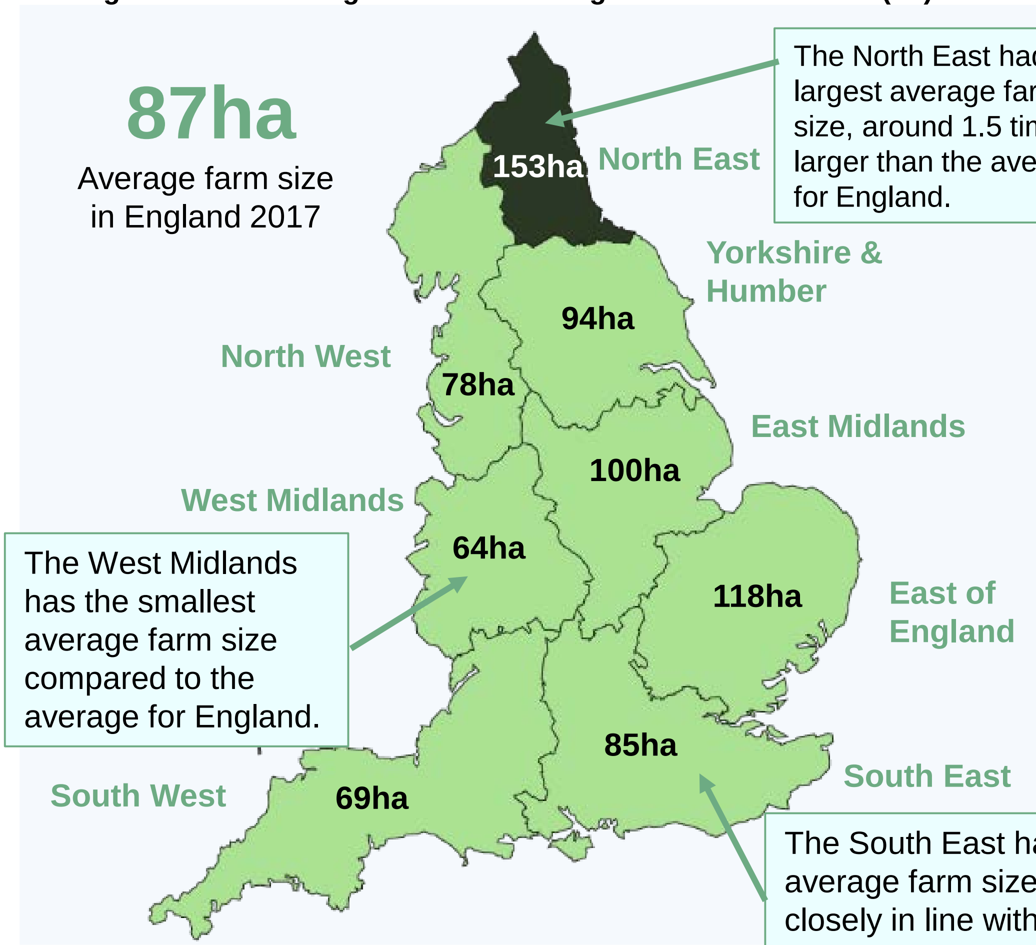
Standard Output measures the total value of output of any one enterprise - per head for livestock and per hectare for crops. For crops this will be the main product (e.g. wheat, barley, peas) plus any by-product that is sold, for example straw. For livestock it will be the value of the main product (milk, eggs, lamb, pork) plus the value of any secondary product (calf, wool) minus the cost of replacement.

Note - the chart excludes businesses classified as ‘specialist horse’

How does average farm size vary across the English Regions?

In 2017, the average farm size in England was 87ha, however farms in the North East had the largest average farm size of 153ha and farms in the West Midlands were, on average, the smallest at 64ha.

Average farm size in England and each Region 2017 in hectares (ha)

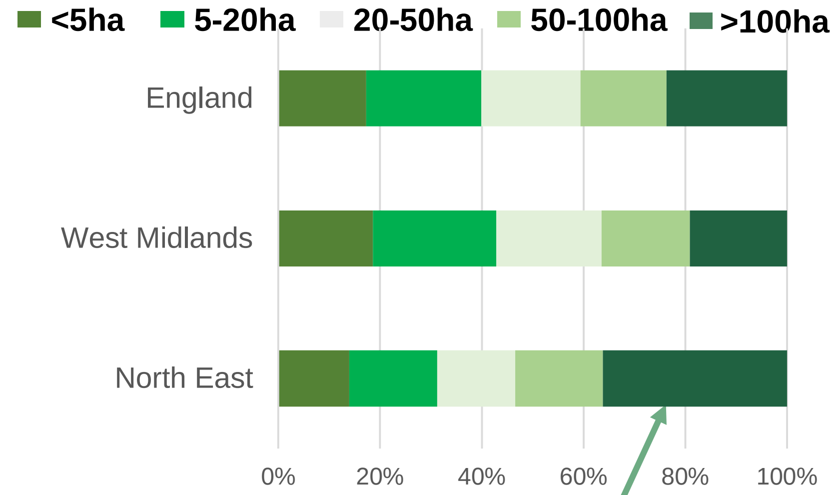


The North East had the largest average farm size, around 1.5 times larger than the average for England.

The West Midlands has the smallest average farm size compared to the average for England.

The South East had an average farm size most closely in line with the average for England.

Distribution of farms by size in England



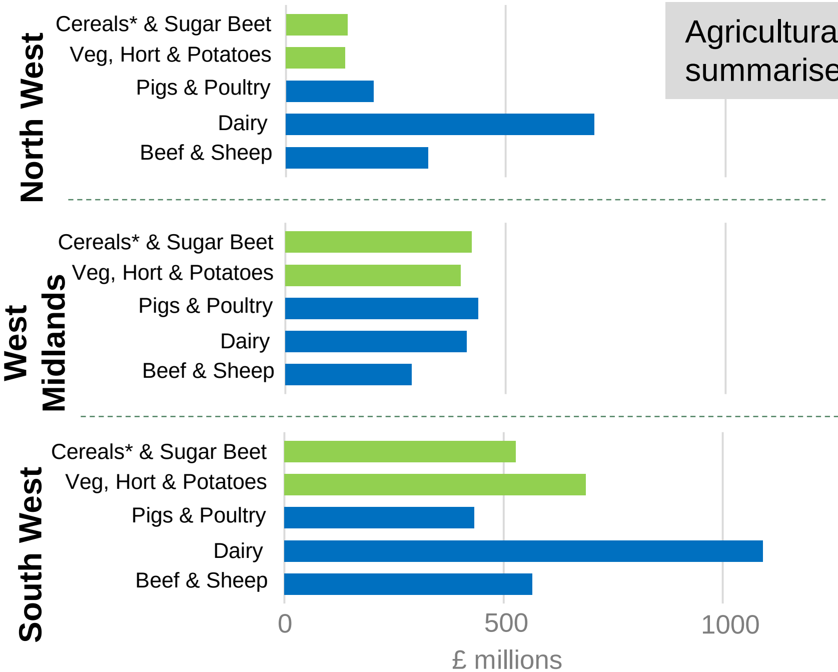
The proportion of farm size >100ha is greater in the North East than any other region, which may be due to the number of large estates in the North East. Large estates are also relevant to the high number of tenant farmers in this Region. Northumberland, for example, has several large, ancestral estates and has the highest rate of tenanted land in the country. There are also large shooting estates in the Pennines, and the coastal arable belt tends to have larger farms.

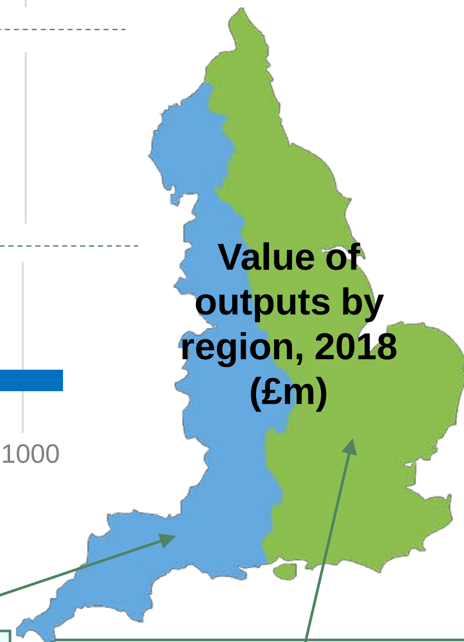
Farm type is also a factor, as there is a high proportion of LFA farms, which tend to be larger because of the grazing area required. There are less dairy farms in the North East, which tend to be smaller in area.

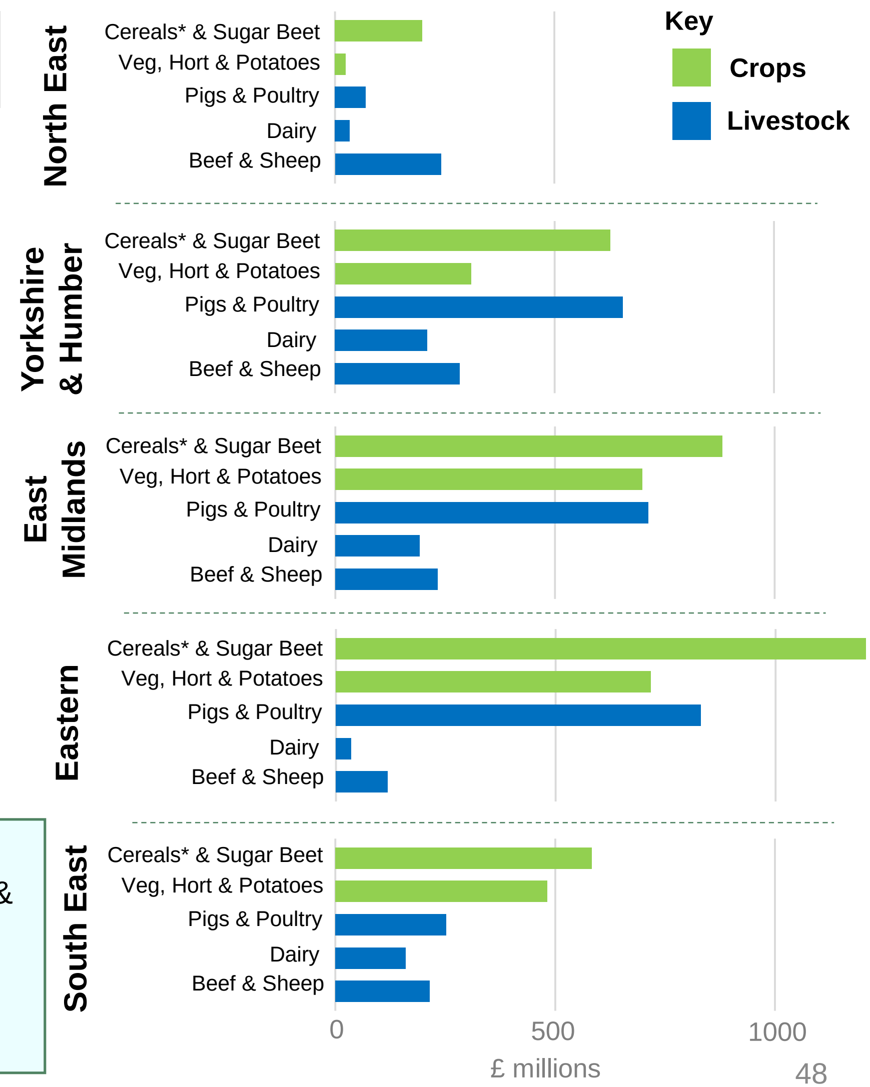
How does the output from agricultural production vary across England?

Livestock is the principal output in the West of England, with dairy having the highest value. Crops are generally more prevalent in the East, however pigs and poultry also have high output values.

Agricultural outputs have been summarised into five main groups.







*Cereals include industrial crops, forage plants and other crop products

Dairy and Beef & Sheep dominate the West of England, with Dairy production in the South West accounting for just over 6% of all England's agricultural outputs.

Agricultural output from livestock and crops is fairly balanced in the West Midlands.

Combinables & Sugar Beet and Vegetables, Horticulture & Potatoes are more dominant in the East, although Pigs & Poultry are also high value outputs in the East.

How are farm types classified in England?

Across England, many farms undertake more than one type of farming, and so farms are classified according to their main output within one of nine main farm types.

Farm Type

General Cropping	Cereals	Mixed	Horticulture	Poultry	Pigs	Dairy	Grazing Livestock Lowland	Grazing Livestock Less Favoured Areas (LFA)

The varied topography and climate of England means that some sectors are more concentrated in some regions than others.

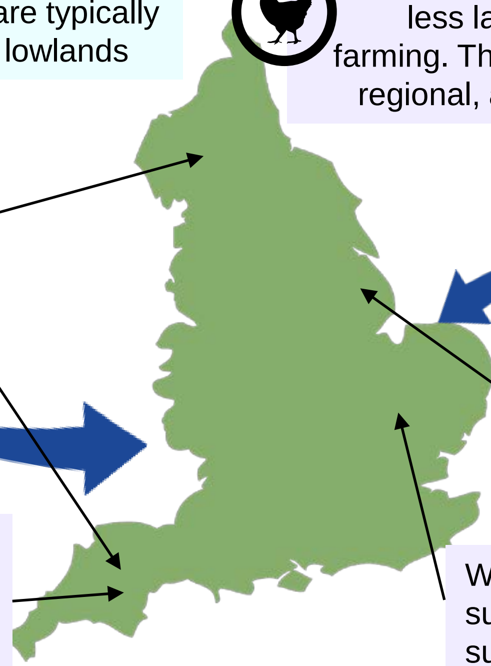
For more information on Less Favoured Areas (LFA) see p59.

The hillier upland regions are typically colder and wetter than the lowlands

Poultry can be reared indoors and require less land compared to other types of farming. Therefore, poultry farming is less regional, and is more evenly distributed.

Sheep are commonly farmed in hillier areas, particularly where cool summers and high rainfall are unsuitable for growing crops. 21% of England's sheep herd is in the South West and 20% in the North West.

Hot air brings dry summers to the East of England



Moist air brings wet weather to the west of the England

Pig farming is concentrated close to where the feed is produced. 37% of the England's pigs are reared in Yorkshire and The Humber.

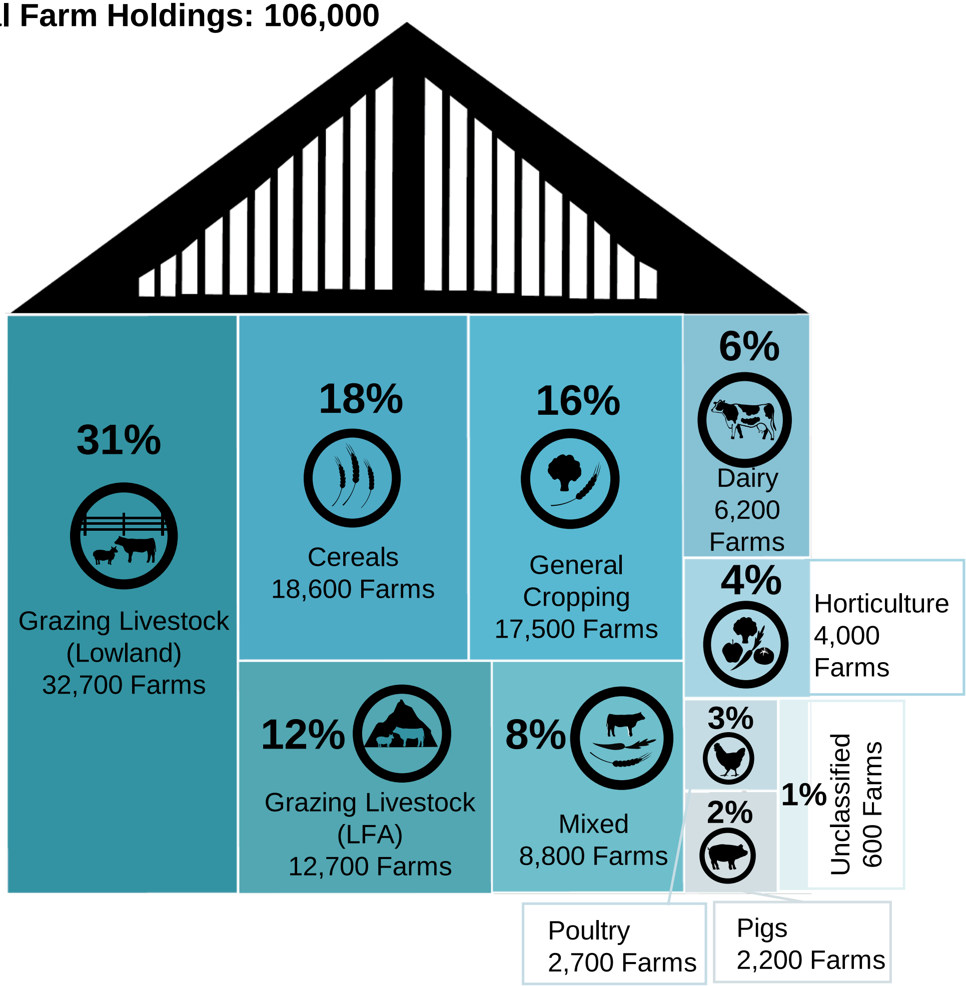
The warm, wet climate and gentler hills of the west of England make it suitable for dairy farming. 38% of England's dairy herd is farmed in the South West.

Warm summers and flat land makes the East suitable for crop farming. 61% of the England's sugar beet and 28% of wheat is grown here.

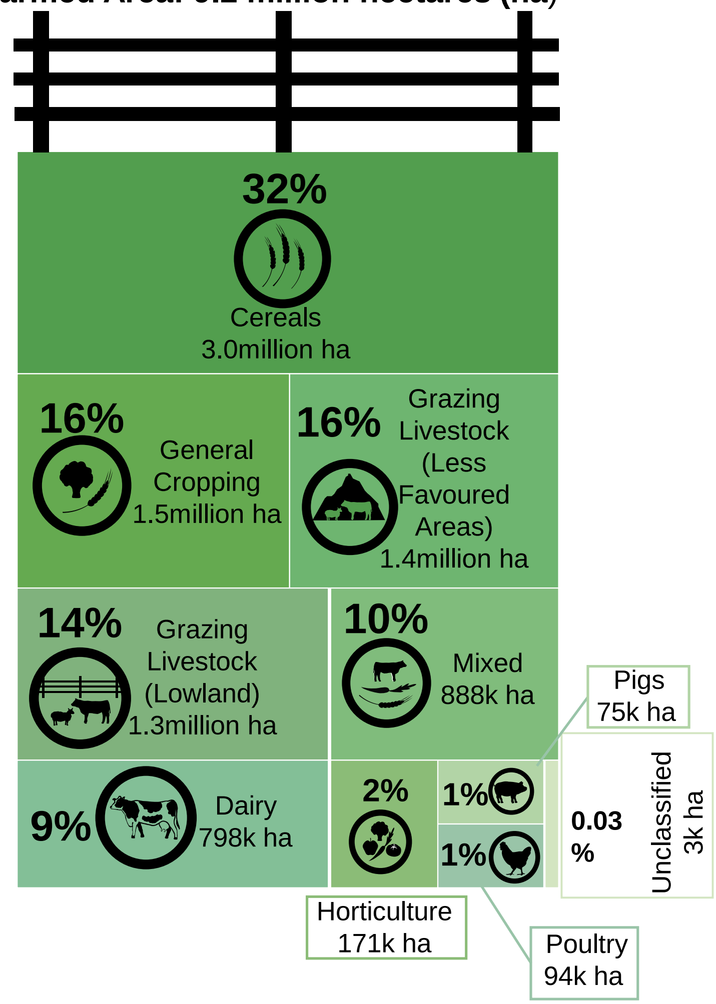
How many of each farm type are there in England and how much land do they use?

In England in 2017, grazing livestock in lowland areas had the greatest number of farms (31% of total), and cereals farms used the largest amount of farmed area (32% of total).

Number of farms by sector type.
Total Farm Holdings: 106,000



Area of land used by sector type.
Total Farmed Area: 9.2 million hectares (ha)



In England, how many farms are owner occupied and how many are tenanted?

In England in 2017, the majority of farms (52%) are owner occupied and the North East has the greatest proportion of holdings that are wholly tenanted.

Of all the farms in England…

52%
Owner occupied

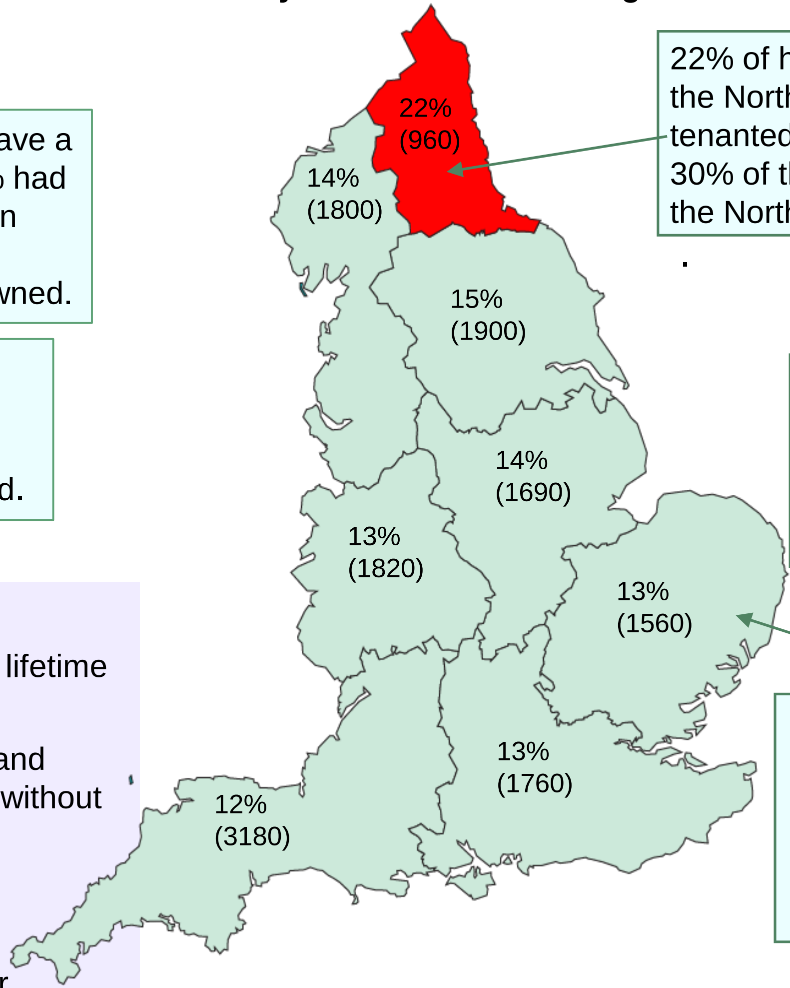
14%
wholly tenanted

Wholly tenanted farms have a younger age profile: 18% had a farmer aged under 45 in 2016 compared to 6% of farms that were solely owned.

34%
mixed tenure
(owning and renting the land that they farm)

Farms of mixed tenure tend to be larger than farms that are wholly owned or wholly tenanted.

Of the wholly tenanted farms in England…



22% of holdings (960) in the North East were wholly tenanted, accounting for 30% of the farmed area in the North East.

In each of the other regions, 15% or less of holdings were wholly tenanted, accounting for less than 20% of land.

Average rents per hectare are greatest in the East and on cropping and dairy farms reflecting the quality of land needed and the demand.

Types of Tenancies in England

Full Agricultural Tenancies (FAT), which generally have lifetime security of tenure.

Farm Business Tenancies (FBT), which can be formal and informal (i.e. based on the same principles as an FAT but without the accompanying legal documentation).

FATs and **FBTs** can be with and without Direct Payment entitlements and can include buildings/other assets.

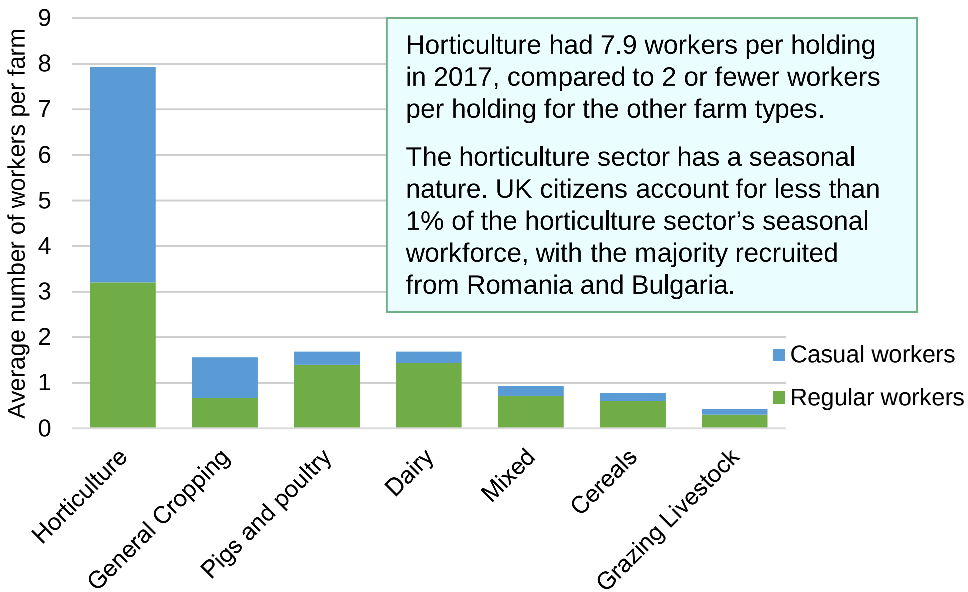
Seasonal agreements include licences for grazing and/or mowing these can also include SPS/BPS entitlements.

What are the characteristics of farmers and employees?

The majority of farm holders in England in 2016 were male (84%) and over a third were aged 65 or more. Horticulture was the most labour intensive farm type in 2017, with 7.9 workers per holding compared to 2 or fewer workers per holding for all other farm types.

All agriculture workers (306,300)

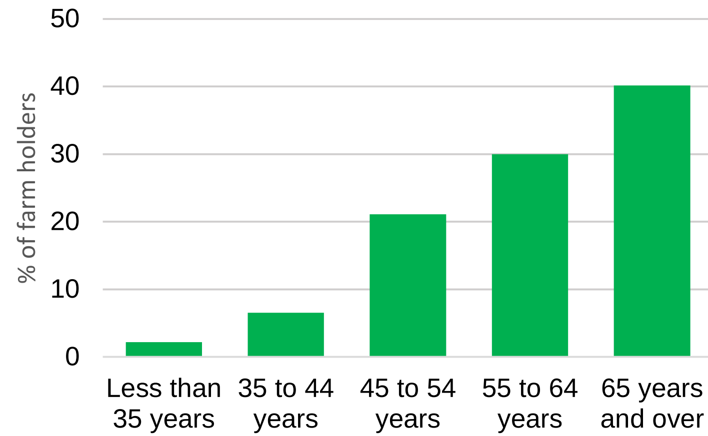
- Farmers, business partners, directors, spouses 57% (174,800)
  - There is an average of 1.6 of this type of worker per holding.
- Farm Managers 4% (11,400)
- Workers 39% (120,100)
  - Regular workers 60% (71,700)
  - Seasonal, casual, gang workers 40% (48,400)



Horticulture had 7.9 workers per holding in 2017, compared to 2 or fewer workers per holding for the other farm types.

The horticulture sector has a seasonal nature. UK citizens account for less than 1% of the horticulture sector's seasonal workforce, with the majority recruited from Romania and Bulgaria.

Agriculture typically has an ageing workforce.
In 2016, over a third of all farm holders in England were over the age of 64 years. Just 2% of holders were aged less than 35 years.



84% of farm holders in England in 2016 were male

16% of farm holders in England in 2016 were female

We capture information on the age and gender of farm holders less frequently. The most up to date data available is for 2016.

What are the costs of production for farmers?

Around half of costs to farmers are variable, changing depending on the level of production, and the other half are fixed, of which machinery is their largest.

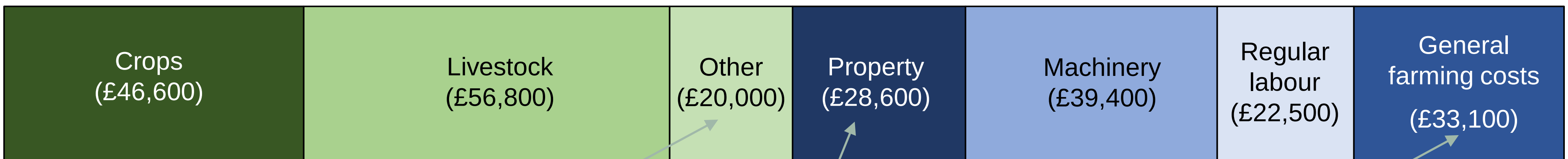
Variable costs change as the level of output varies. For example if a farmer plants more crops they need to purchase more seed or would need more casual labour for harvesting.

Fixed costs are constant in the short term meaning they are the same regardless of how much the farmer produces.

In the longer term these can vary, for example, through negotiation of lower rent or purchasing of cheaper machinery.

Total variable costs (£123,400)

Total fixed costs (£123,700)



Other variable costs
This contains mainly contractor costs and casual labour which increase or decrease depending on the amount produced by the farm.

Rents
On average for all farm types, rent contributed 43% (or £12,400) to total property costs, or 5% of all input costs between 2015/16 and 2017/18.

Many farms have no rental costs as they are owner occupied. For wholly tenanted farms, rental costs made up 12% (or £31,000) of their total costs.

General costs
This group includes items such as bank charges, professional fees, water, electricity, net interest payments, bad debt write off.

Water and electricity comprise around a half of these costs.

For more information on how costs can affect the performance of farms, see p78.

How is farm business profit calculated and what was the average for all farms in England in 2015/16-2017/18?

Farm Business Income (FBI) is a measure of net profit, calculated as Farm Business Outputs (revenue) minus Farm Business Inputs (costs). Between 2015/16 and 2017/18 the average profit for all farms was £43,400, with Direct Payments equivalent to the largest share of this (58%).

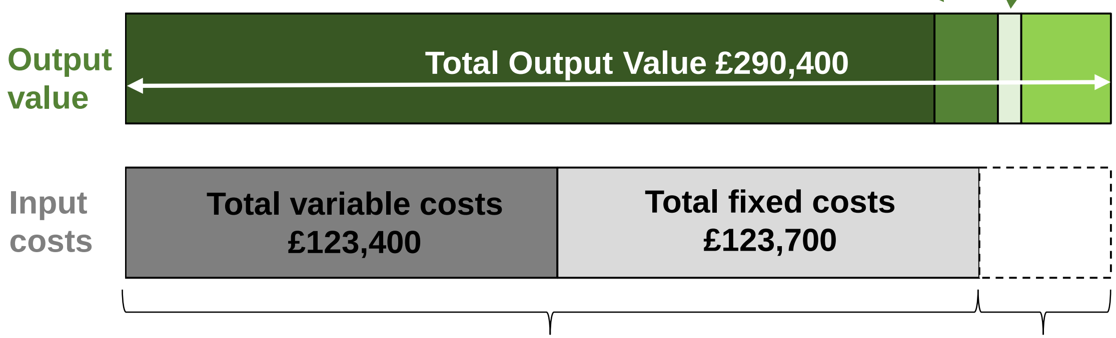
Average inputs and outputs for all farms from 2015/16 – 2017/18

Agriculture (£236,100) Main measure of the value of crop and livestock outputs.

On average, across all farm types the agricultural part of the business **made a marginal loss** of £2300 between 2015/16 and 2017/18.

Diversification (£20,300) Non-agricultural work of an entrepreneurial nature, on or off farm, but utilising farm resources, such as running a farmhouse bed and breakfast.

Agri-environment (£6,100) Payments to deliver environmental outcomes, compensating for income foregone in providing them.



Direct Payments (£27,800) Direct Payments are farm subsidy payments from the EU under the Common Agricultural policy. They are paid to farm businesses based on the amount of agricultural land they maintain.

Direct Payments will be phased out from 2021. For more information on the impact of this on farm businesses, see p70.

Costs (£247,000) Around half of costs to farms are variable, changing depending on the level of production, and the other half are fixed, of which machinery is the largest. For more information on costs, see p53.

Farm Business Income (£43,400) The amount that a farm business has left after costs to invest, pay taxes and pay salaries.

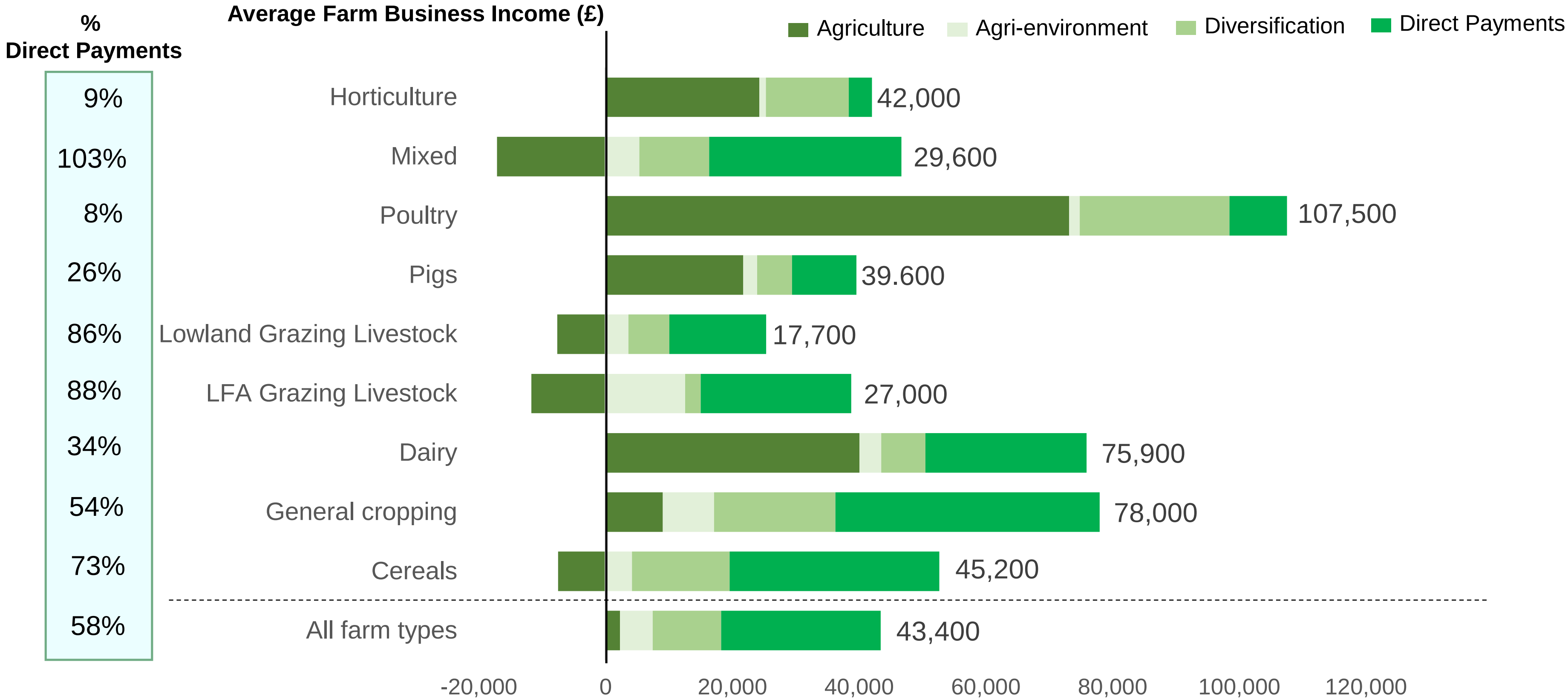
Output values include the total value of crops produced, livestock enterprise output, by-products, forage and cultivations, and miscellaneous output.

Inputs are resources used in the production process, such as feed, materials, labour and machinery, measured in physical or financial terms.

Direct Payments contribute, on average, £27,800 to the revenue of the farm, but also have costs (£2,700) associated with them, such as the application process and cross compliance. This means that the average net income from Direct Payments was around £25,200.

How does profit (Farm Business Income) vary across the different farm types in England?

Profit (Farm Business Income) varies across the different farm types, and over the period 2015/16 to 2017/18 poultry farms were most profitable and grazing livestock and mixed farms the least.



Mixed, grazing livestock and cereals farms made a loss from the agriculture side of the business as their costs of production outweighed the value of their output.

Around two-thirds of Farm Business Income came from the agricultural side of the business for pig and poultry farms.

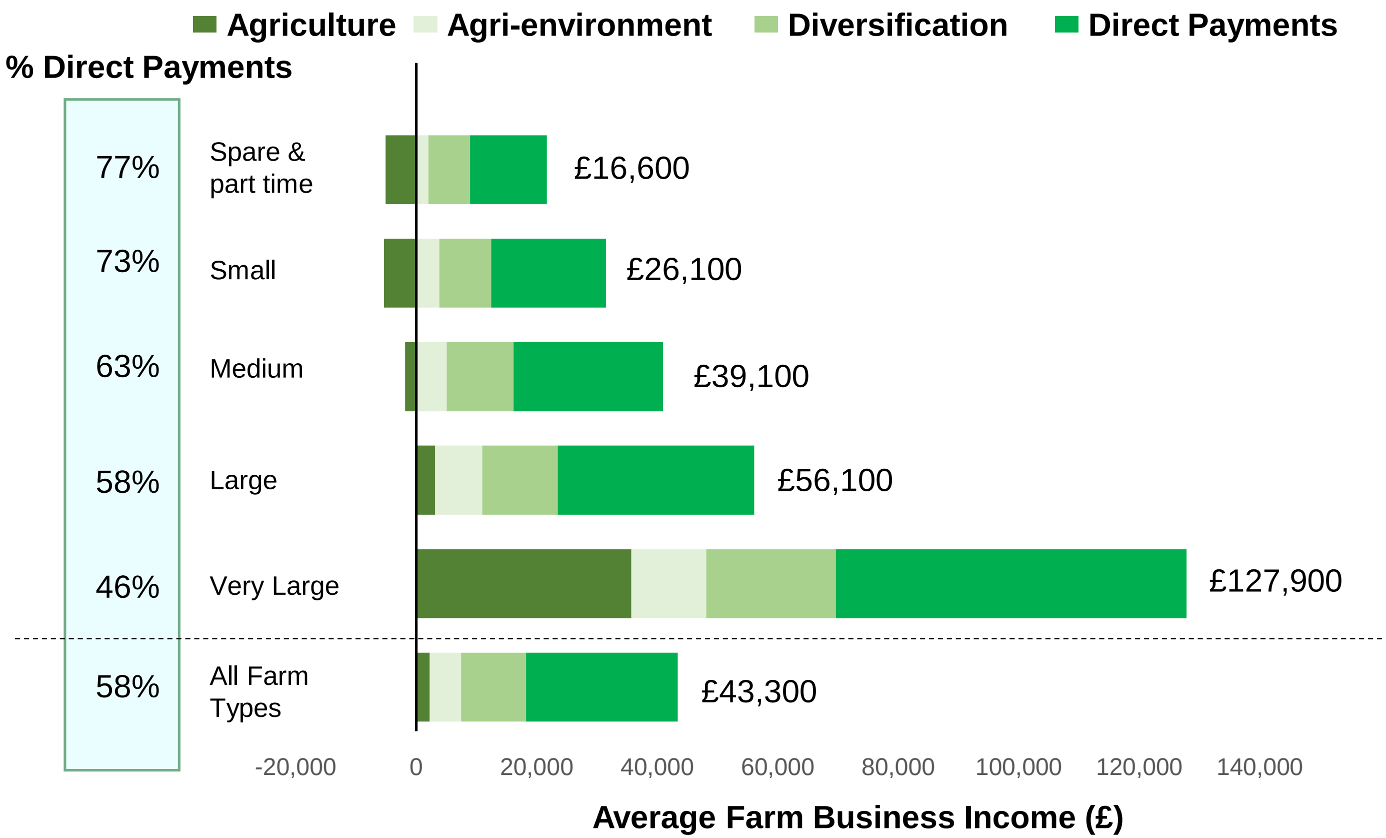
Over 70% of Farm Business Income came from Direct Payments for cereal, grazing livestock and mixed farms.

How does profit vary according to different farm size in England?

Farm Business Income varies by farm size, and over the period 2015/16 to 2017/18 part time and small farms were more reliant on Direct Payments and very large farms the least.

The standard labour requirement (SLR) of a farm represents the normal labour requirement, in Full Time Equivalents, for all enterprises on a farm under typical conditions. The SLR for a farm is calculated from standard coefficients applied to each enterprise of the farm. The standard coefficients represent the input of labour required per head of livestock or per hectare of crops for enterprises of average size and performance.

Farm size	Definition
Spare & Part time	Less than 1 SLR
Small	1 to less than 2 SLR
Medium	2 to less than 3 SLR
Large	3 to less than 5 SLR
Very Large	5 or more SLR



For spare and part time farms and small farms, more than three quarters (77% and 73%) of their Farm Business Income came from Direct Payments.

For Medium and Large farms, the amount of their income (63% and 58%) that came from Direct Payments was just above the average for all farms (58%).

For very large farms just under half (46%) of their income came from Direct Payments.

How does Farm Business Income vary by tenure type?

Over the period 2015/16 to 2017/18 Mixed – mainly tenanted farms had the highest farm business income (£63,700) and Tenanted farms the lowest (£28,400).

In England in 2017…

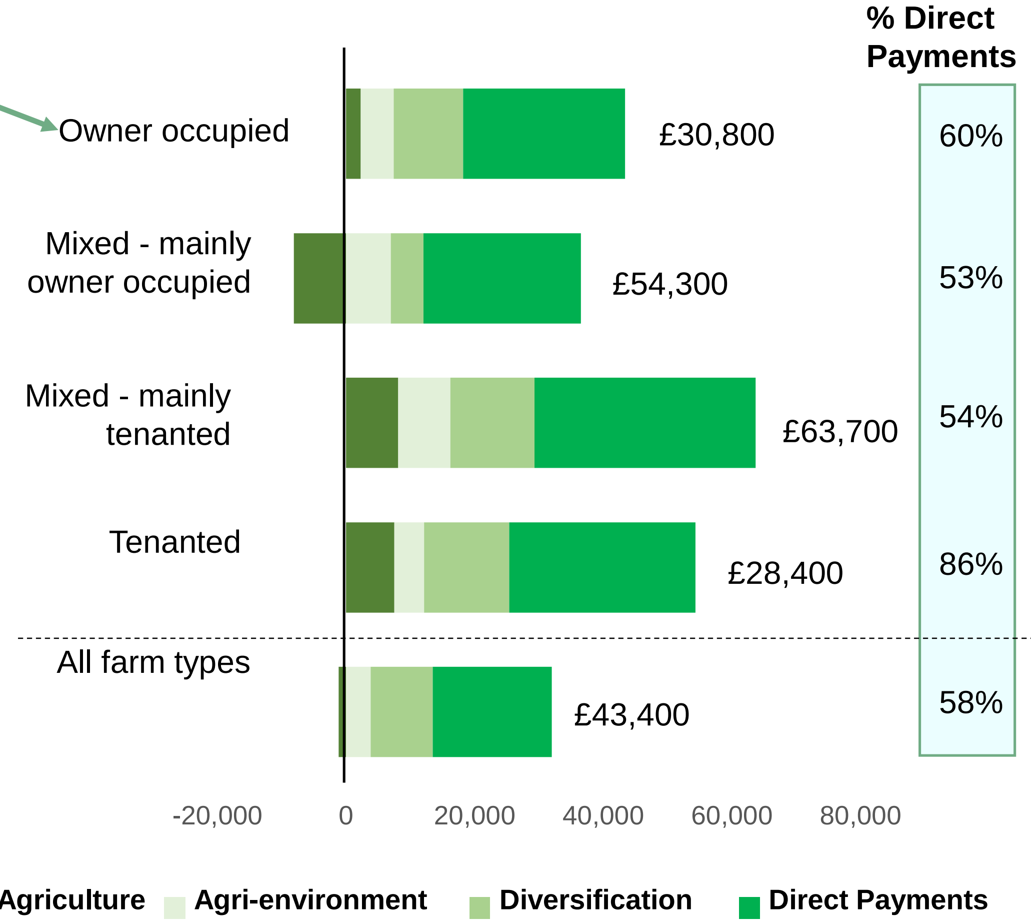
Of the land that was rented, the majority (85%) was rented for at least a year, while the remaining 15% was rented seasonally.

52%
of farms were owner occupied (55,000 farms). These accounted for 35% of farmed area (3.2million ha).

34%
of farms were mixed tenure (36,000 farms). These accounted for 50% of farmed area (4.6million ha).

14%
of farm holdings were wholly tenanted (15,000 farms), accounting for 16% of farmed area (1.4million ha).

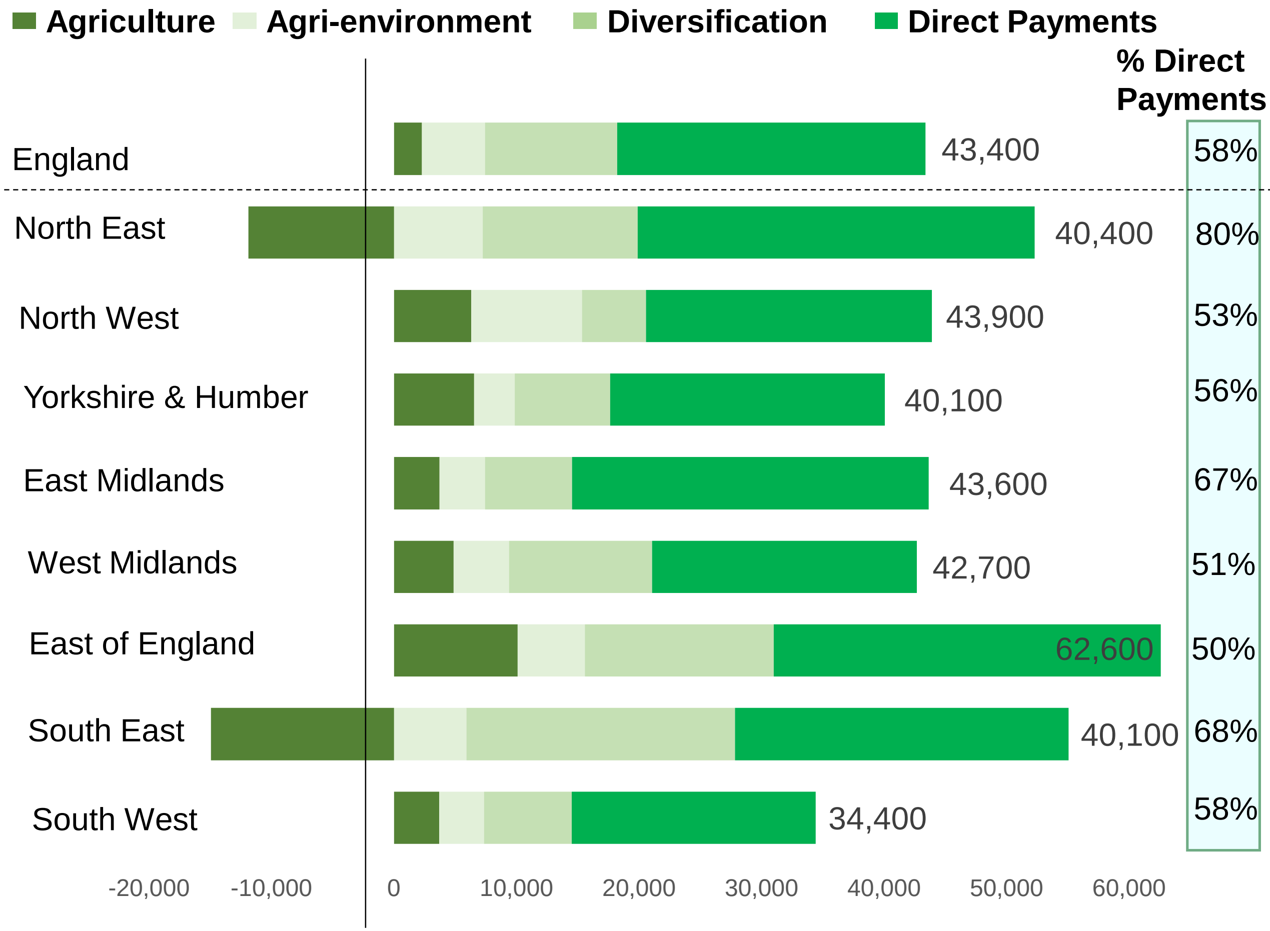
Average Farm Business Income (FBI) by tenancy type, based on 3 year matched dataset 2015/16 to 2017/18



How does Farm Business Income vary by region?

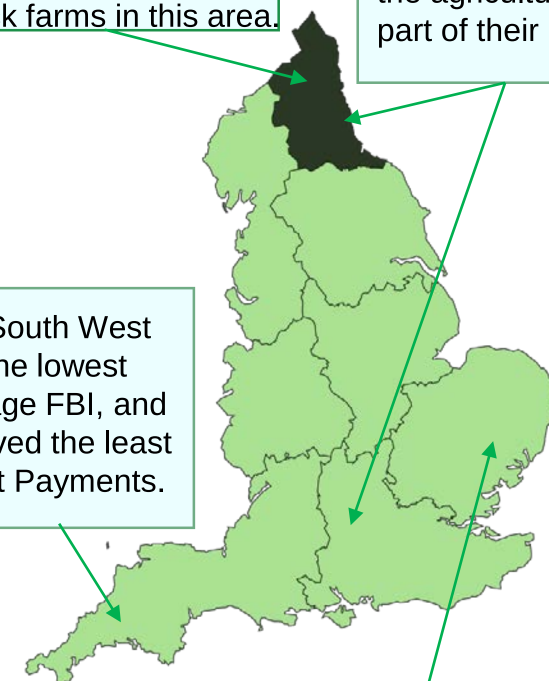
Farm Business Income (FBI) varies across the different regions of England, and on average over the period 2015/16 to 2017/18 the East of England had the highest FBI (£62,000) and the South West the least (£34,400).

Farm Business Income (FBI) and the proportion that comes from:



The North East had the highest proportion of income from Direct Payments due to a prevalence of Grazing livestock farms in this area.

Farm businesses in the South East and North East made losses on the agriculture part of their FBI.



The South West had the lowest average FBI, and received the least Direct Payments.

The East of England had the highest average FBI of £62,600.

How does profit vary between the Uplands and Lowlands?

On average, over the period 2015/16 to 2017/18, grazing livestock farms in Severely Disadvantaged areas (SDA) made a greater loss from farming activities, but Farm Business income (FBI) for these was higher than grazing livestock farms generally due to greater income from Direct Payments and agri-environment schemes.

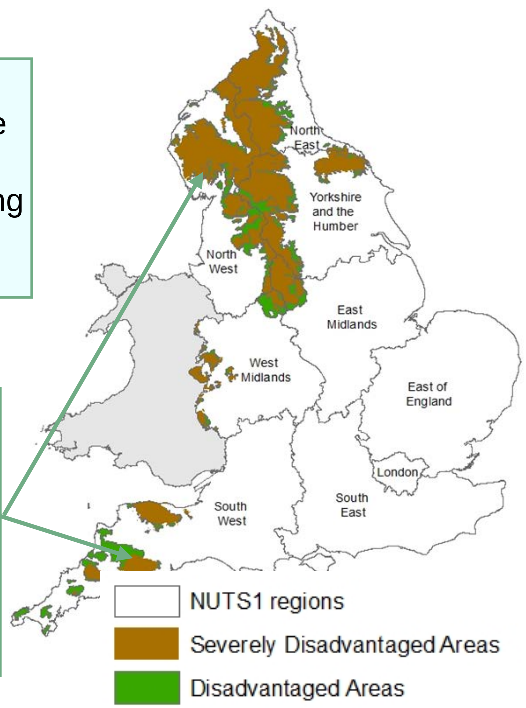
Less Favoured Areas (LFA) in England are subdivided into two areas.

The more environmentally challenging areas within the LFA, which tend to be more upland in character, are classed as 'Severely Disadvantaged Areas' (SDA). The remainder is classified as 'Disadvantaged Areas' (DA).

This distinction is important as it determines eligibility for support payments and environmental schemes, with SDAs being the focus of Government support in the LFA.

Three quarters of farm holdings in the SDA are grazing livestock, accounting for 87% of the farmed area.

In 2016 there were 9,500 holdings forming 9,200 farm businesses classed as having the majority of their land in the SDA in England, covering 1.1million hectares (excluding common land).

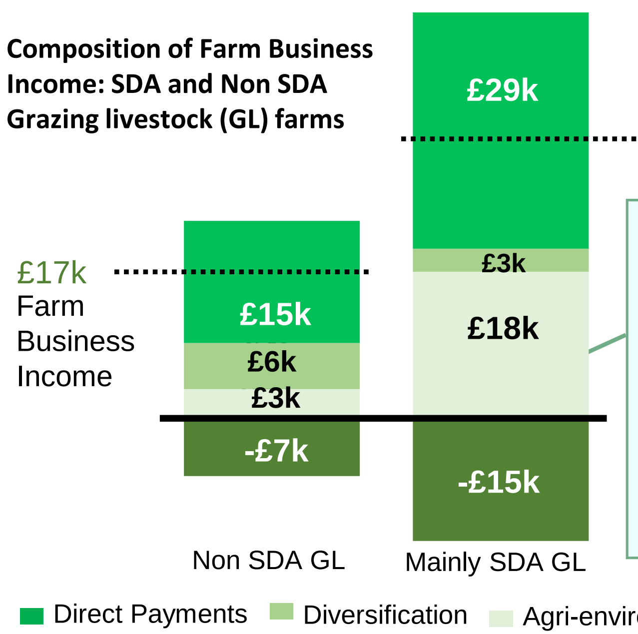


Average FBI for all farms in the SDA is lower than the average of all farms outside the SDA due to the prevalence of Grazing Livestock (GL) farms, which tend to have lower incomes than other farm types.

SDA GL farms made greater loss from agriculture, but overall FBI was higher due to greater income from Direct Payments and agri-environment schemes.

On average, SDA GL farms are larger than non-SDA GL farms (132ha compared with 45ha), and hence the per farm income from Direct Payments and agri-environment schemes is larger.

Composition of Farm Business Income: SDA and Non SDA Grazing livestock (GL) farms



Without Direct Payments, SDA GL have an average FBI of £5,500 compared to non-SDA GL FBI of £1,900 due to larger agri-environment payments.

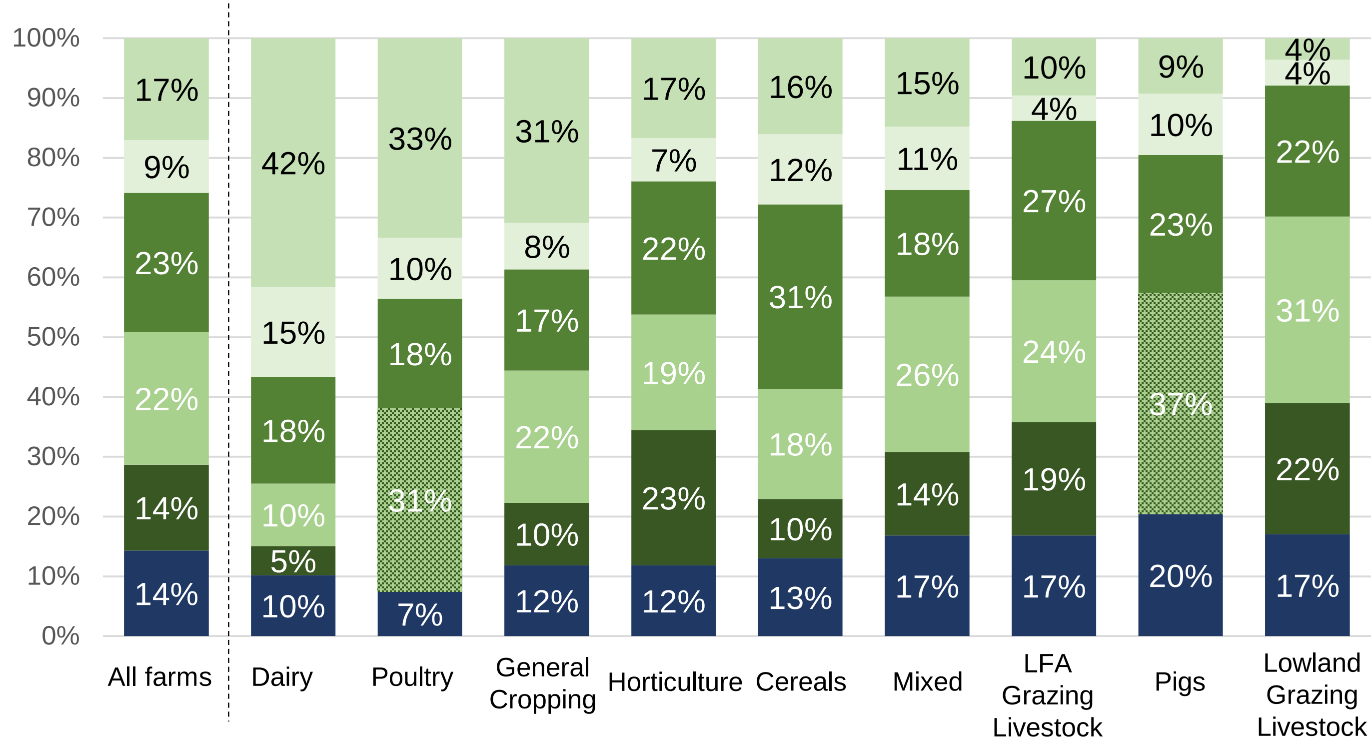
What are the most profitable farm business types?

Between 2015/16 and 2017/18, 14% of all farms made a profit of more than £75k, with Dairy and Poultry having the greatest proportion of farms in this group and pig, mixed and grazing livestock farms more likely to make a loss.

Key (Average in brackets)

- More than £75k
- £50k to less than £75k
- £25k to less than £50k
- £10k to less than £25k
- £0k to less than £10k
- Less than £0 (make a loss)

% of farms within different Farm Business Income bands, 2015/16 to 2017/18



While Farm Business Income averages are useful to get a sense of how profitable the sector or a particularly farm type is overall, averages can mask the variation in profitability.

Thus, while there are some farms in every farm type who are not making a profit currently, there are also a large proportion of farms who are, demonstrating the potential for farms to be more profitable overall.

A majority of Dairy farms (42%) made more than 75k, however even with these farms 1 in 10 made a loss.

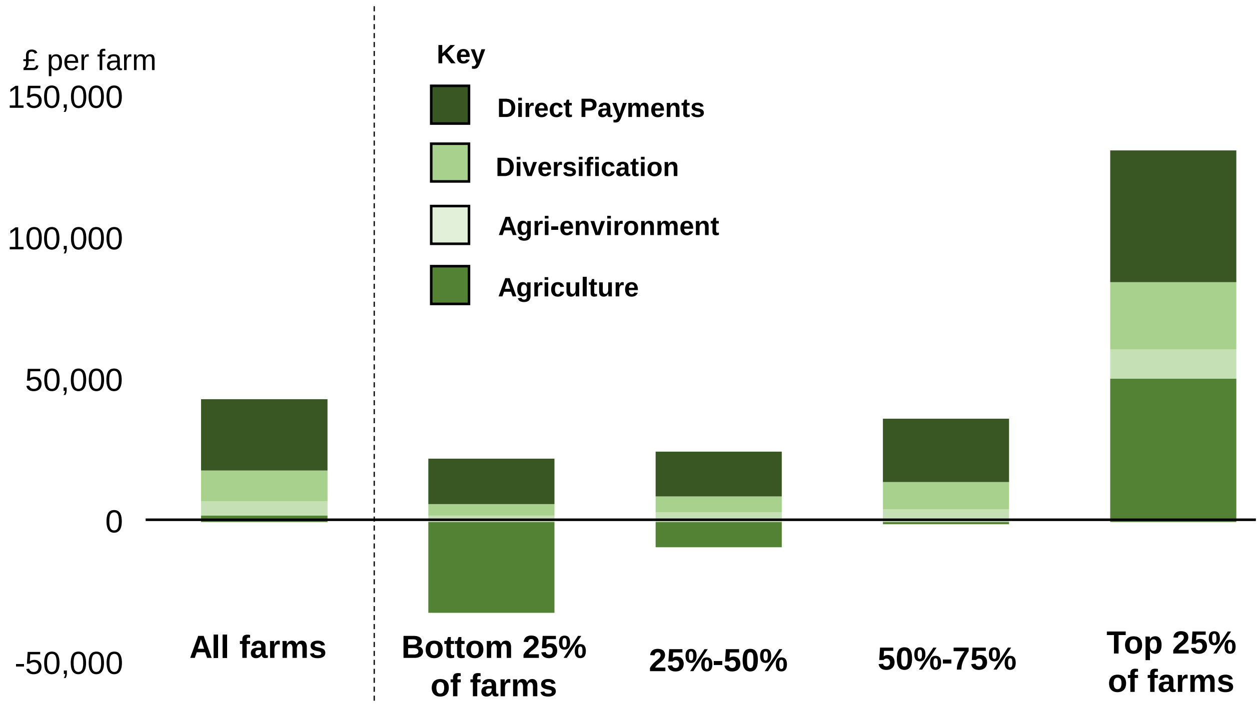
60% of Grazing Livestock farms in the Less Favoured Areas and 70% of Lowland Grazing Livestock farms had a profit of less than £25k per year.

A third of poultry farms made a profit of over £75k, but a third also made £0 to less than £10k.

How does agriculture contribute to the incomes (or profit) of farmers in England?

In 2015/16 to 2017/18, only the top 25% of farms made a profit from agriculture (£50,600). The bottom 25% of farms made a loss of £32,000 from agriculture, and overall made a loss of £9,600. The middle 50% of farms made losses on agriculture, but made a profit overall due to agri-environment, diversification and Direct Payments.

Contributions to Farm Business Income (or profit)



	All farms	Bottom 25% of farms	25%-50%	50%-75%	Top 25% of farms
Income from agriculture	£2,300	-£32,000	-£8,900	-£700	£50,600
Farm Business Income	£48,800	-£9,600	£15,900	£35,800	£131,200

Farms are ranked from the lowest to highest Farm Business Income

Ranking farms from lowest to highest by their Farm Business Income and splitting into 4 equal groups:

Agriculture
Only the top 25% on average made a profit from the agricultural part of the business (£50,600). The bottom 25% made an average loss of £32,000 from agriculture.

Agri-environment
These schemes contributed an average £5,200 to farm incomes.

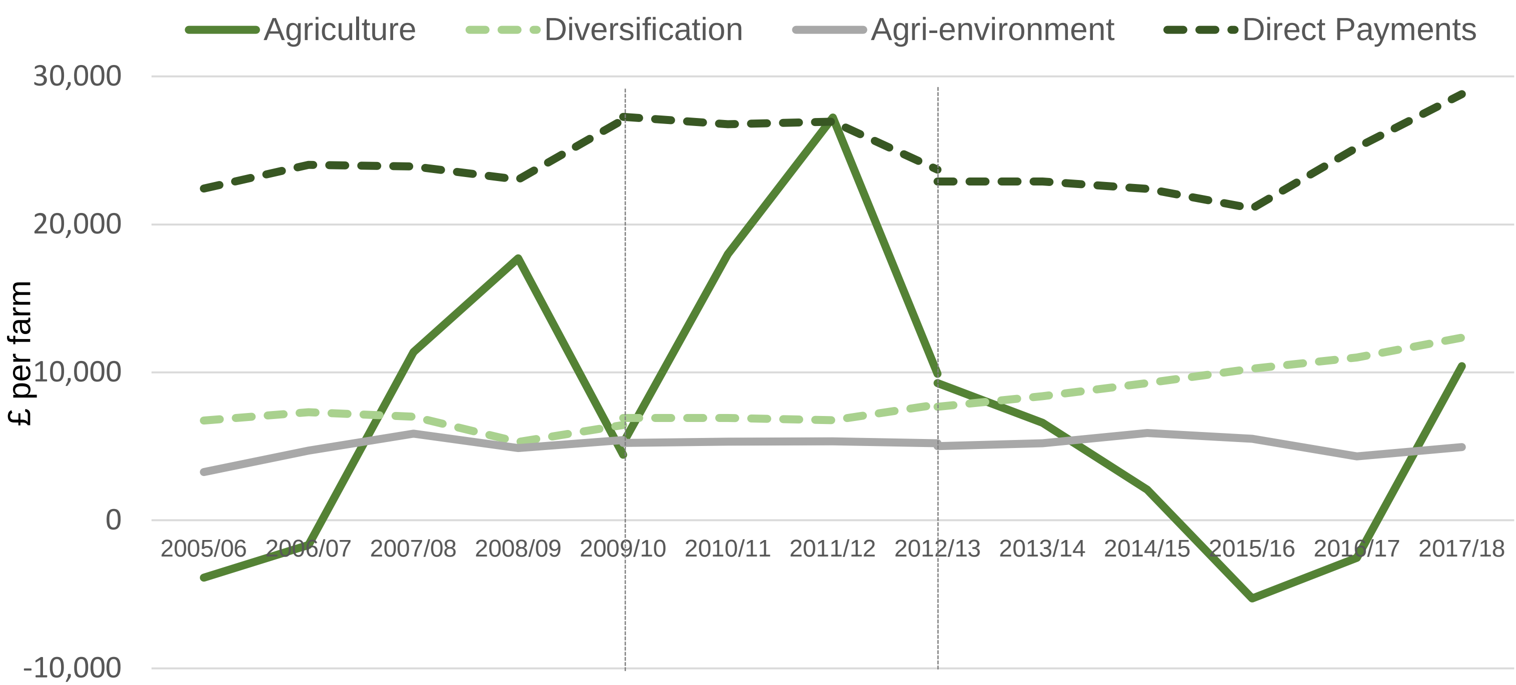
Diversification
On average, diversification provided profit to farms in each group, but contributed most (£23,700) to the top 25% of farms. The bottom 25% made only £4,100 from diversification.

Direct Payments
For the top 25% of farms, the average proportion of income from Direct Payments (£46,100) was almost as great as that from agriculture. These farms receive more because this is an area based payment and they tend to be larger.

What factors are contributing to some farmers in England continuing to farm while making a loss?

Income from agriculture can be volatile, as farm businesses are price-takers and the determinants of the prices they receive can be out of their control. Income from Direct Payments, agri-environment schemes and diversification tends to be more stable.

Average income (£) from agriculture, diversification, Agri-environment and Direct Payments for all farms from 2005/06 to 2017/18



Note there are slight discontinuities in the data in 2009/10 and 2012/13

Compared to income from Direct Payments, Agri-environment schemes and Diversification, **income from agriculture** is volatile from year to year. This volatility in agricultural income is found across all farm types.

Fluctuations in **Direct Payments** are due to changes in the exchange rate. The sterling rates are set based on the exchange rate in September each year.

Farmers are price-takers

Many of the determinants of the prices farmers receive are out of their control. Farmers plant crops and raise animals, but by the time their produce is available for market the actual price they receive may have fallen. Many agricultural products are perishable and cannot be stored on farm, so have to be moved into the supply chain quickly, meaning farmers cannot wait for better prices. Weather patterns can also impact both domestic and global supply.

These factors mean that in some years farmers make profits and in others losses.

How much income do farmers generate from providing non-agricultural products using their farm resources?

In 2017/18, 2/3rds of farms used farm resources to deliver non-agricultural activities, generating around £680million additional profit (£18,700 average per farm).

Diversified enterprises = non-agricultural work of an entrepreneurial nature on or off farm, but which utilises farm resources.

Over the last 9 years, uptake of diversified activities has increased from 51% of farm businesses in 2009/10 to 66% in 2017/18.

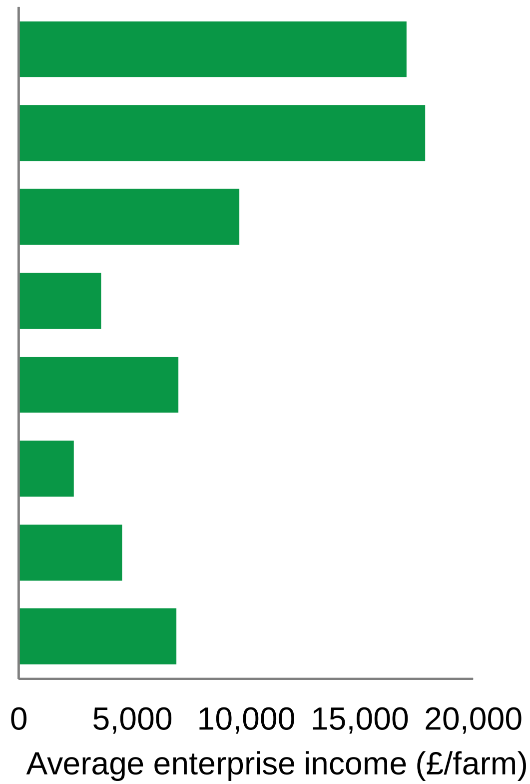
For those farms with a diversified activity, their income from that activity accounted for 28% of their profit in 2017/18.

Just under a quarter (23%) of these businesses had a greater income from diversification than from the rest of the farm business.

Letting out buildings for non-agricultural use was the most common diversified activity, on average generating around £18,500 for those carrying out this activity in 2017/18.

Processing and retailing of farm produce had the second highest average income stream among the diversified activities but only 11% of farms carried this out in 2017/18.

	% of farms carrying out	Average amount for those carrying out
Diversified enterprises (all kinds)	66%	£18,700
Letting buildings for non-farming use	45%	£18,500
Processing/retailing of farm produce	11%	£11,600
Sport and recreation	14%	£3,900
Tourist accommodation and catering	6%	£7,000
Solar energy	21%	£2,100
Other sources of renewable energy	10%	£8,600
Other diversified activities	10%	£6,200



For more information on how diversification can impact farm profitability, see p84.

What factors are contributing to some farmers in England continuing to farm while making a loss?

Many farmers put the farming lifestyle as being more important to them than maximising profits. Many farms are also asset rich, with owner occupied farms averaging a net worth of £1.9m.

Many farmers are asset rich
52% of farm holdings in England are owner occupied and the average net worth of this group was around £1.93 million pounds in 2017/18. The average for this group has also increased by 28%, or £422,000, since 2013/14.

A further 21% of farm holdings are mixed tenure but mainly owner occupied and the net worth of these farms was almost £2.8 million in 2017/18, up 33% since 2013/14.

However, tenanted farms (14% of farm holdings) have fewer assets (e.g. machinery and livestock). Their average net worth was £289,000 in 2017/18, broadly similar to 2013/14.

Tenancy Type	Average net worth (£million)	Average total area (hectares)	Average owner occupied area (hectares)	% owned
Owner occupied	1.93	60	60	100%
Mixed - mainly owner occupied	2.77	135	105	78%
Mixed - mainly tenanted	1.41	145	35	24%
Tenanted	0.29	97	0	0%
All farms	1.91			

Please note: the data on net worth is taken from the Farm Business Survey which only samples from farms in England with a standard output of over 25,000 Euros and therefore will exclude smaller farms.

For many farmers profits are not their main motivation and many farm households are supported by off-farm income
Approaches to farming vary – some focus on the business, others on the lifestyle (individual and family heritage). In a survey conducted for Defra (in 2008) to understand different attitudes to farming, 93% agreed that the farming lifestyle is what they really enjoy and 91% agreed that maintaining environmental assets is a priority. This compares to 79% saying farming is about maximising profit.

Many farms are supported by income generated off farm, either from other family members or a second job, and for 40% of principal farmer households, the income received from non-farming sources exceeded the income received from the farm business.

What are Direct Payments and how much do farm businesses currently receive?

Direct Payments are an EU Subsidy paid to farm businesses based on the amount of agricultural land they maintain. In England in 2017, £1.775bn of payments were made across 85,000 farms and 10% of claimants received half of this total. 33% of farms received less than £5,000 each.

Under the EU's Common Agricultural Policy, it is often argued that Direct Payments are primarily justified as 'income support'. They are part of a policy framework where the stated goals are to: improve agricultural productivity; tackle climate change and manage resources sustainably; preserve rural areas and landscapes, and boost the rural economy. However, there is evidence to suggest these goals are not being achieved.

How are Direct Payments made up?

The **Basic Payment** is based on land area. Certain animal and public health, welfare and environmental standards must be met (known as Cross Compliance).

The **Greening Payment** (30% of total budget) is conditional on meeting certain broad requirements. Greening was meant to enhance the environmental performance of the Common Agricultural Policy (CAP), but a report from the European Court of Auditors concluded that the mechanism - as currently implemented - is unlikely to significantly enhance the CAP's environmental and climate performance.

Farmers aged under 40 can also claim a **Young Farmer** payment**,** although this makes up a very small portion of total payments.

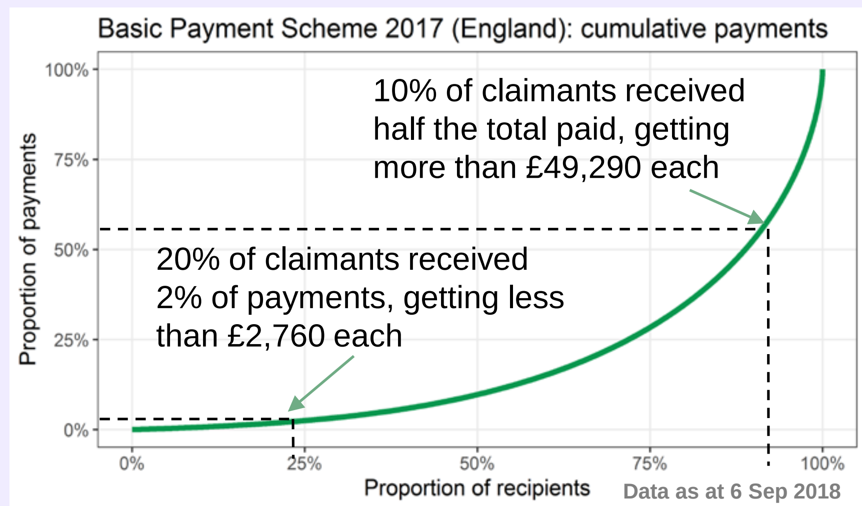
How much do Direct Payments cost?

£1.775bn	£70m	£9,590
total payments in England, 2017	Administrative cost per year in England	Median Payment in 2017 (half of recipients had less and half had more)

How are Direct Payments allocated?

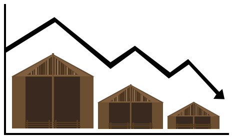
Farms must farm at least 5 hectares of land to qualify for Direct Payments, meaning many small farms are not eligible.

Recipients of the largest amounts are typically farms with large land areas. Of the total payments under the CAP, almost 50% is given to 10% of farms, while the bottom 20% of recipients receive just 2% of the total payments.



What is the rationale for removing Direct Payments?

Evidence suggests that Direct Payments offer poor value for money and inhibit the development of a productive and competitive agricultural sector that delivers optimal environmental outcomes. From 2021, Direct Payments will be phased out during a 7 year agricultural transition.



Undermine efficiency and productivity growth

Direct Payments are equivalent to a significant proportion of farm income for many in the industry. While payments are formally decoupled from production decisions, as a substantial subsidy to the sector, they likely create indirect channels through which they dampen the focus of some farms to seek out and adopt best-practice to optimise the profitability of their agricultural activity. In the long term, adopting best practice and embracing technological developments is key to improved productivity performance.

Direct Payments can also hold back structural change and exert upward pressure on land prices and rents. This makes it harder for some new entrants to join the sector and for more efficient farms to find land to expand. This process of some businesses entering or expanding, with others exiting, has long since been recognised as crucial to productivity growth across the economy (see p96 for more detail).

Untargeted Income Support

Direct Payments provide income support, but lack a system of means testing. Instead, the amount received is largely dependent on the land area of the farm, providing support to many high income households.

Fail to deliver optimal environmental outcomes

Around 30% of the Direct Payment depends on Greening, however a report into Greening from the European Court of Auditors concluded that the mechanism was unlikely to significantly enhance environmental and climate performance.

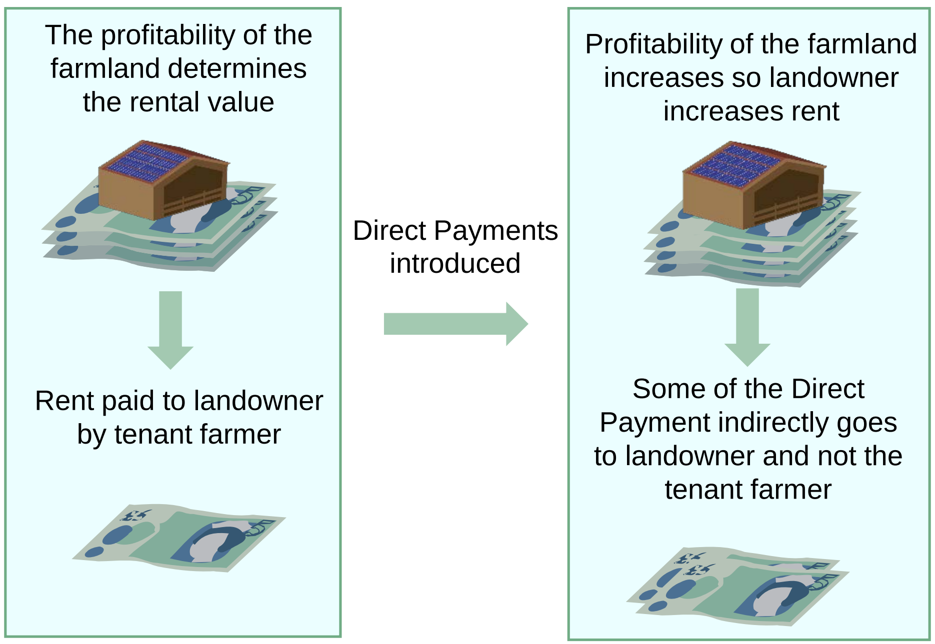
How have inflated farm rents impacted competition and how might the removal of Direct Payments change this?

There is evidence that Direct Payments inflate farm rents. 37% of the farmed area in England is rented and for those that rent all or part of their farm, any fall in rent would help to offset any reduction in Direct Payments.

Direct Payments have led to rent inflation

The introduction of Direct Payments increased the amount of money a farm could obtain from using that land, therefore increasing the expected agricultural return.

As a result of this, landowners who wanted to rent their land rather than farm it themselves were able to increase farm rents due to the increased return it provided. This means that some of the Direct Payment is indirectly paid to the landowner through inflated rent prices, rather than to the farm business:

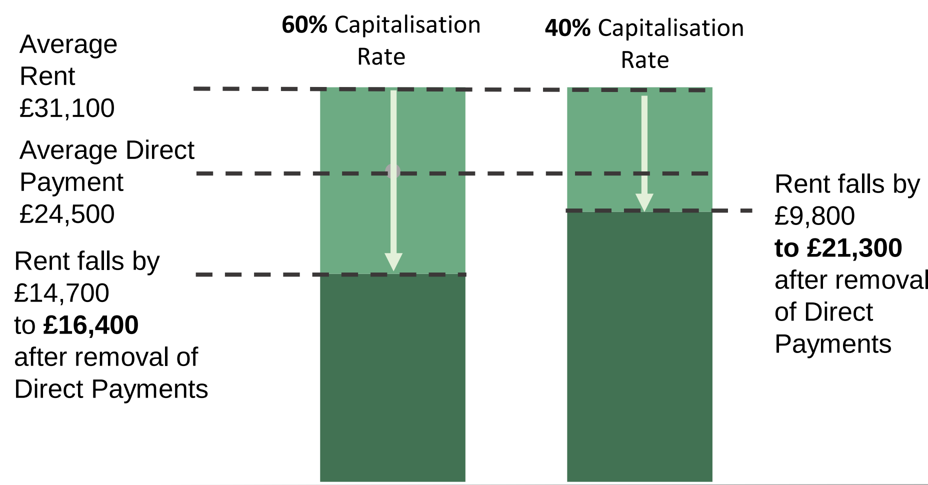


How might removing Direct Payments influence rent prices?

As Direct Payments have led to an increase in rents, their withdrawal will see the reversal of this impact. The capitalisation rate is how much each pound of subsidy inflates farm rents. Estimates of the capitalisation rate range widely and will vary depending on farm type and region, and so the extent to which rents have increased in relation to the subsidy will vary from farm to farm.

For illustrative purposes, the chart below uses the average Direct Payment and rent payments of wholly tenanted farms, between 2015/16 to 2017/18, to show how much rents may be reduced for capitalisation rates of 60% and 40%, using the following formula:

$$\text{Rent reduction after removal of Direct Payments} = \frac{\text{Capitalisation Rate x Direct Payment}}{100}$$

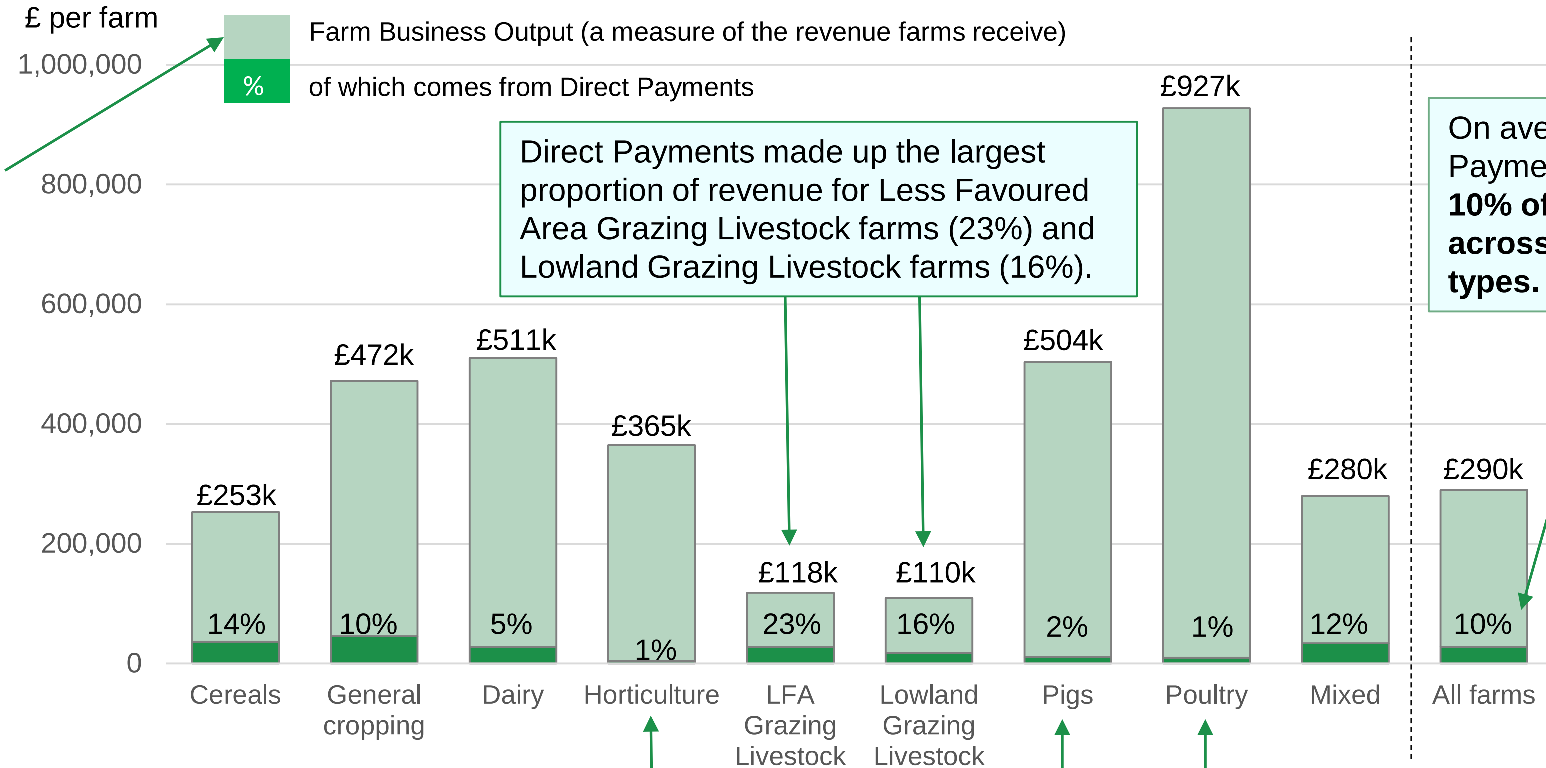


How does the contribution of Direct Payments to revenue vary by sector?

On average, over the period 2015/16 - 2017/18, Direct Payments made up 10% of revenue across all farm types. The importance of Direct Payments to revenue varies by sector, such as for Less Favoured Area Grazing Livestock farms, where they made up an average of 23% of total revenue.

Average Farm Business Output and the proportion that comes from Direct Payments by 2017 farm type (based on 3 year matched dataset 2015/16 to 2017/18)

Revenue (Farm Business Output) is the **total sales** generated by a farm business.



Direct Payments made up the largest proportion of revenue for Less Favoured Area Grazing Livestock farms (23%) and Lowland Grazing Livestock farms (16%).

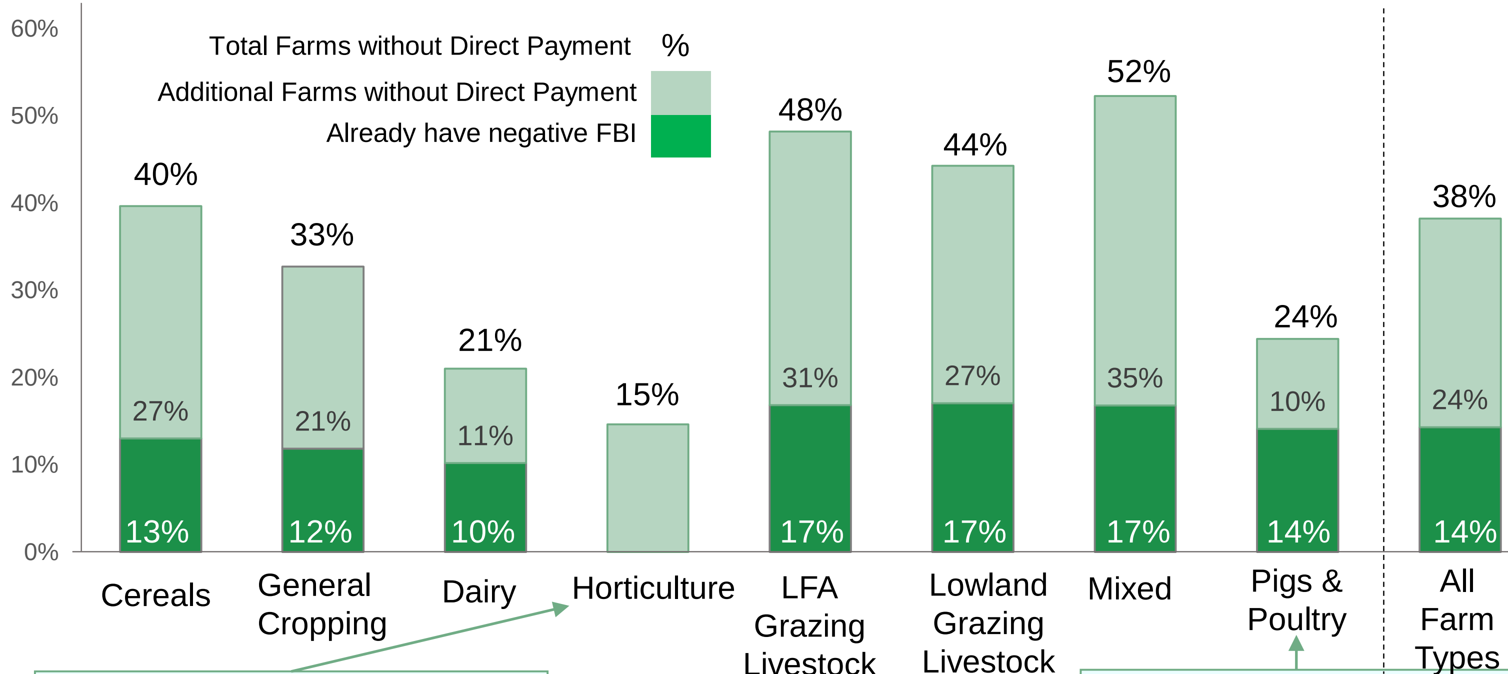
On average, Direct Payments made up **10% of revenue across all farm types.**

For Poultry, Horticulture and Pig farms, only a very small proportion of revenue comes from Direct Payments. Fewer of these farms claim Direct Payments than other farm types as they tend to be smaller, and are more likely to have land that is ineligible for Direct Payments.

How does the contribution Direct Payments make to farm profit vary depending on farm type?

Over the period 2015/16 to 2017/18, 14% of farms had costs exceeding their revenue including Direct Payments, and with Direct Payments excluded from accounts this rises to 38%. Mixed and LFA Grazing Livestock have the greatest additional proportion of farms with negative FBI with Direct Payments removed, with Pigs & Poultry and Dairy the least.

Proportion of farms with a negative FBI with and without Direct Payments by farm type, based on 3 year matched dataset 2015/16 to 2017/18



There are not enough farm businesses in the sample to show separately for horticulture.

Mixed and LFA Grazing Livestock have the largest additional number of farms with negative FBI. These farms are likely to have more land eligible for Direct Payments.

Pig & Poultry farms show the smallest increase in farms that would have a negative FBI without Direct Payments. These farms tend to be smaller in size, and are more likely to have land that is ineligible for Direct Payments.

For more information on how Farm Business Income is calculated see p54.

Long term vs. short term impacts of removing Direct Payments

Depreciation is used to account for declines in value of a tangible asset, by allocating it a cost over its useful life. It does not alter the day to day cash flow of a business.

However, depreciation needs to be considered in the long term, as farm businesses need to replace and maintain machinery and buildings.

Excluding both Direct Payments and depreciation, only 17% of farms would not have been able to cover production costs.

How profitable are farms without Direct Payments?

On average, with Direct Payments excluded from their accounts, over the period 2015/16 to 2017/18, for every £100 spent farm businesses made £107, meaning a profit of £7 per £100 inputs.

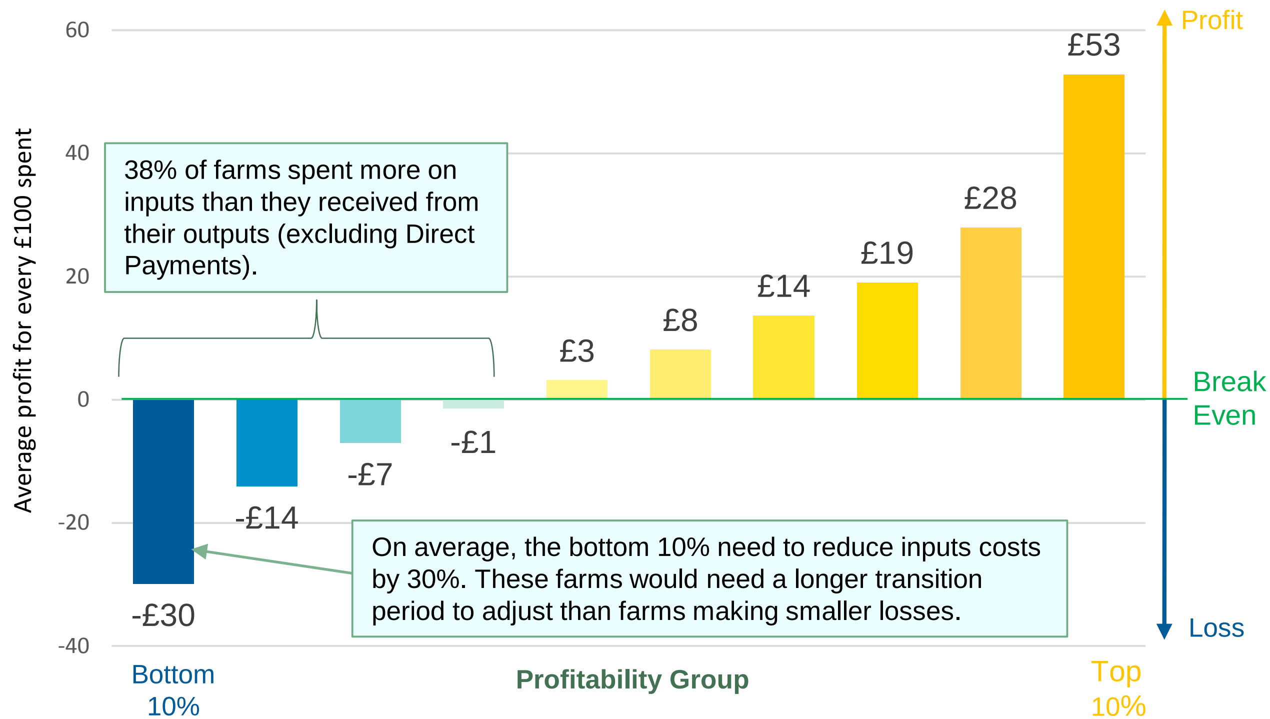
Farm Profitability (profit for every £100 inputs)

Profitability groups are defined by lining up farms in order of profitability from 1-100 (with 1st position being least profitable and 100th position being most profitable) and dividing these up into 10 groups, meaning that 10% of all farms fall within each group.

Farms with a greater profitability will produce more output for every £100 of input. Unlike farm performance, this measure does not include unpaid labour as a cost. On average across all farms, for every £100 spent, farms received £107 in outputs, making a profit of £7.

Most farms have the potential to be profitable. However, when looking at farm profitability by farm characteristic (such as farm type, economic size, land ownership status and farmer age), some characteristics are more prevalent in the bottom 10% than the top 10%. For example, 67% of farms in the bottom 10% are Grazing Livestock or Mixed farms compared to 33% in the top 10%.

Average profit for every £100 spent by profitability group (2015/16 to 2017/18) excluding Direct Payments.



Farm characteristics of the top 10% and bottom 10%

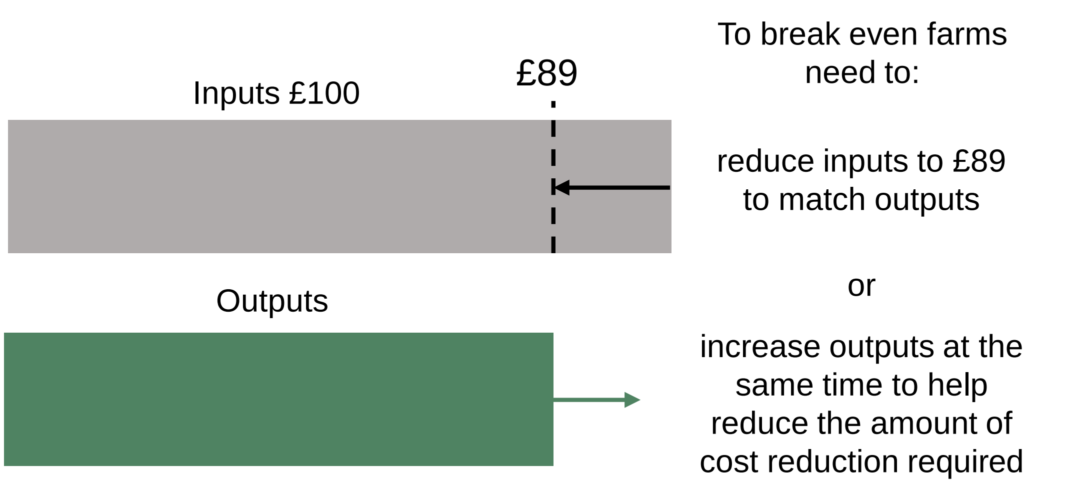
	are Grazing Livestock or Mixed farms	very small economic farm size	are wholly tenanted	are aged at least 65 (farmer)
Top 10%	33%	40%	5%	33%
Bottom 10%	67%	54%	17%	38%

How much would loss making farms need to reduce costs by in order to break even without Direct Payments?

On average, farms who would have made a loss without Direct Payments in their accounts had £89 in outputs for every £100 they spent on inputs. In order for them to break even without Direct Payments they would need to reduce their costs by 11% to £89 to match their output, or increase output as well as reducing costs.

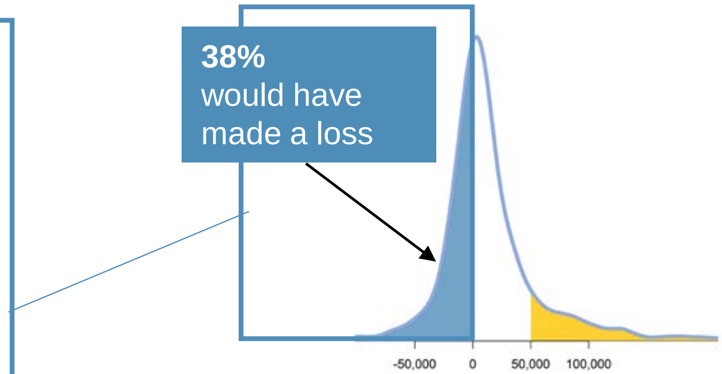
Improvements to break even based on cost reductions alone might be beyond some farms. Other routes to breaking even include maximising prices received for outputs, or undertaking a diversified activity (see page 84).

Average adjustment required to break even without Direct Payments



The average adjustment required to break even masks a wide range of adjustments needed. For the bottom 10% of farms by profitability, their average cost reduction would be three times larger than the overall average, requiring a 30% reduction in costs (see page 70).

Distribution of all farms by Farm Business Income (2015/16 to 2017/18) without Direct Payments, with depreciation



Volatility and Profitability

Of those farm businesses who made a loss on average over the period 2015/16 to 2017/18, when looking at individual years, not all farm businesses made losses every year.

In some cases, farms may have made a loss only in one year because they unexpectedly lost output, for example through disease. In these instances returning to average levels of output may see them return to profit rather than necessarily needing to reduce costs.

How much would different loss making farm types need to reduce costs by in order to break even without Direct Payments?

Loss making Grazing Livestock in Less Favoured Area farms have the biggest challenge in reducing costs to break even. Half of these farms require cost reductions of less than 15% and half require cost reductions of more than 15%, based on the period 2015/16 to 2017/18.

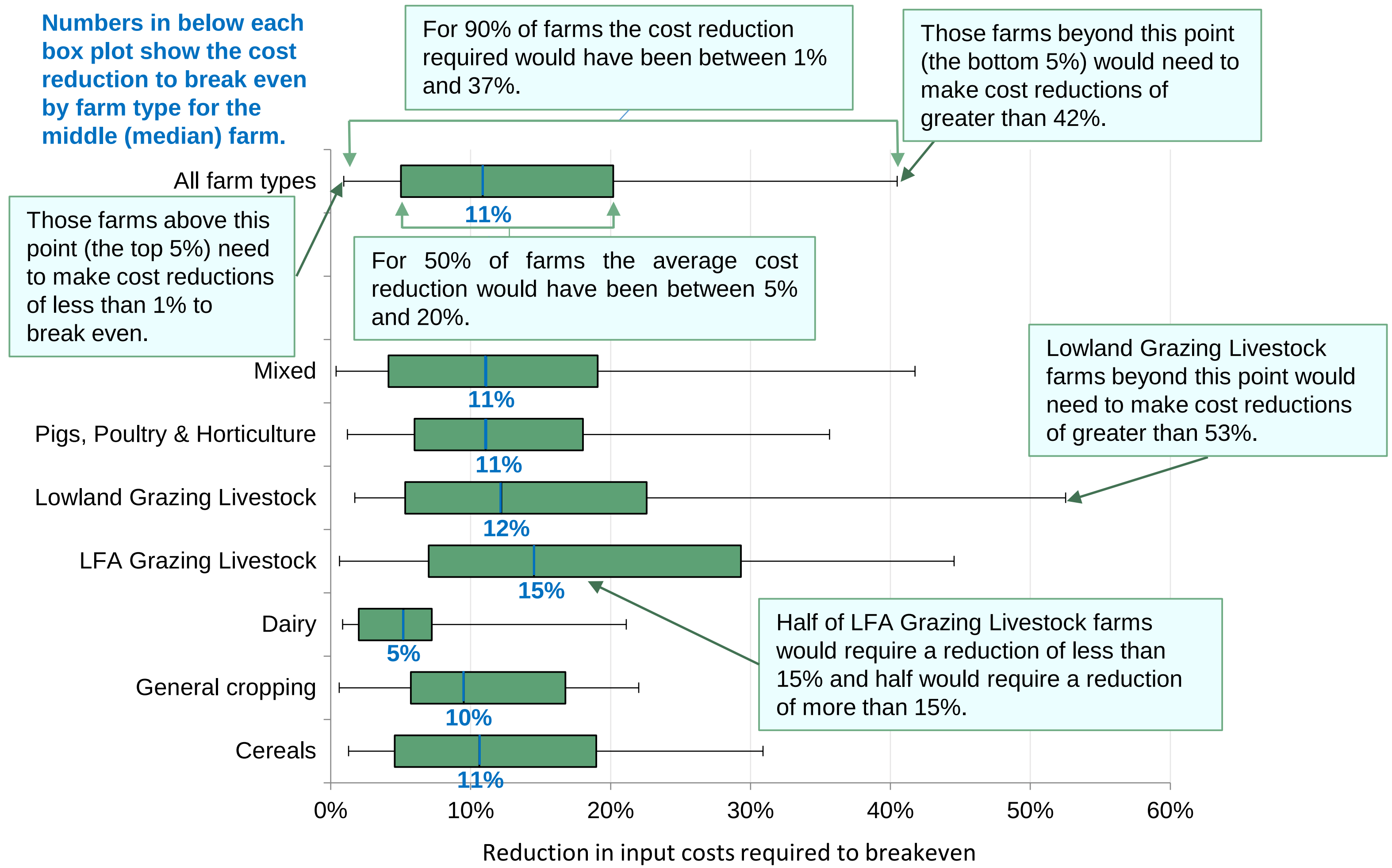
This chart shows the wide range of cost reductions required to break even by those farms that would have made a loss without Direct Payments over the period 2015/16 to 2017/18.

The line within the middle of each box shows the cost reduction required by the middle (median) farm: half of farms require a cost reduction less than this value and half require a greater cost reduction.

The median values are shown in brackets for all farms and for each farm type. Across all farms, half of those effected would require a cost reduction of less than 11% and half above 11%.

Farms can also reduce costs in conjunction with increasing their output.

Reduction in costs needed to break even without Direct Payments by loss making farm type, based on data 2015/16 to 2017/18



How do farmers/farm businesses feel about the agricultural transition and the future of farming?

During 45 farmer-led discussion groups undertaken by Defra over the last 18 months farmers demonstrated they are keen to help shape the future of farming. Most recognised the need for change and identified both opportunities and risks.

During farmer-led discussion groups…

Many farmers told us they would prefer to farm without direct support and that the removal of direct payments in itself is not a threat to business survival as long as issues affecting farm profitability are also addressed.

Most farmers also stated a commitment to environmental management and a willingness to participate in new schemes that provide real economic value.

Farmers recognise the need for a period of adjustment but clearly state the importance of clarity throughout the transition period. This includes not just issues such as the trajectory of direct payment decline but also standards and market equivalence, tariffs and environmental payments.

In a survey of 1000 farmers undertaken alongside the 45 discussion meetings, most were confident that their business could adapt to the changes ahead.

However whilst there was a high degree of confidence in some sectors i.e. around three-quarters of dairy and pig businesses, confidence amongst those in upland grazing was relatively low with less than 4 in 10 farmers positive.

For those farmers not confident, the top three reasons were uncertainty over prices and trade; uncertainty over policy direction and the business was already under financial pressure.

'No-one owes us a living'

'BPS is wrong - propping up inefficiency'*

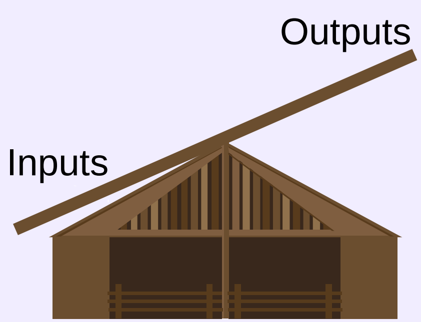
'evolution not revolution'

How are we going to be monitoring changes during the transition?

As well as continuing with farmer-led discussion groups, we will be developing a survey to be undertaken within farmers through the transition period to understand the impacts of change.

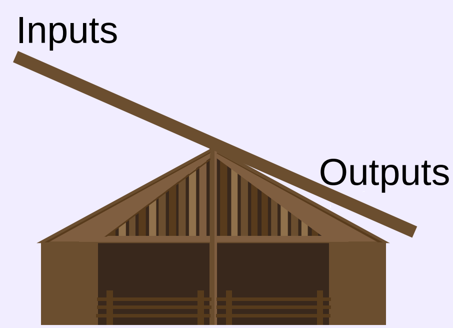
*Basic Payment Scheme (Direct Payments)

Farm performance



Current Farm Performance

Pp75-78



Routes to improving performance

Pp79-83

How does economic performance vary between the highest and lowest performing farms in England?

Across all farms types in England in 2017/18, the average performance of the top 25% of farms was 1.8 times better than the bottom 25%. The largest gap was among horticulture and grazing livestock farms, and smallest within poultry and dairy.

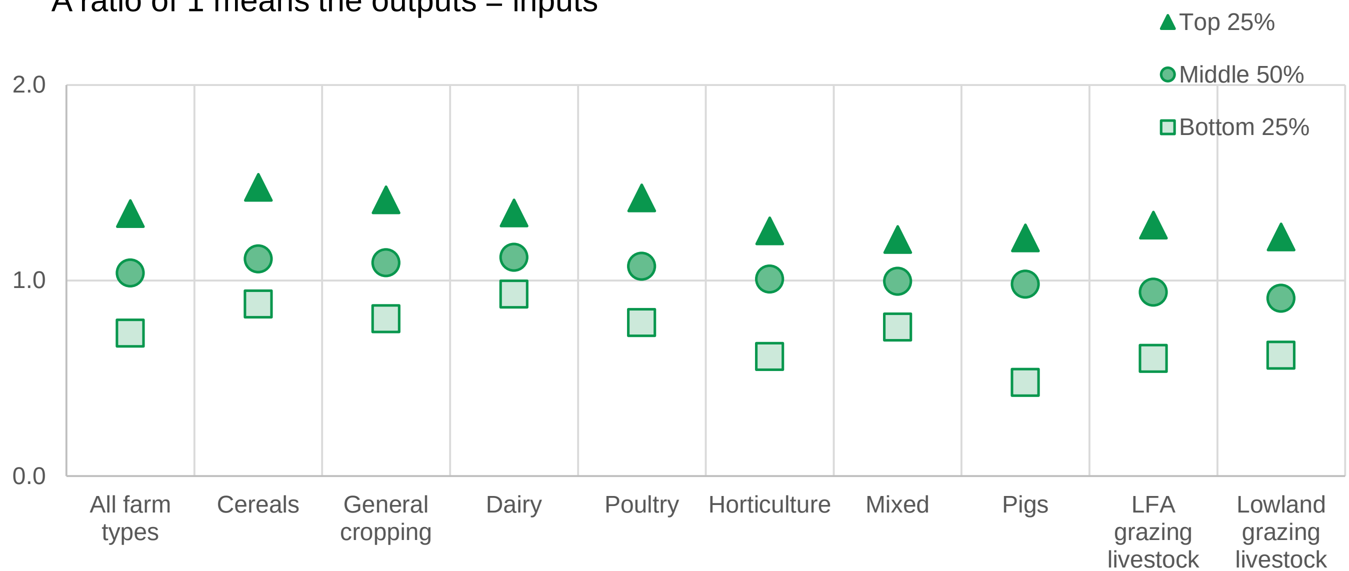
For the top 25% of farms across each sector, cereal farmers had the best average performance with outputs 50% higher than their inputs in 2017/18.

Comparing average economic performance of the top 25% of farms to the bottom 25% of farms shows the largest performance gap was among pig, horticulture and grazing livestock farms.

If the bottom 25% of farms improved to become more in line with the average then productivity for the whole sector would increase.

Ratio of the average output costs and average input costs for whole farm business for the top 25% of farms, middle 50% (25%-75%) and bottom 25% of farms, 2017/18

A ratio of 1 means the outputs = inputs



Ratio of economic performance, top 25% vs bottom 25%:	All farm types	Cereals	General cropping	Dairy	Poultry	Horticulture	Mixed	Pigs	LFA grazing livestock	Lowland grazing livestock
	1.8	1.7	1.8	1.4	1.8	2.1	1.6	2.5	2.1	2.0

Farm Business Income (FBI) is calculated as the **difference** between Farm Business Outputs and Farm Business Inputs. It does not deduct the cost of unpaid labour. When calculating **farm economic performance**, unpaid labour is included as a cost. This allows a fairer comparison between farms with employees and those that use unpaid (often family) labour.

How does the economic size of a farm affect its performance in England?

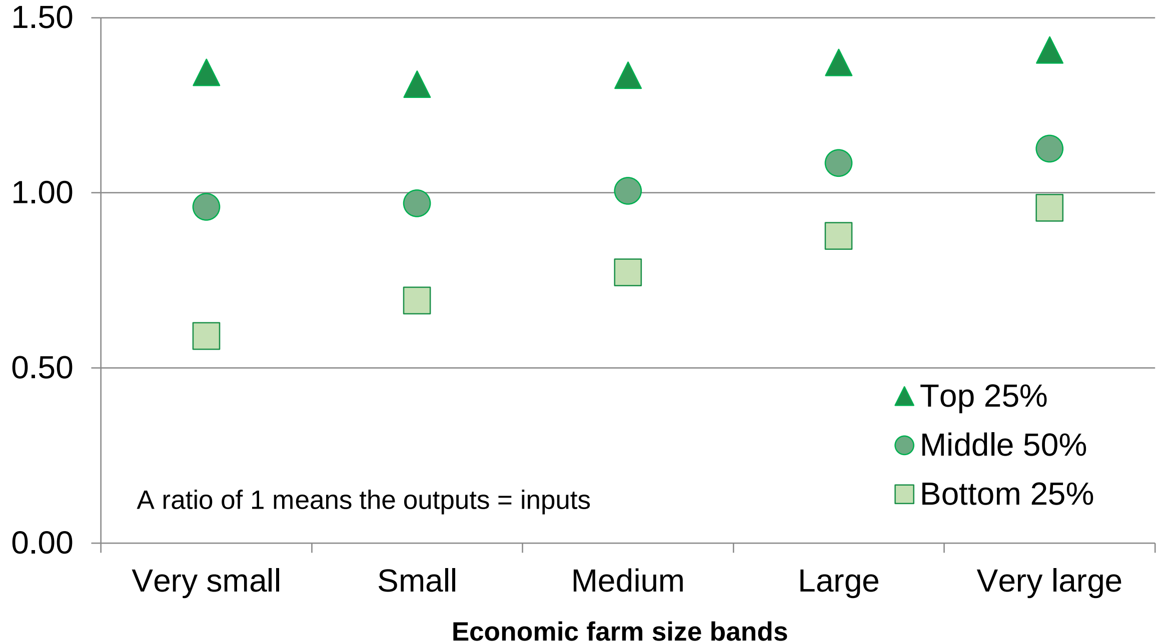
In England in 2017/18, the highest performing 25% farms have a similar level of performance regardless of farm size. However, the gap between the top and bottom 25% is greater for smaller farms.

Very small farm businesses show the largest difference in performance between top 25% and bottom 25%, but the average performance of the top 25% is similar to larger farms.

Farm sizes are based on the estimated Standard Labour Requirements (SLR) for the business, not its land area.

SLR is defined as the theoretical number of workers required each year to run a business, based on its cropping and livestock activities. For more information on how SLR is defined see p56.

Ratio of the average output costs and average input costs for whole farm business for the top 25% of farms, middle 50% (25%-75%) and bottom 25% of farms by economic size, 2017/18



Ratio of economic performance, top 25% vs bottom 25%:	Very small	Small	Medium	Large	Very large
	2.3	1.9	1.7	1.6	1.5

Farm Business Income (FBI) is calculated as the **difference** between Farm Business Outputs and Farm Business Inputs. It does not deduct the cost of unpaid labour. When calculating **farm economic performance**, unpaid labour is included as a cost. This allows a fairer comparison between farms with employees and those that use unpaid (often family) labour.

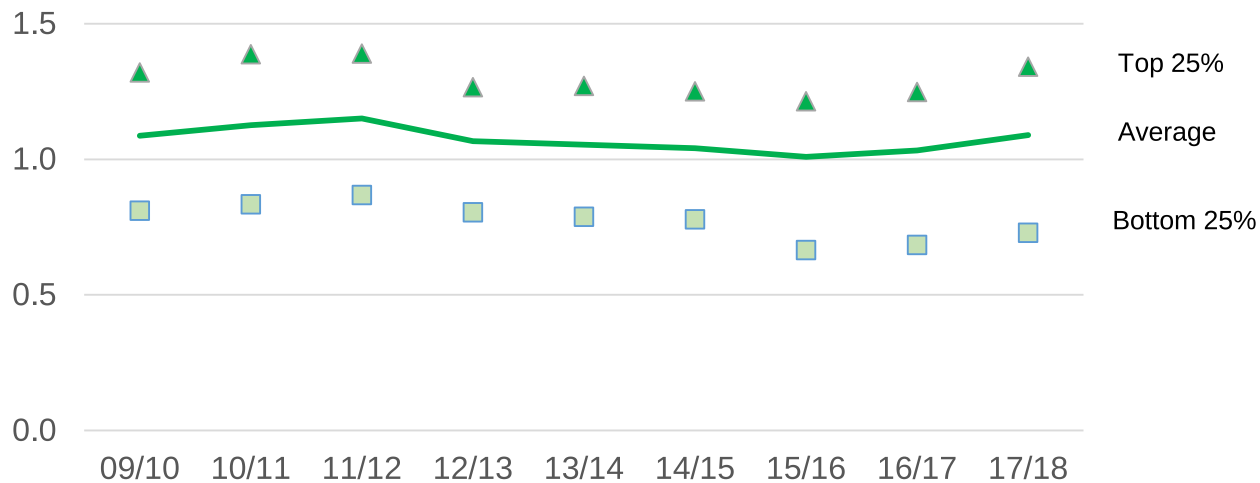
How has economic performance of all farm businesses changed between 2009/10 and 2017/18?

Average performance has changed little since 2009/10 for the business as a whole. The difference between the top 25% and bottom 25% has grown very slightly.

The average performance at the farm business level has changed little since 2009/10.
The difference in performance between the top and bottom 25% of farm businesses has grown since 2009/10.

Farm business performance

If performance ratio = 1, then value of outputs = value of inputs
Over 1 indicates a profit and under 1 indicates a loss



Ratio of economic performance, top 25% vs bottom 25%:	1.6	1.7	1.6	1.6	1.6	1.6	1.8	1.8	1.8

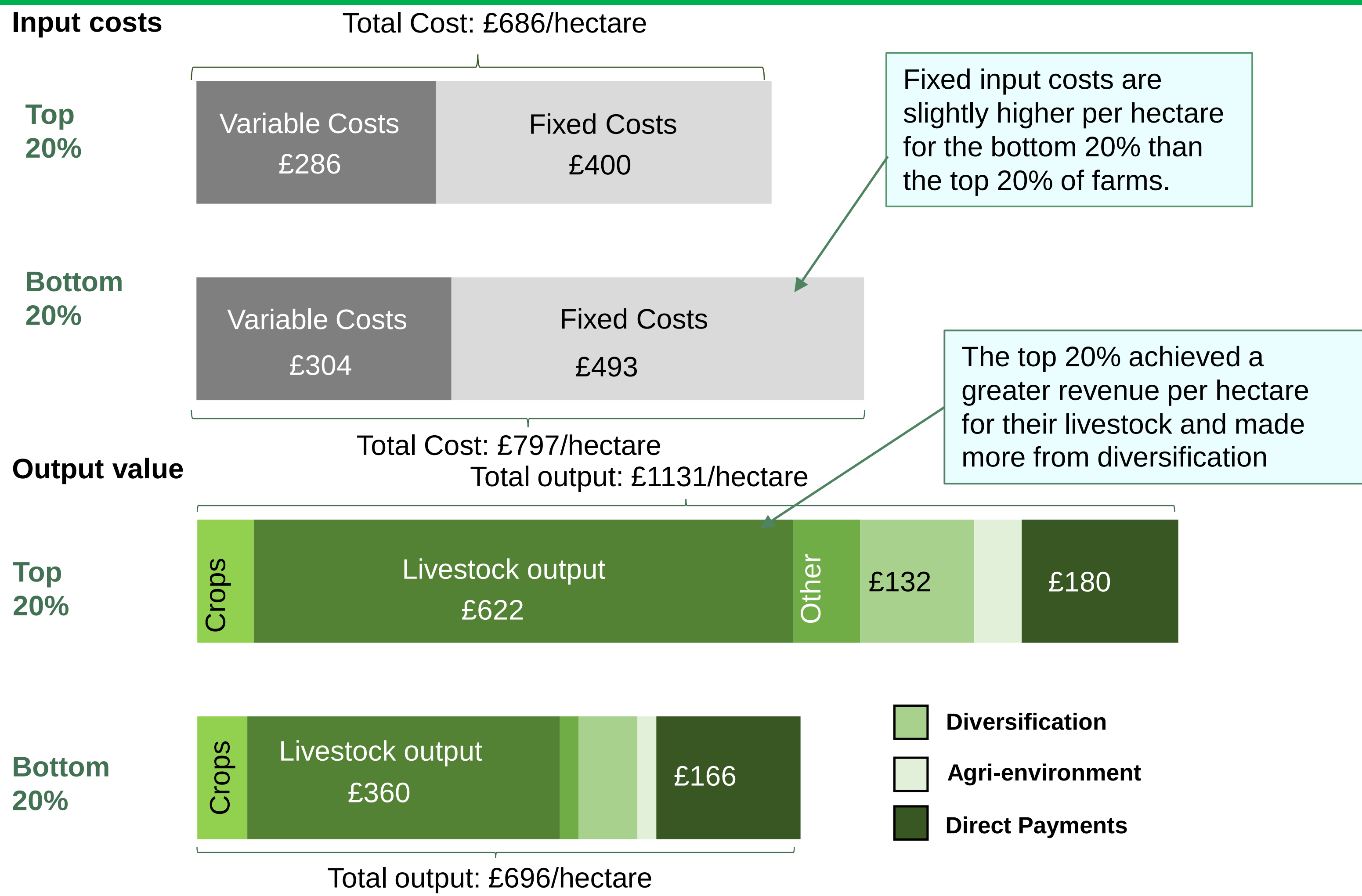
Farm Business Income (FBI) is calculated as the **difference** between Farm Business Outputs and Farm Business Inputs. It does not deduct the cost of unpaid labour. When calculating **farm economic performance**, unpaid labour is included as a cost. This allows a fairer comparison between farms with employees and those that use unpaid (often family) labour.

Why does agricultural performance vary so widely and how can lower performing farms improve performance?

Differences achieved in input and outputs values is one reason for differences in farm performance. As a result of differences in input and output values achieved, for every £100 spent by Lowland Grazing Livestock farms, those in the top 20% made on average £165 compared to £87 for farms in the bottom 20%.

Differences in inputs costs can be due to inefficient use of inputs, differences in farming system and management, and the resource efficiency of crops and livestock on the farm. Our research shows that where beef animals of the same breed were reared in different sized groups the feed intake required to obtain the same growth rate varied considerably, by up to 23%.

Differences in outputs achieved may be due to system design, impacts of pests and diseases, and the yield potential of crops and livestock grown on the farm. For example, diseases such as Bovine Viral Diarrhoea can reduce milk outputs by 10% to 20% (see p81)



What are the routes to improving farm performance?

Routes to improving farm performance include reducing inputs, such as by feed efficiency or nutrient management, maximising the value of outputs by improving animal and plant health or the marketability of outputs, or alternative routes such as diversification.

Reducing Inputs

Monitoring Input Use
Crop and livestock inputs represent 84% of variable costs to farms, which may be reduced by improving feed efficiency, selective breeding of animals and/or following a detailed crop nutrient management plan (p80).

Controlling Livestock and plant disease can help farmers to reduce input costs, such as veterinary medicines or plant protection products (p81 and p82).

Efficiency Improvements/Reducing Input Costs

There are often large variations in input costs for farms (see p78). Some aspects of this may be outside of a farmers control, such as transport costs (delivery and collection) being higher for farms in more remote areas .

In some circumstances, farm businesses can work together to create a purchasing cooperative for greater buying power. Cash flow will impact on the ability to do this as some farm businesses may not have the capital to buy in advance.

Increasing Outputs

Improving Animal & Plant Health

Poor animal and plant health can decrease productivity and increase emissions, such as greenhouse gases, associated with production. (p81 & p108)

Improving Marketability of Outputs

Farms can maximise their outputs by responding to the market, such as by ensuring their outputs conform to processor safety requirements and quality specifications, therefore reducing wastage and increase prices achieved (p83).

Business Management Practices

Whilst reducing inputs and maximising outputs could help offset the reduction of subsidies, business management practices could also be used to make improvements (see p93).

Alternative Options

Diversification
Between 2015/16 to 2017/18, for the 71% of farms that had diversified, the average additional income from diversification was £18,700 in 2017/18 (p84).

Environmental Land Management System (ELM)
Farms may be able to use some of their agricultural land, in particular the less productive land, to deliver environmental benefits through a new ELM system (p117).

The ability to diversify will depend on the characteristics and location of the farm. If more farms diversify, this would increase the supply and thus in turn may lower the return to the farmer.

How can better input management help to reduce variable costs?

Crop and livestock inputs represent 84% of variable costs to farms. Costs can be reduced by practices such as improving feed efficiency, selective breeding of animals and/or following a detailed crop nutrient management plan developed with a qualified advisor.

Reducing livestock costs

Feed Efficiency

Animal feed is expensive for farmers, and inefficient conversion to a product for human consumption (meat, eggs and dairy) is costly. The feed conversion ratio (FCR) is the amount of feed required to produce 1kg of live weight. Since 2010, FCR has improved for poultry and pigs, indicating greater feed efficiency and increased productivity in these sectors (see p98).

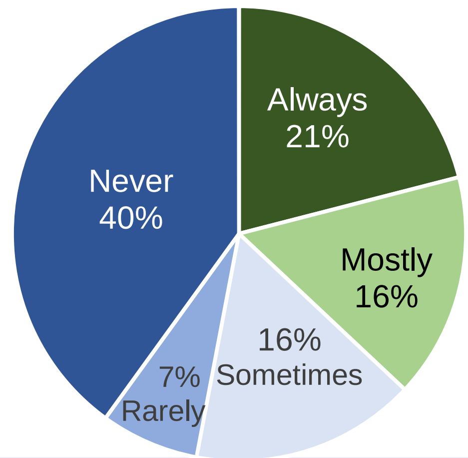
Choosing the most appropriate feeds and ensuring the right balance of protein and nutrients can help farmers reduce costs and optimise production.

Breeding

Selecting traits in livestock can improve productivity and efficiency. Estimates from the Beef Feed Efficiency Programme suggest profits could increase by 40% if feed efficiency was incorporated into breeding programmes.

The estimated breeding value (EBV) measures the genetic worth of an animal for traits like meat production. However, in 2018 nearly half of holdings rarely or never used bulls with high EBV when breeding beef cattle.

% holdings using bulls with high EBVs when breeding beef cattle in 2018



Reducing crop costs

Nutrient Management

Farmers need to make advance decisions on input use, without having information on the conditions, future yield or the price that the product will be sold at. Because of this, farmers may use standardised quantities (e.g. as recommended within RB209 fertiliser manual), or apply excessive amounts to try and secure a better yield. Excessive use of inputs reduces profits as the cost of using more than is optimal may exceed the revenue gained. Nutrient excess also contributes to poor water and air quality, as well as GHG emissions. Farmers can optimise inputs so every unit of input increases profit.

Nutrient management practices like taking soil type, climate and crop demands into account could reduce the amount of fertiliser needed, reducing costs. However, nearly

1/2

of holdings do not have a nutrient management plan.

The majority of holdings spread manure, slurry or fertilisers, and limiting the use of nitrogen rich fertilisers to economically efficient levels can save money. However,

1/3

of relevant holdings do not have a manure management plan.

Measuring soil fertility allows farmers to determine the type and amount of fertiliser that needs to be applied, minimising unnecessary fertiliser application. However, nearly

1/3

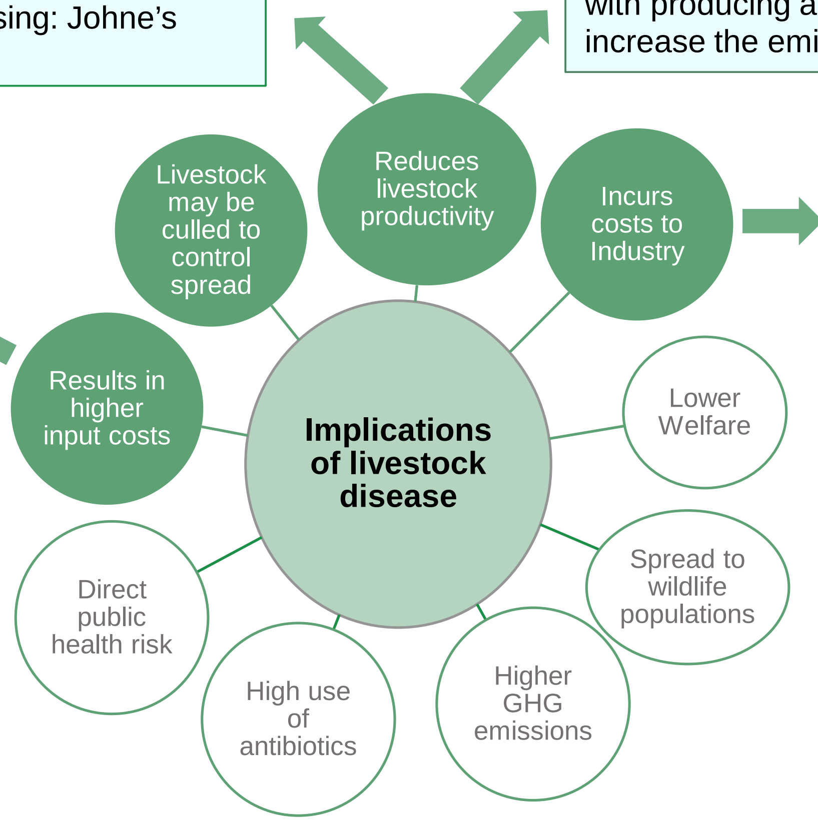
of relevant farms do not test the nutrient content of their soil.

How can controlling livestock disease improve farm economic performance?

Controlling livestock diseases can help reduce inputs costs, such as veterinary medicines, and allows farmers to maximise outputs. Annual cost estimates for the English industry due to sheep scab, bovine diarrhoea and porcine reproductive respiratory syndrome alone amount to around £90million.

In 2011, Defra and its stakeholders identified 10 endemic cattle diseases in the UK estimated to have the greatest impact on cattle production, with the top three in terms of impact encompassing: Johne's disease, salmonella and BVD.

In 2015, a Defra funded life-cycle analysis found that compared to healthy animals, infection with such diseases can increase the GHG emissions associated with producing a unit of milk by up to 25% and can increase the emissions for a unit of beef by up to 130%.



Sheep scab	£17mn/year
Bovine Viral diarrhoea	£34mm/year
Porcine Reproductive & Respiratory Syndrome	£38mn/year

The total cost of Vets and medicine in 2017/18 in England was £248.8million.

Reducing the occurrence of disease in livestock positively benefits animal welfare and can help to reduce greenhouse gas emissions.

For more information relating to these animal welfare and environmental benefits please see p108.

Why is it important to protect plants from pests and diseases?

The economic, social and environmental value of crops, forests and horticulture was estimated to be around £9bn per year in 2018. Targeted and proportionate prevention and control of invertebrate pests and fungal diseases reduces reliance on agrochemical inputs.

Public Goods Impacts

Plants provide a wide range of benefits to the public, such as air filtration.

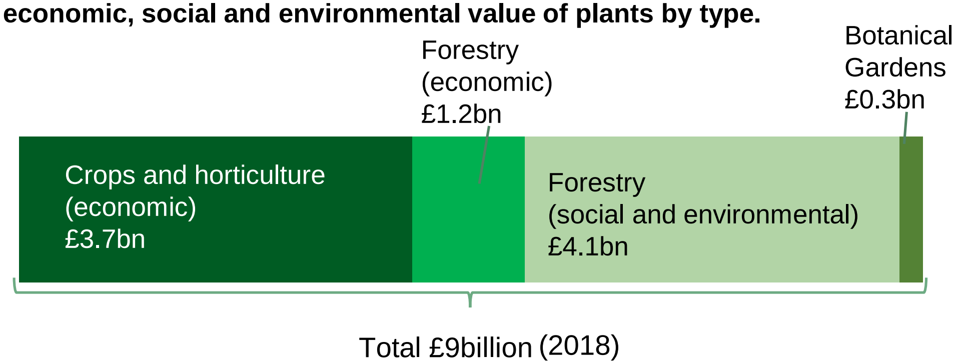
Damage to plants from pest and diseases may decrease this value, and disease eradication can be costly to the taxpayer if not undertaken promptly.

Productivity Impacts

Disease outbreaks result in a loss of commercial value and costs to landowners, farmers and foresters through productivity losses.

For example, **5-20%** annual loss of UK cereal productivity is caused by pests and pathogens.

The economic, social and environmental value of plants by type.



This partial estimate of the benefits to UK society incorporates economic value with carbon sequestration, air pollution absorption, recreation, biodiversity and landscape value.

It excludes many elements that cannot easily be monetised, so will underestimate the total value.

For more information on the economic, social and environmental value of forests see p106.

How can plant pests and diseases be prevented?

Government and industry help protect this value by **preventing disease outbreaks** and addressing them as quickly and effectively as possible if they arrive:

- There are systems in place to prevent pests and diseases on commodities reaching the border (e.g. through sharing information across countries on disease risks), at the border (e.g. document/physical checks) and through surveillance inland (including inspections).
- We work collaboratively with landowners to remove diseased trees/pest reservoirs to limit the damage and costs they experience when an outbreak occurs.
- Defra's R&D invests in integrated crop breeding programmes to improve the productivity, sustainability and resilience of UK crops as part of its Genetic Improvement Networks and also explores approaches to developing integrated pest management strategies. This all aims to improve resistance to, and control of, priority pests and diseases to reduce reliance on agrochemical input (see p99 for more information)

How can farms maximise their outputs?

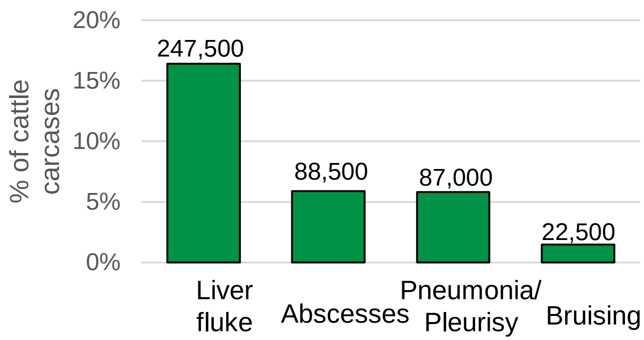
Farms can maximise their outputs by responding to the market, such as by ensuring their outputs conform to processor safety requirements and quality specifications, therefore reducing wastage and increase prices achieved.

Safety requirements

Farm businesses can maximise their returns by minimising the loss of saleable products.

Livestock sold for slaughter must be fit for human consumption. Anything that doesn't meet safety requirements will be rejected, resulting in reduced returns and possible non-payments to farmers. Many losses are avoidable through disease management and welfare practices. For example, liver fluke (parasitic worms) can be avoided through vaccination programmes and bruising avoided through taking greater care of animals during transit.

Main causes for rejection in English red meat slaughterhouses in 2017



Losses can also be avoided in other sectors. For example, knowing the hygiene requirements of a dairy contract can avoid hygiene deductions, and following protocols to ensure mycotoxin levels are low enough in cereals can ensure standards are met.

Understanding the market

Meeting quality specifications can maximise the price of the product.

Abattoirs require animals that satisfy certain fat and weight specifications to meet consumer demands. However, **49% of prime beef fails to meet target market specifications**. Knowing the market means that cattle of the appropriate breed, weight and specification can be reared to maximise returns.

Securing more favourable contracts may help maximise prices paid or highlight problematic clauses, to ensure the farmer gets the best deal. Dairy contracts, for example, can have different standards for fat and protein levels, affecting the price by up to 0.75p/litre.

Crop loss at harvest, out-graded material and spoilage in storage accounts for 2-25% of yield. Losses can be avoided by investing in machinery to minimise potato damage, or ventilation systems to improve grain drying.

Greater transparency in the food chain increases information flow, enabling farms to better respond to market signals and increase efficiency. This could be through **vertical integration,** where a farm business becomes involved in the processing, retailing or catering of their produce. Alternatively, seeking feedback from processors can help farms monitor and improve.

How can diversification help to increase farm profitability?

Between 2015/16 to 2017/18, half of farms (54%) in the bottom 10% by profitability undertook a diversified activity, compared with three quarters (77%) in the top 10%. Of those farms that had a diversified activity, the bottom 10% made, on average, £31/ha, compared with £137/ha for farms in the top 10%.

1/3rd

Of farms did not undertake some form of diversified activity in 2017/18

£18,700

Average income from diversification for farms that diversified in 2017/18

Farms that have not yet diversified may be able to improve their income by undertaking diversified activities. However, the ability to diversify will depend on the characteristics and location of the farm.

For those farms that had diversified, the average additional income from those activities was £18,700 in 2017/18.

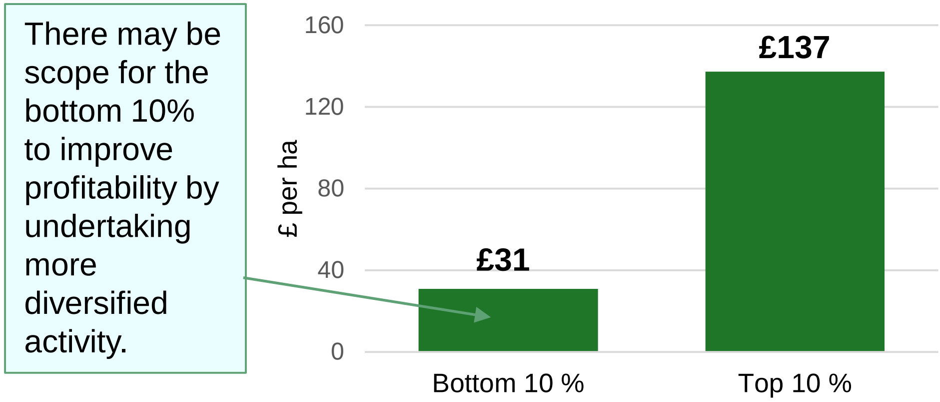
For around a quarter (23%) of these businesses, the income from diversification was higher than the income from the rest of the farm business.

Supply and demand may also affect the profitability of the activity. For example, if more farms diversified into tourism this would increase the supply and may in turn lower the return to the farmer.

Differences in diversified activities by farm profitability

A greater proportion of farms in the top 10% by profitability (77%) undertook a diversified activity compared to the bottom 10% (54%) between 2015/16 and 2017/18. There was little difference in the type of diversified activity undertaken by farms in these two groups. However, those in the bottom 10% made on average £31/ha, compared with £137/ha for farms in the top 10%.

Profit from diversified enterprises by farm business profitability group



What are Diversified activities?

Diversified activities are non-agricultural work of an entrepreneurial nature on or off farm, but which utilise farm resources. This includes letting buildings for non-farm use, the processing or retailing of farm produce, sport and recreation, tourist accommodation and generating renewable energy (see p63 for a more detailed breakdown of this).

UK Agricultural productivity

Current state and International comparisons

Pp86-89

Drivers for improving productivity

Pp90-96

Agricultural Research and Development

Pp97-100

What is productivity and how has UK agricultural productivity changed over time?

Productivity is a measure of the efficiency with which businesses turn inputs into outputs, indicating the economic competitiveness of a sector. Total factor productivity (TFP) in agriculture has increased by 53% since 1973 (1% per year), due to a 36% increase in outputs and a 12% decrease in inputs.

Productivity improves if the same use of inputs produces a larger volume of output*, or if the same volume of output is achieved from a smaller volume of inputs. The two main ways of measuring this are:

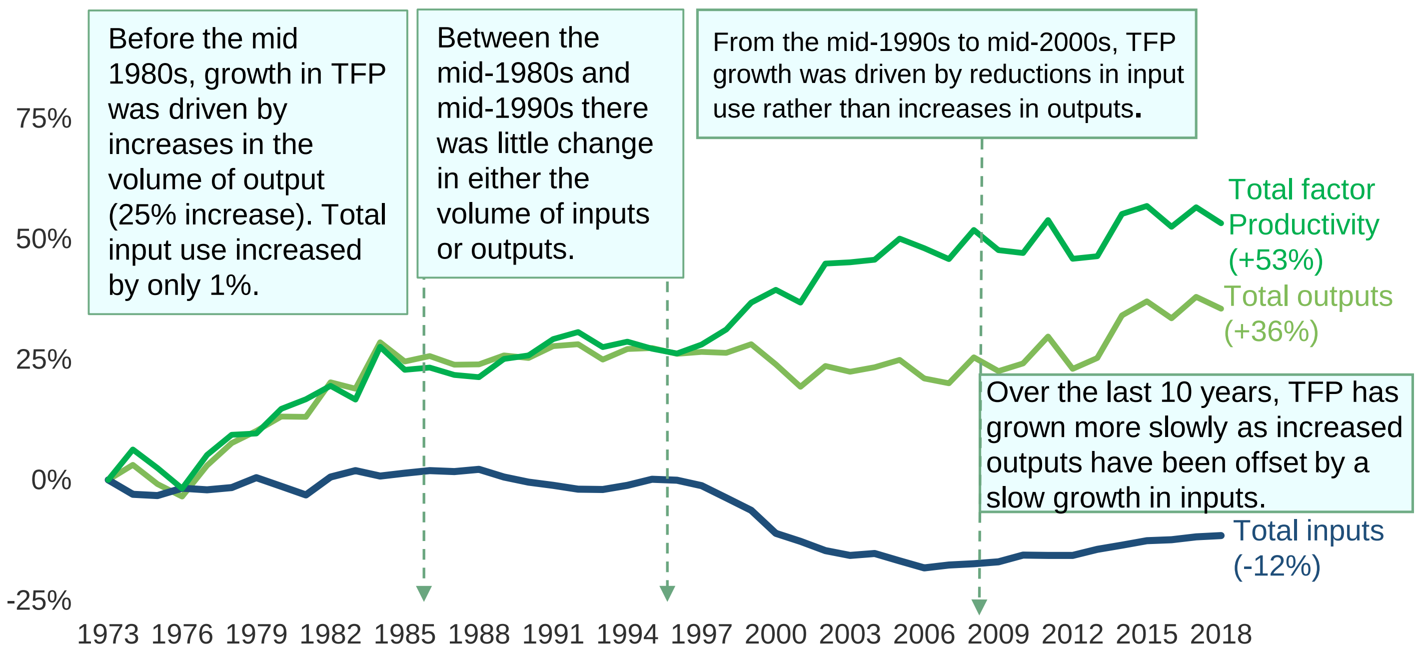
Total Factor Productivity (TFP) is a measure of how well agriculture turns inputs into outputs

$$\text{TFP} = \frac{\text{total volume of agricultural outputs}}{\text{total volume of agricultural inputs}}$$

Labour Productivity (LP) is a measure of the average output produced by each unit of labour.

$$\text{LP} = \frac{\text{total output (by volume or value)}}{\text{total volume of labour inputs}}$$

Change in agricultural inputs*, outputs and total factor productivity since 1973 (%)



*For more information on inputs and outputs see p53 and p54.

How do farmers view productivity?

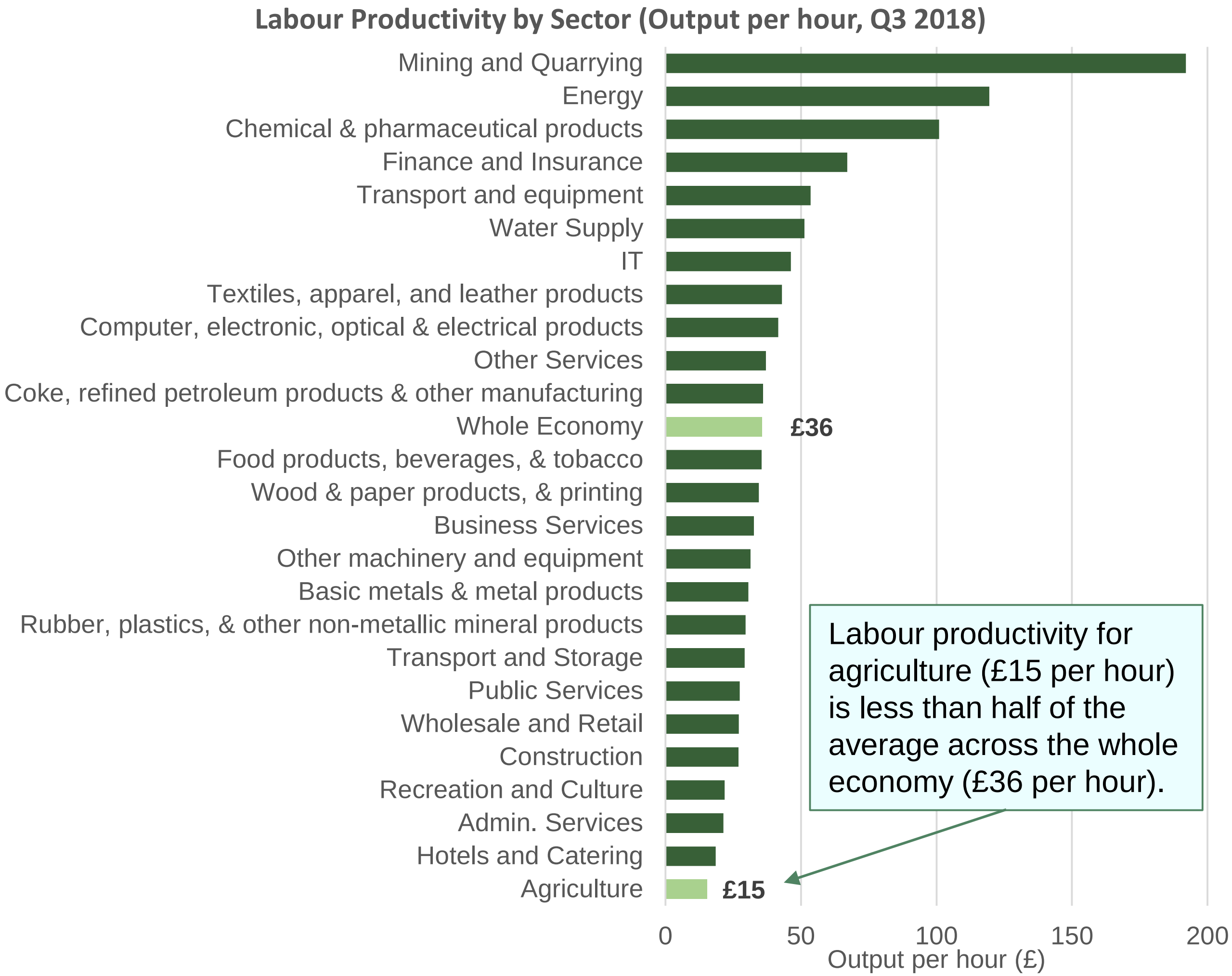
From an economic perspective, improving productivity in the agricultural sector increases the productive capacity of the economy, leading to economic growth and improved international competitiveness.

Farmers taking part in discussion groups understood ‘productivity’ to relate to profitability rather than its economic definition, and view productivity as part of their objectives for business growth and sustainability. The importance assigned to productivity depends on whether farmers’ motivations are closer to profit and business growth, or lifestyle and environmental stewardship.

Productivity and the environment - Reducing input use by using more efficient production systems improves productivity, in addition to providing beneficial environmental outcomes from reduced use of natural resources and other inputs (see p98 and p100 for more information).

How does agricultural productivity compare to other sectors in the UK economy?

In 2018, the agriculture sector had an average labour productivity of £15 output per hour, the lowest figure of all sectors and £20 less per hour than the average for the whole economy (£36).



Labour Productivity (LP) is a measure of the average output produced by each unit of labour.

$$\mathbf{LP} = \frac{\text{total output (by volume or value)}}{\text{total volume of labour inputs}}$$

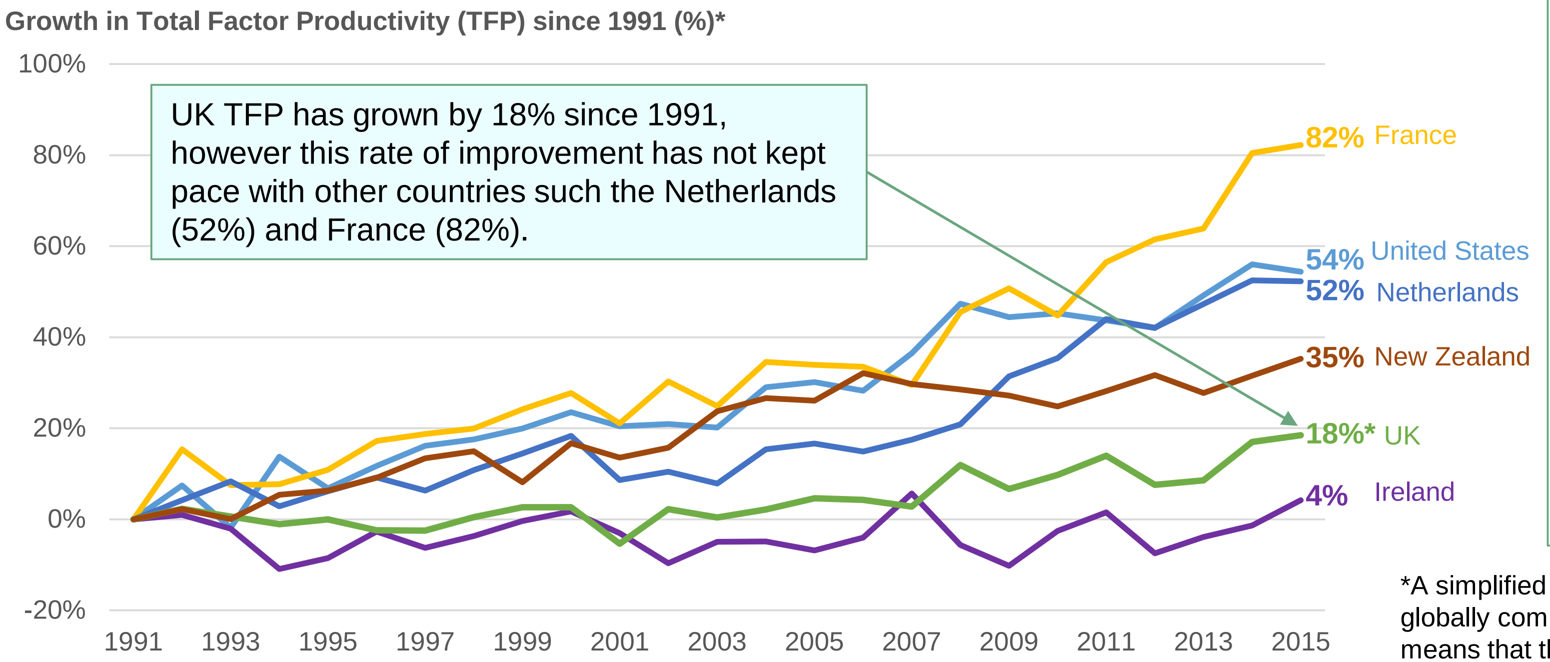
Labour productivity is lower for agriculture than for many other sectors of the UK economy.

This could be due to an extent to the relatively low market value of agricultural products and relatively lower bargaining power compared to other primary industries such as mining and quarrying that extract high-value resources such as diamonds.

Agriculture's relatively low labour productivity may also be due in part to the relatively high hours worked in the sector, with workers on average working for 44 hours per week compared to the economy-wide average of 32.

How does UK agricultural productivity compare with international competitors?

International comparisons of Total Factor Productivity (TFP) show that the UK has seen smaller improvements than some competitors over the past 30 years, however due to limitations with aggregate calculations it is important to also consider comparisons on a sector level.



While Direct Payments (see p66) are likely to have held back productivity-enhancing incentives in the UK, other EU countries have seen greater agricultural productivity growth whilst also receiving this subsidy.

There is potential for improvement in each of the ‘pillars’ of productivity: Ideas and Innovation, People and Information, Investment and Competition (p90).

*A simplified methodology is used here to calculate globally comparable estimates of TFP growth. This means that the UK TFP growth shown in this chart differs to Defra’s published TFP statistics (p86).

However, direct comparisons with other countries are not straightforward.

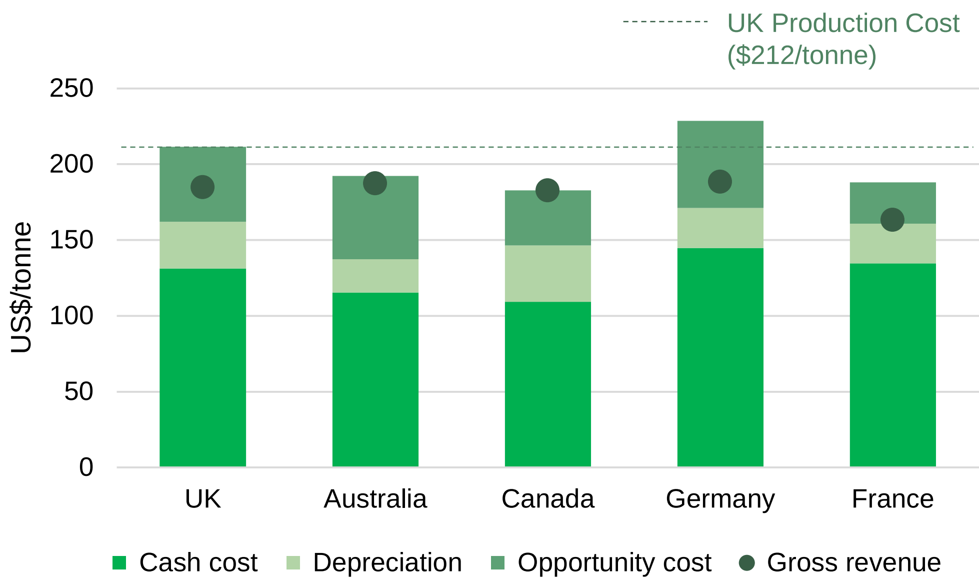
While the UK agriculture sector appears to perform poorly when compared to other countries, care must be taken when interpreting these comparisons. TFP growth rates do not take into account the differences in absolute productivity; although the UK seems to have lower growth; it may be that productivity in the UK was already high and competitors are catching up. Variance in the standards of production in each country are also not accounted for in these comparisons. Aggregate data does not allow for the different types of farms found in each country. For instance the UK has a greater proportion of grazing livestock farms than the Netherlands, which tend to have lower average farm productivity overall regardless of country, and therefore a greater number of these in any one country will result in overall productivity seeming lower due to the particular types of farm.

How does UK agricultural competitiveness on cost compare internationally by sector?

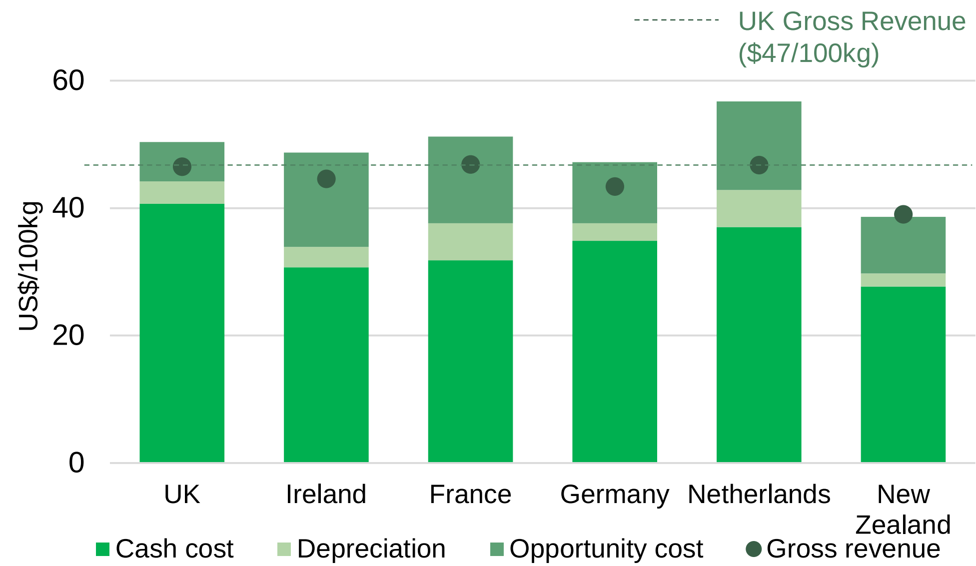
Although aggregate comparisons suggest lagging UK agricultural productivity growth, other data shows that certain UK sectors have costs of production that are competitive on a global scale, such as for wheat and milk production.

Costs of production are influenced by productivity, as well as other factors such as production standards and exchange rates. Comparisons are shown for selected, comparable countries.

Wheat average* cost of production and revenue, 2017



Milk average* cost of production and revenue, 2017



For wheat, the average revenue for representative farms in the UK was similar to other EU and non-EU countries. Average production costs are competitive with some countries, with costs of $212/tonne lower than Germany ($229), although higher than others such as Canada ($183).

For milk, average revenues are competitive with other countries at around $47/100kg. Costs are largely competitive with most countries, with the exception of New Zealand.

*These charts show data from a small number of representative or typical farms in a given country rather than the national average. Opportunity cost is calculated as a combination of unpaid family labour and imputed rent; these are based on local/regional values.

What drives productivity growth in the agriculture sector?

People, innovation, competitive pressures and capital are the four key drivers of productivity growth in UK agriculture, underpinned by the wider business environment including the trade regime, infrastructure and regulatory frameworks. Productivity growth must also be balanced with environmental outcomes.

Wider business environment including Government, market frameworks, infrastructure, local and rural economic policy and macroeconomic climate

Ideas and Innovation	People and Information	Competition	Investment
Investment in research and innovation which generate new products, processes and business models.	Investment in people with the right skills to implement new ideas and technology to generate commercially viable outputs	Competitive pressures in domestic and international markets which encourage firms to innovate.	Investment in capital such as machinery and equipment, branding, land and natural capital.
Short term outcomes: Greater use of innovation and technology	Better able to recognise and implement new ideas and practices as well as better risk management .	Farmers adapt businesses. Land use changes to better reflect market and public values.	More finance goes to productive investments that embody innovation.

Final outcomes: Improved productivity and resilience to volatility.

Productivity and the Environment

Increasing productivity must be considered alongside environmental outcomes (see p100).

The Agricultural Productivity Evidence Group (APEG), which comprises Defra officials and external analysts, is developing a set of productivity and environment metrics that will enable a more holistic assessment of the UK agriculture sector's productivity performance.

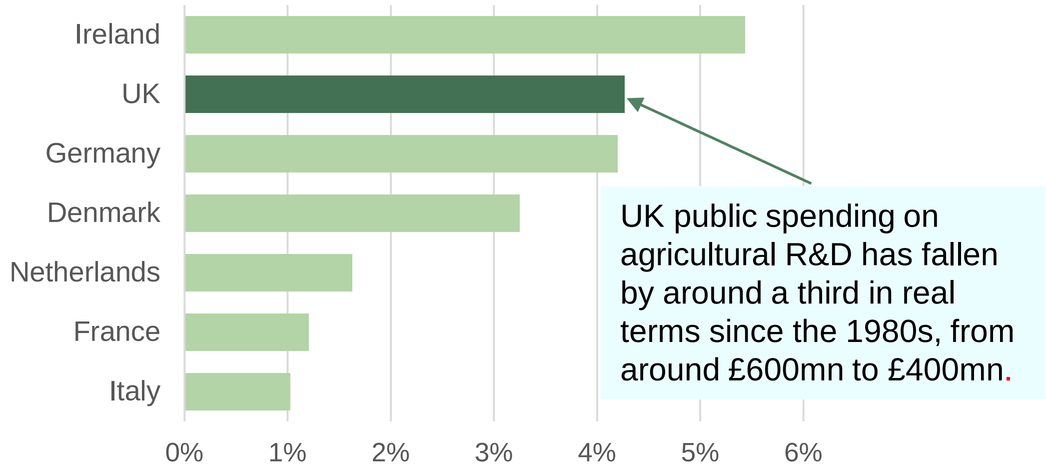
What is innovation, how is the UK performing?

Innovation is central to productivity growth and evidence suggests there should be high returns from public support for Research and Development (R&D) for agriculture.

Innovation is the successful exploitation of new ideas. New ideas can take the form of new technologies, often embodied in capital equipment, new products or new ways of working.

Public sector spending is strong and higher or comparable with other European Countries, supporting a strong research base….

Public Agricultural R&D as a percentage of agricultural GVA (average 2008-2017)



Public sector R&D should be complemented by private sector investment, although this has remained stagnant at approximately 1.1% of GDP since 1995, compared to an OECD average of 1.6%.

For more information and examples of agricultural R&D undertaken using public sector spending please see pp97-101.

…however, this appears not to have translated into higher productivity growth in the UK.

UK agricultural productivity has not grown as fast as some of our competitors (see p88), including those with lower public investment in innovation.

Evidence suggests this may be due to fragmentation and coordination failures in the current UK innovation system, which have resulted in poor translation of public spending on innovation into productivity improvements on the farm level.

The Standing Committee on Agricultural Research found that there are a number of gaps between practitioners and the research community that need to be bridged:

- **Success is judged in different ways.**
- **Researchers and farmers have different styles of communication**
- **Researchers must be aware of the realities for farmers regarding which innovations they use**

Survey responses to Health and Harmony and discussions with farmers undertaken by Defra highlighted the following as key factors to increase innovation and to promote wider adoption of new approaches of technology: enabling farmers to be involved in research – both individually and in collaborative efforts - tailoring research to farmers' needs, and effective knowledge exchange.

How many farmers innovate and what are their motivations?

The strong agricultural research base needs to be mirrored by uptake of innovative practices by farmers. In autumn 2018, 54% of farms had introduced a significant change to their business in the previous year. Increased productivity, lowering costs and making things easier for self and staff were the most commonly cited motivations.

When asked in autumn 2018:

54%
Had introduced a significant change to their business in last year

33%
Planned to introduce a significant change to their business in the next year

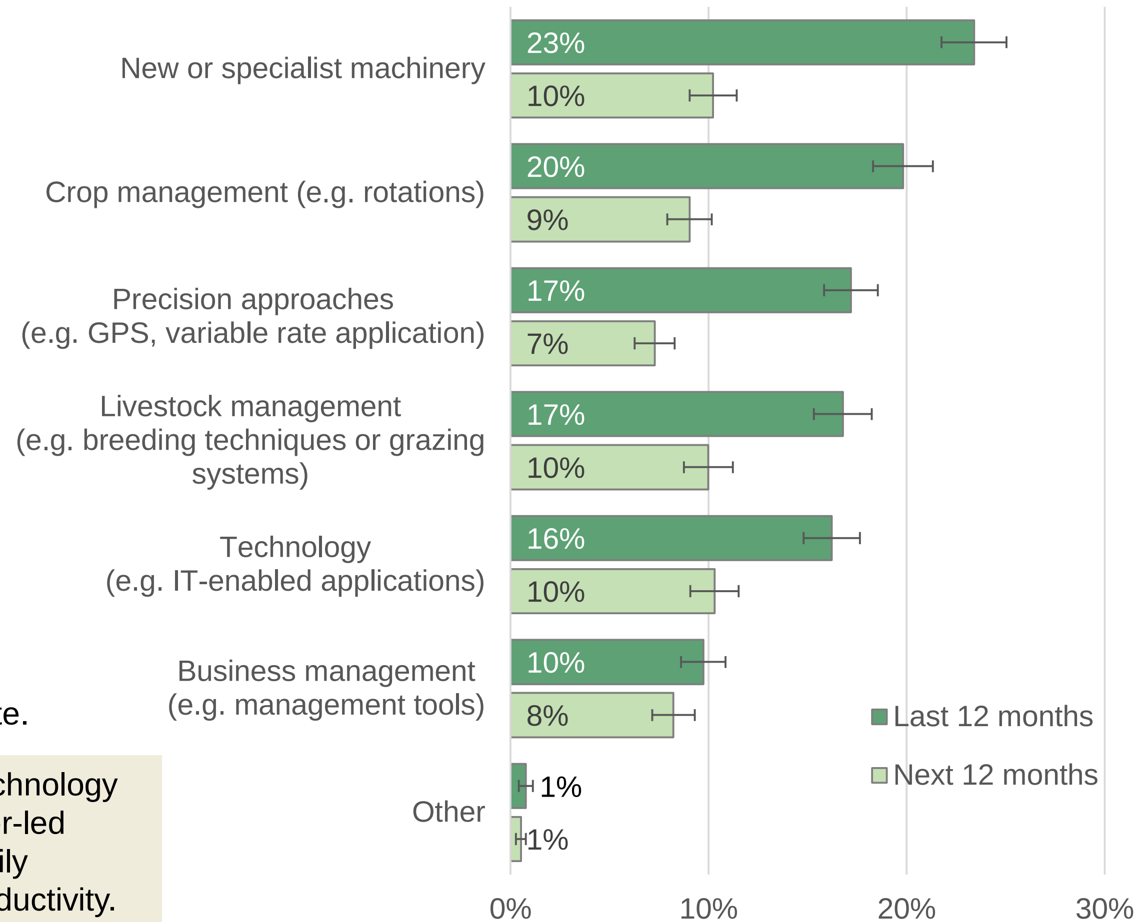
Large farms were more likely to have introduced a significant change than small farms. Cereal farms were more likely to have introduced a significant change than other farm types.

The most commonly selected motivations for innovating were to “increase productivity” (67% of farms), “lower costs” (65%) and “make things easier for me and my staff” (64%).

Farm advisors (51% of farms), other farmers (44%), the farming press (36%) and family (36%) were the most commonly selected as sources of encouragement to innovate.

Whilst there were a number of businesses very focused on technology (i.e. for horticulture), most of the farmers participating in farmer-led Future Farming discussions regarded innovation as being easily adopted measures, rather than just technology, that boost productivity.

Types of innovation introduced or intended to be introduced, autumn 2018



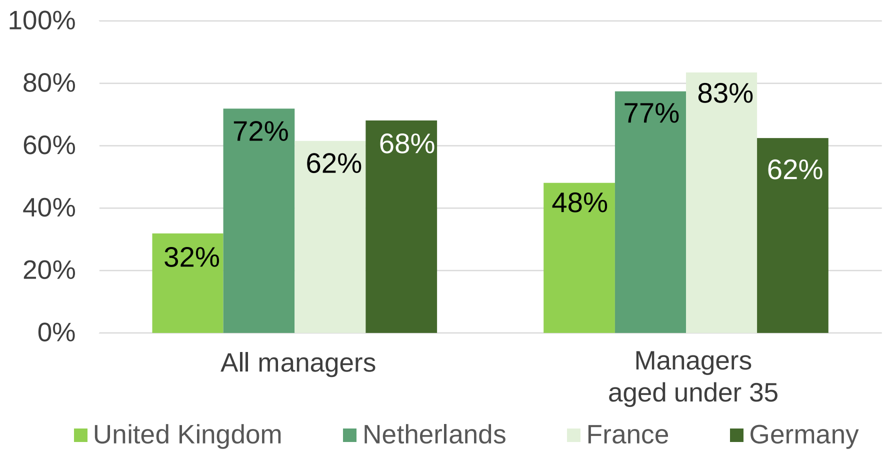
How could improving farm business and technical skills improve productivity?

Improving farm business and technical skills can enable more efficient working and greater resilience. In England, farms with higher economic performance are more likely to undertake farm business management practices such as business planning and benchmarking.

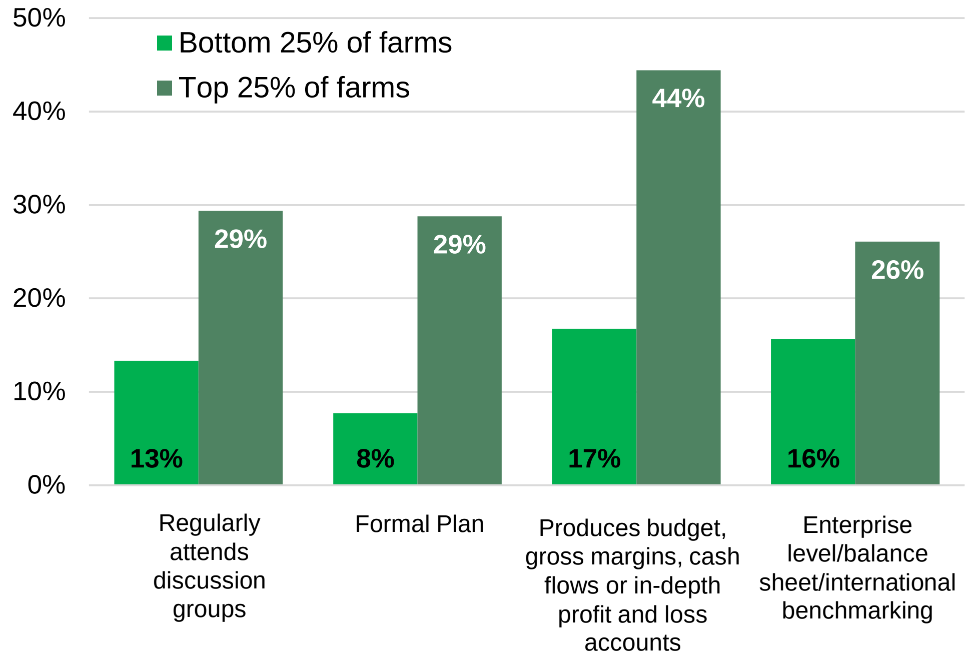
Business management skills are important for ensuring that managers employ best practices to optimise performance and to underpin an efficient knowledge exchange system. Good managers are better able to recognise new ideas and undertake complementary investments to turn these ideas into new products and processes.

Only a third of farm managers in the UK had some form of formal training in 2013, compared to our main competitors, of which at least 60% of farm managers had a form of formal training. The UK compares better when considering younger farmers, with approximately 48% of farm managers aged under 35 in the UK having a form of formal training.

Percentage of farm managers with formal agricultural training (2013)



Proportion of farm businesses in top 25% and bottom 25% engaging in business management practices (2016/17).



While farms with higher economic performance are more likely to engage in farm business management practices, even the majority of these higher performers do not engage in these practices.

Grazing Livestock farms were the least likely to produce budgets and in depth profit and loss accounts. These farms also tended to have the lowest Farm Business Income (see p55).

How do farmers manage price risks to their business?

In 2018, 88% of farms said they positively managed price risks, however 40% indicated they didn't have all the risk management tools they needed, with the high cost of tools and insurance, a lack of knowledge and difficulty in implementing tools stated as the main reasons for this.

Farmers are price-takers, and many of the determinants of the prices farmers receive for their agricultural products – such as fluctuations in market prices or weather patterns - are out of their control (see p62). Risk management is one way of safeguarding against volatility.

How do you manage price risks to your business (% of respondents)

The most commonly selected risk management practice was "Good business practice" (51%).

Specialist crop or livestock insurance can help manage the risk of shocks, such as extreme weather events. While farmers understand the value of insurance, high insurance premiums inhibit uptake.

A quarter of farms do not use data on market prices to inform business decisions. These farms are more likely to be small farms than larger farms and to be pig/poultry farms than other farm types.

Diversifying the business can help stabilise income (due to the volatility of agricultural prices) (see p84).

Those that said they did not actively manage risk were more likely to be small farms than medium or large farms and less likely to be cropping or dairy farms than other farm types.

How did results vary by farm type and tenure status?

Dairy farms were mostly likely to have selected "Good business practice."

Cereal farms and cropping farms were more likely to be a member of a collaborative practice than grazing livestock farms.

Of the third of farms indicated that they managed risk on a case by case basis, there was no difference between farm types, sizes, region or tenure.

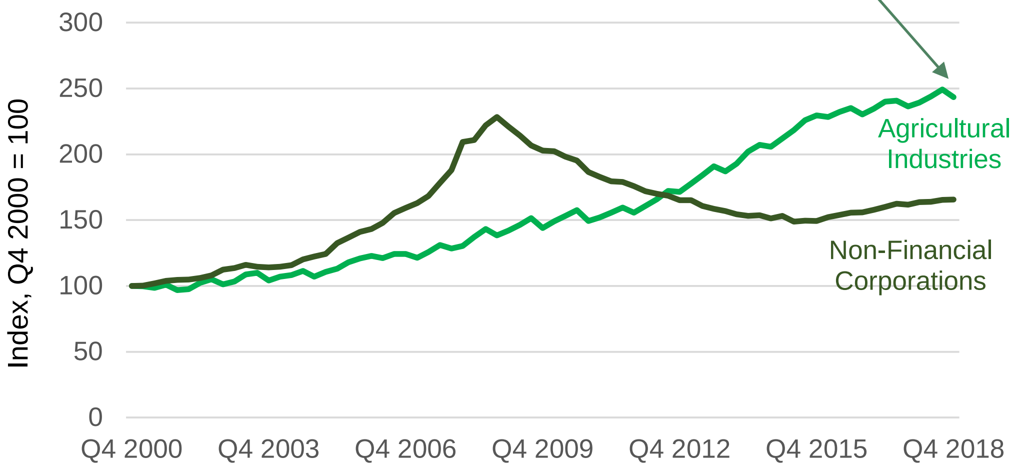
How does investment drive productivity and what barriers can stop farmers from investing?

Capital investment drives productivity improvements by enabling workers to be better able to do their jobs and produce output more efficiently. Uncertainty about the future is a key barrier to investment decisions.

Lending to the agricultural sector is strong….

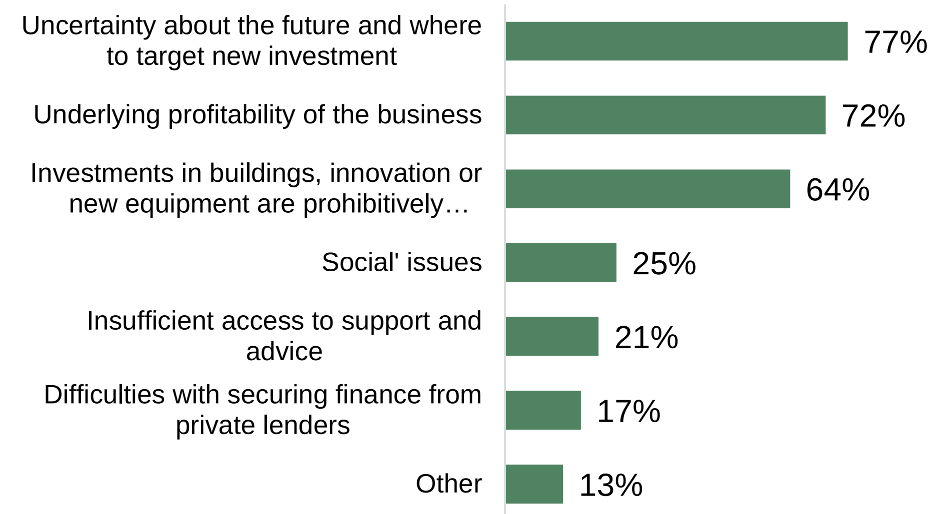
Agriculture has seen a consistent upward trend in lending since 2000, compared to non-financial corporations. Although not all lending will be for investment purposes, access to finance for farm businesses appears to be strong.

Outstanding lending from monetary financial institutions(£m)



…However, there are some barriers to investment.

Proportion of online respondents that selected each option as a barrier to new capital investment that could boost profitability and improve animal and plant health on-farm



Whilst only 17% of on-line respondents to Defra's Health and Harmony consultation cited difficulties with securing finance as a barrier to capital investment, for 77% the barrier was considered to be uncertainty about the future and where to target new investment.

Listening to farmers as part of our discussion groups, we heard that profitability is a key factor in driving investment decisions. Some farmers highlighted future uncertainty over markets and standards (including trade and tariffs) as a barrier to investment, as well as labour and financial support becoming increasingly important, including for securing loans based on less certain business plans.

How does competition drive productivity and what competition is there in the agriculture sector?

Competition, as measured by entry and exit rates, is much lower for agriculture than for the wider economy. Removing Direct Payments could drive productivity improvement through greater entry and exit and reallocation of resources.

Competitive markets encourage new entrants and act as a spur to incumbents to innovate or exit.

The Direct Payments system has acted to maintain high prices of agricultural land, impacting entry and exit rates as higher land prices have: made it difficult for new entrants wanting to start a new farm businesses to obtain land; increased the cost of expansion for productive businesses; and constrained incentives to exit for less productive farm businesses. If there is limited exit from the sector, this directly limits entry due to the need for land on which to farm (for more information on the impact of Direct Payments see p66)

The median age of farm holders is **60 years** and just 2% are aged under 35 years highlighting the limited structural change in the sector.

60 years

Median age of farm holders in England

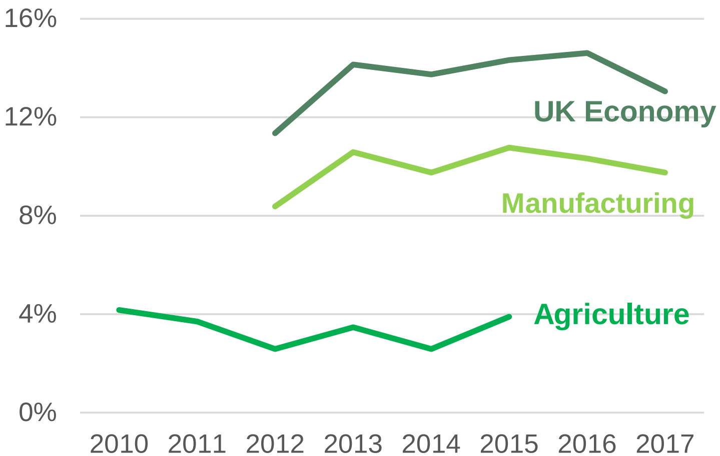
2%

farm holders aged under 35 in England

A common view from farmers participating in Future Farming discussion meetings was that encouraging new entrants was important for the long-term success of the industry.

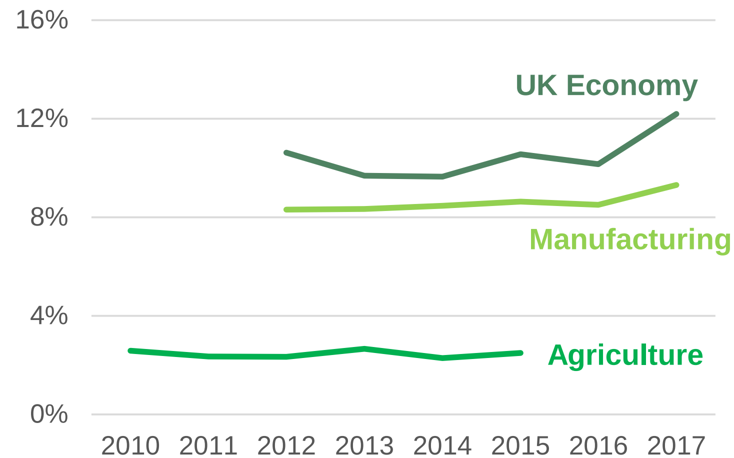
There was also a view that some structural change could be encouraged by older or less productive farmers leaving the industry.

UK business birth rates



Business birth and death rates for agriculture remain consistently below those for the UK economy as a whole and the manufacturing sector. As a result, the "churn" of businesses in the agriculture sector is limited.

UK business death rates



What agricultural R&D does Defra fund and why?

Defra research delivers evidence to underpin policy making. Our work focuses on issues that other funders are unable or unwilling to address to enhance delivery of public goods by improving the productivity, resilience and sustainability of UK agriculture.

Why does Defra fund agricultural Research and Development (R&D)?

Defra funds agricultural R&D to provide information for policy making. Our R&D also fills gaps where other sectors would not or cannot fund and where the outputs benefit the public overall (e.g. reducing greenhouse gas emissions).

This work focuses on increasing the **productivity, resilience and sustainability** of UK agriculture, taking breakthroughs from basic science funded by the research councils and explores the scope for **practical application** in UK relevant agricultural practice.

Defra works closely with UKRI, AHDB and other funders across the R&D-funding spectrum including via the Global Food Security programme to align and coordinate activity and maximise returns.

Defra delivers in partnership with the EU and third countries, exploiting synergies and creating opportunities for greater **international collaboration.**

Our research programme covers crops, livestock, and agricultural systems including the sustainable intensification of agriculture.

Improvements to livestock genetics, feed efficiency and other practices can make livestock farming both more profitable and reduce negative impacts on the environment (see p98).

Targeted and proportionate control of pests and diseases helps protect the environmental and social benefits of crops and trees, and reduces productivity losses. Resistance to pests, diseases and the potential impacts of climate change can be improved through breeding programmes, whilst exploring approaches to integrated pest management helps reduce reliance on agrochemical inputs (see p99).

Defra funded R&D has developed a range of tools to understand, model and compare the full impact or cost of different agricultural production methods (see p100).

Improvements in the understanding of sustainable intensification (SI) help farming systems balance farm sustainability with productivity (see p101).

How can R&D help the livestock sector become more efficient, productive and competitive?

Improvements to livestock genetics, feed efficiency and other practices can make livestock farming both more profitable and reduce negative impacts on the environment.

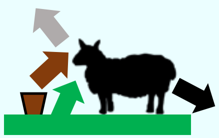
Why does Defra fund research in this area?

Livestock are an important component of agriculture in much of the UK, but livestock farming has significant negative impacts on air quality and GHG emissions, as well as wider impacts to soils and water.

As well as being good for business profitability, improvements to livestock farming efficiency offers environmental benefits. Industry research tends to focus on improving yields and farm returns. Government research is required to underpin environmental gains.

Beef and Sheep sectors are particularly vulnerable and have relatively low investment in R&D in both public and private sectors.

Feed efficiency



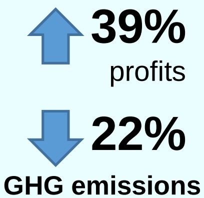
Livestock feed is a large input/cost for many Farmers. Inefficient Conversion of feed to products for human consumption exacerbates cost to farmers and increases impacts on the environment. Our research shows it takes about 10kg of feed to produce 1kg of lamb or beef, in comparison to 1.6kg of feed to produce 1kg of poultry meat. Improved breeding, nutrition and health can help improve efficiency.

Example: Methane emissions from sheep and beef were reduced by ~20% when fed high sugar grass varieties, whilst also reducing nitrogen excretion in manure by 15%.

Breeding programmes

Historically, breeding has focussed on yield improvement, which has often been achieved to the detriment of other traits such as fertility or feed efficiency in cattle. The fragmented nature and lower average incomes of the beef and sheep sectors are barriers to progress, so Defra is working with industry on coordinated breeding.

Example: Our **Beef Feed Efficiency Programme** suggests possible increases in profit for the beef sector of 39% with significantly reduced environmental impacts through balanced breeding goals that protect health and welfare.



Understanding trade-offs

Breeding and managing livestock for high production can lead to detrimental effects on immune system performance and fertility. Understanding these trade-offs will allow the industry to make more informed decisions on breeding and animal husbandry and lead to lower levels of disease and higher animal welfare.

Example: Research to decrease mortality rates and reduce disease in sheep – particularly in young lambs – is using cutting edge biochemical analysis techniques to measure how animals allocate protein in their diet, with the aim of boosting immune system function whilst maintaining high production.

How can R&D help arable and crop sectors become more resilient?

Resistance to pests, disease and the potential impacts of climate change can be improved through breeding programmes, while exploring approaches to integrated pest management helps reduce reliance on agrochemical inputs.

Why do we do research into this area?

Commercial breeding programmes invest heavily in increasing yields; traits that improve sustainability and resilience are less well incentivised by the market.

Agrochemical use has increased over time; since 2010 the weight of pesticides applied has increased by 18% with potential implications for biodiversity.

We need to understand how pest and disease threats change over time and with varying conditions, as well as how climate change may impact the range of crops which can be grown across the UK.

Breeding programmes

Resistance to pests, disease and other stresses (e.g. drought) can be improved through breeding, reducing the risk of crop failures and delivering public goods (a healthier countryside and resilient food supply). This also reduces risks associated with narrowing the genetic diversity of commercially grown plant varieties.

For example, the Vegetable Genetic Improvement Network (VeGIN) screened more than a thousand non-commercial varieties to identify improved resistance to pests, diseases and drought. These traits are now being used to provide sustainable solutions to increasing environmental pressures and the demand for increased productivity in the fresh produce sector.

Reducing the need for crop protection products

Reducing reliance on pesticides and other plant protection products will help to improve biodiversity and pollinator numbers. Use of Integrated Pest Management (IPM) has been identified in the 25 Year Environment Plan as a key aim for future food production systems.

For example, proPlant, a freely available population-prediction tool for pollen beetles is used as part of an IPM framework for oilseed rape, helping farmers reduce use of insecticides, with the added benefits to biodiversity and profitability, whilst reducing the potential of beetle populations becoming resistant to treatments. The tool was validated through work jointly funded by Defra.

Identifying and tracking pests and diseases

The increasingly variable weather conditions experienced in the UK are causing significant fluctuations in the prevalence of crop pests and diseases. Tracking pests and diseases, along with how farmers are managing and applying treatments, helps predict future risks.

For example, the Survey of Crop Pests & Diseases identified yellow rust as a new, emerging threat. Yellow rust can reduce untreated wheat yields by 50%. Detection of yellow rust by CropMonitor enabled a rapid control response and ensured the Wheat Genetic Improvement Network began exploring genetic resilience to this new threat.

How do we support farmers and land managers to make informed decisions?

Defra funded R&D has developed a range of tools to understand, model and compare the full impact of different agricultural production methods, including the economic, environmental and social costs.

Why do we want to support farmers to make more informed decisions?

The way we utilise the UK's landscape, from the amount of land dedicated to agriculture or forestry, to the intensity of grazing and improvement of grassland, affects:

- Public goods and ecosystem services such as food production and flood protection, and
- Environmental impacts such as diffuse pollution, greenhouse gas emissions and soil degradation.

A significant body of Defra R&D has, therefore, explored how to maintain or improve the competitiveness of UK agriculture sectors by supporting productivity and yield increases whilst protecting and enhancing the environment and protecting the public goods it farming provides.

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Examples of outputs from research projects that support farmers to make informed decisions

Decision support tools

Farmscoper is a tool which helps farmers and land managers asses the cost and benefits of on-farm measures to increase productivity, and improve environmental outcomes including climate impacts, biodiversity, air and water. The tool is an evolving product, with new mitigation measures, impacts and scenarios being added over time to better reflect current farming practices and the full diversity of UK agricultural landscapes and systems.

Products like the **Farm Management Information System (FMIS)** allow land managers to access precision farming recommendations specific to their soil type, geography, climate and crop type.

Research Groups and Platforms

Sustainable Intensification Platform

Defra's Strategy sets out our ambition for the UK to:
(1) grow more, sell more, and export more food around the world, and
(2) to be the first generation to leave the natural environment of England in a better state than that in which we found it.

The Sustainable Intensification Platform (SIP) sits at the interface of these two ambitions. SIP was an innovative, collaborative programme of research assessing the opportunities for maintaining production while enhancing environmental and social benefits, across the farm, landscape and supply chain scales (see p101).

How can R&D help farming systems balance farm sustainability with productivity?

Improvements in the understanding of sustainable intensification (SI) can help to increase farm productivity whilst enhancing the environment, economy and society.

Why do we do research in this area?

Sustainable Intensification is a system approach to balancing the **three pillars of sustainability:**

1 Environment

It is important that land management practices enhance the environment and protect natural capital.

2 Economy

Farms must be productive and competitive to be financially sustainable. Production systems must reflect land capability and market demands .

3 Society

Long-term social sustainability of rural areas is pivotal to ensuring stability of future provision of farming goods.

The 'Sustainable Intensification Research Platform' (SIP), funded by Defra and the Welsh Government, studied the opportunities and risks of Sustainable Intensification (SI) in a variety of landscapes and scales, over three years:

SI at the farm scale (SIP 1):
Tested SI practices and their applicability to commercial farms (including effects on productivity) through a robust set of metrics to help define farm scale best practice and the potential impact of SI.

Example output: Metrics
3 novel metrics for measuring sustainable efficiency, environmental inefficiency and sustainable productivity were developed to improve farm monitoring and to allow benchmarking of SI performance.

SI at the landscape scale (SIP 2):
Assessing the opportunities and risks of delivering SI at the landscape scale, included social studies of farmer behaviours and the development tools to improve the targeting of SI practices.

Example output:
Landscape Typology Tool was developed based on land-use opportunities for business planning and environmental risk for agricultural land in England and Wales. The typology takes account of economic, environmental and social outcomes.

SI at the supply chain scale (SIP 3):
External drivers of SI-orientated decision making were studied, specifically in relation to farmer attitudes / practices and mechanisms for driving change in farm SI performance.

Example output: Understanding SI drivers
The supply chain (incl. farm suppliers/ advisors) is the main factor influencing on-farm adoption of new SI practices; the strongest barrier to taking up SI practices is finance.

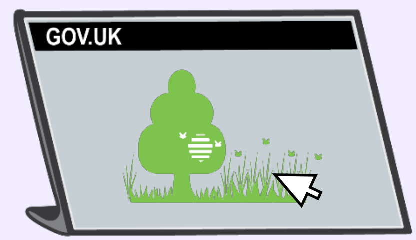
Public Money for Public Goods

Environmental opportunity

Pp103-107

Environmental challenge

Pp108-113



Environmental stewardship schemes

Pp114-117

What is the environmental opportunity of agriculture?

A number of public goods arise from a well-managed landscape, including recreational and environmental benefits.

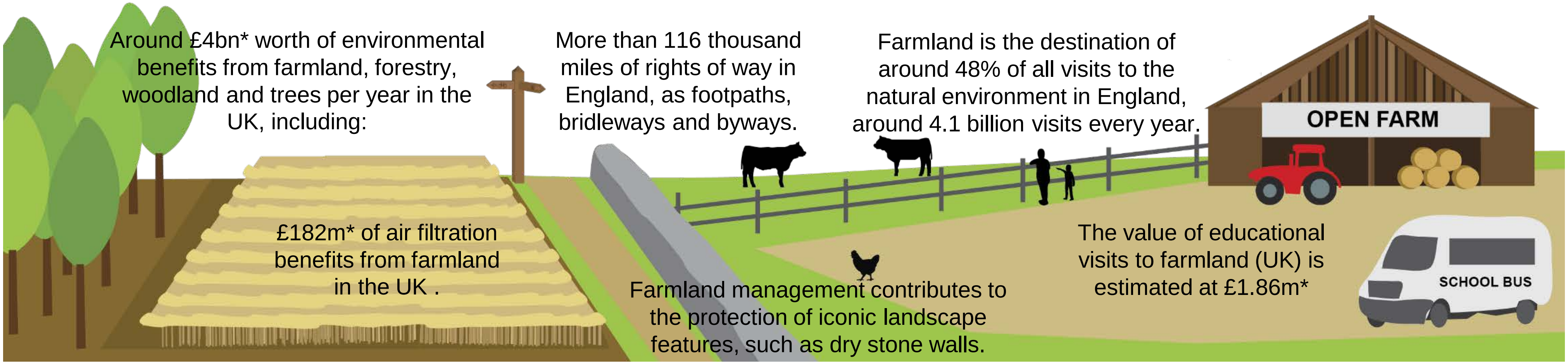
Public goods are goods or services that no one can be stopped from using and where one person's use does not affect another's. For the environment, this includes such goods as an attractive landscape or a public park. If left to the market alone, the benefits to society provided by these goods would be underprovided or not provided at all, due to a lack of profit incentive.

Farming and forestry can safeguard natural capital and provide public goods such as the provision of beauty, heritage and engagement. Farmland and woodland can provide thriving plants and wildlife as well as contributing to the provision of cleaner air and water.

Government can use policy to provide incentives for the delivery of public goods. Policies such as environmental stewardship schemes can reward the delivery of public goods by incentivising farmers to adopt beneficial practices or measures.

Natural Capital

refers to the elements of the natural environment that provide valuable goods and services to people, such as water, food and recreation.



*2015 value in 2017 prices

What is the environmental opportunity of agriculture in relation to maintaining landscapes?

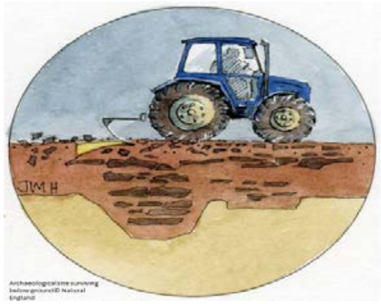
Farming is important to the maintenance of our diverse and distinctive landscapes, including the historic environment and archaeological features.

The historic environment can be seen everywhere, and provides a wide range of tangible and intangible benefits. These include socio-economic benefits, such as health and well-being, tourism, local distinctiveness, sense of place and community.

It is a non-renewable resource that, once lost, cannot be re-created. Changes in agricultural policy, technology and practice has resulted in a steady degradation of our cultural heritage.

In addition, monitoring of landscape change since the 1970's shows how underlying trends in agricultural intensification and a general decline in traditional farming practices have resulted in a simplification of landscape pattern and structure in many places.

Environmental stewardship schemes have a key role in helping to restore the complexity of features that contribute to a distinctive sense of place, revealing our past in the present landscape, and provide a wide range of other benefits for people.



From archaeological sites, to field patterns, to parkland and to traditional buildings, the historic environment tells us the story of our past. England's farmers are the guardians of our shared heritage.

Due to changing agricultural practices, traditional farm buildings are vulnerable to neglect and decay. Agri-environment schemes have funded the maintenance and restoration of over 14,000 buildings.

Agri-environment schemes also support the management and restoration of archaeological sites on farmland, ensuring their preservation for future generations.

Over 355,000 hectares are under positive management. Key practices conserve:

- field trees
- boundary features
- wet and rough grasslands
- woodlands and orchards

A combination of options working together have delivered most for landscape character.

What is the environmental opportunity of agriculture in relation to flood risk?

There are many land management practices that can reduce flood risk as well as provide wider environmental outcomes.

Natural Flood Management techniques can be adopted by farmers to help manage flood risk by using land management practices that slow or store water in the landscape. When properly targeted, Natural Flood Management (NFM) techniques can provide excellent value for money, with cost-benefit ratios of around 5:1 and benefits of around £100 per m^3 of water stored for flood risk reduction alone.

Leaky woody dams
Provide floodwater storage and have been shown to increase habitat diversity by as much as 46%.

Leaky woody dams can also result in decreases of in stream Phosphate concentrations, which can cause harmful blooms of plant life that deoxygenate rivers and lakes.

Riparian (riverbank) planting
Can reduce peak flow by up to 19%, as well as removing over 20% more nitrates than channel management of rivers. Planting trees on the river bank increases shade, benefitting biodiversity by preventing water temperature from rising to lethal limits for species such as brown trout, and leading to reductions in phytoplankton load by as much as 44%.

Swales
Swales are shallow, broad and vegetated channels that can reduce run-off by 40%, peak flow by 50%, and increase flood lag time by 16%.
Swales can also result in sediment delivery being reduced by 90-100%, and reduce the concentrations of phosphorus and heavy metals in storm water run-off by up to 74% and 94% respectively.

Buffer strips
Are areas of permanent vegetation that can reduce run-off by over 50%, and contribute to reductions in water pollution. They can also aid biodiversity, such as increasing numbers of invertebrates compared with normal cropped margins.

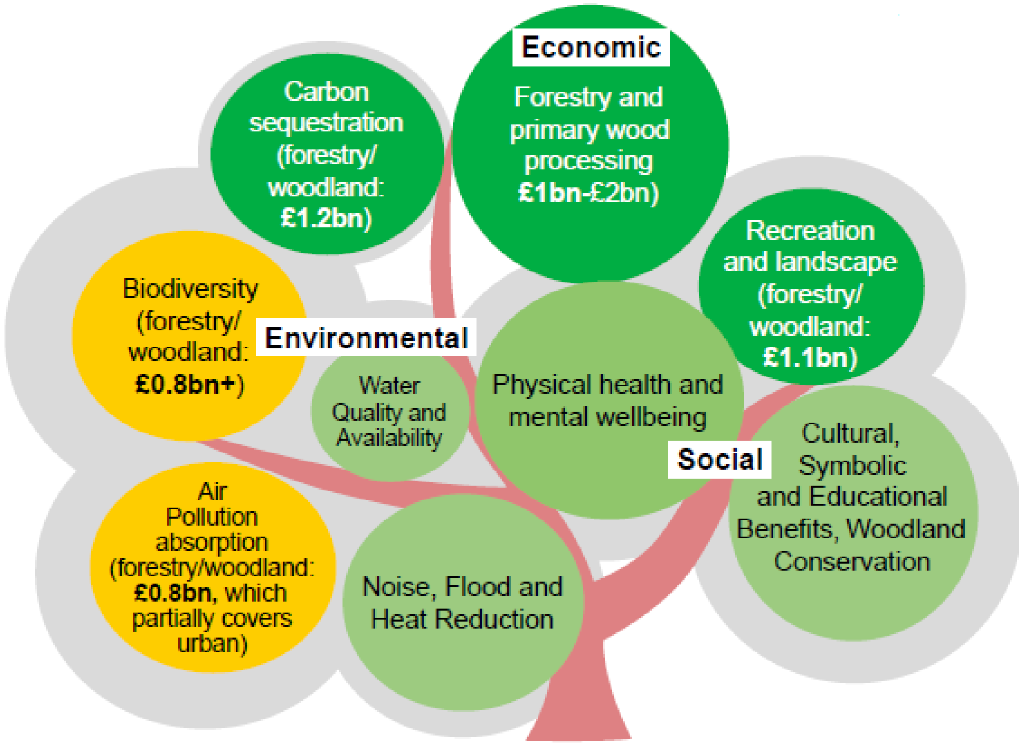
Cover crops
Can reduce surface run-off by 80% and both nutrient and sediment losses from the soil by up to 80%, and nitrate leaching losses by 60%.

Ponds and reservoirs
Can reduce the risk of flooding by between 4 and 25% in any one year. They also have the benefit of reducing both downstream phosphorus and nitrate concentrations during storms by 25% and 15% respectively.

What is the environmental opportunity of forests/woodland?

Forests and woodlands provide economic, environmental and social benefits, including £1.2bn worth of carbon sequestration and £1.1bn worth of recreation and landscape benefits.

Summary of the Value that Our Forests and Trees Provide to Society



The Government is committed to planting 11 million trees through the 25 Year Environment Plan (2018) and manifesto commitments.

The forestry social and environmental value estimated above totals £3.9bn. This differs to the figure given in slide 82 which has been inflated using HMT's GDP deflator to estimate an updated value of £4.1bn for 2018.

The woodland area of the UK in 2018 was 3.17 million hectares, covering 13% of total UK land area. There is 1million hectares of woodland on agricultural land.

For more information on the current state of Forests and Woodlands in the UK, see p30.

Incorporating trees and woodlands into agricultural systems has a number of benefits, including:

- Reduced soil erosion rates
- Carbon sequestration
- Shelter for livestock
- Biodiversity gains and habitat connection and creation
- Reduced flooding risk for downstream communities
- Agroforestry incorporates trees into productive farming systems

Well managed and diverse woodlands help to increase resilience against pests and diseases as well as wild fire events. Measures are in place to prevent and address disease and pest outbreaks quickly and effectively, and we work with land owners to remove diseased trees and pests on detection.

What is the environmental and public goods opportunity of improving animal welfare?

The public values high animal welfare standards and wants government to support farmers to improve animal welfare. 78% of UK consumers said it is 'very important' to protect the welfare of farmed animals.

There are five aspects of animal welfare outlined by the Farm Animal Welfare Committee:

- Freedom from hunger and thirst
- Freedom from discomfort
- Freedom from pain, injury and disease
- Freedom to express normal behaviour
- Freedom from fear and distress

There is strong public support for the government to **support farmers to improve animal welfare:**

68% respondents to the Health and Harmony consultation said there is a strong case for government funding pilots to incentivise and deliver improved welfare.

82% of respondents to a YouGov poll said they support farmers being rewarded for delivering enhanced animal welfare standards.

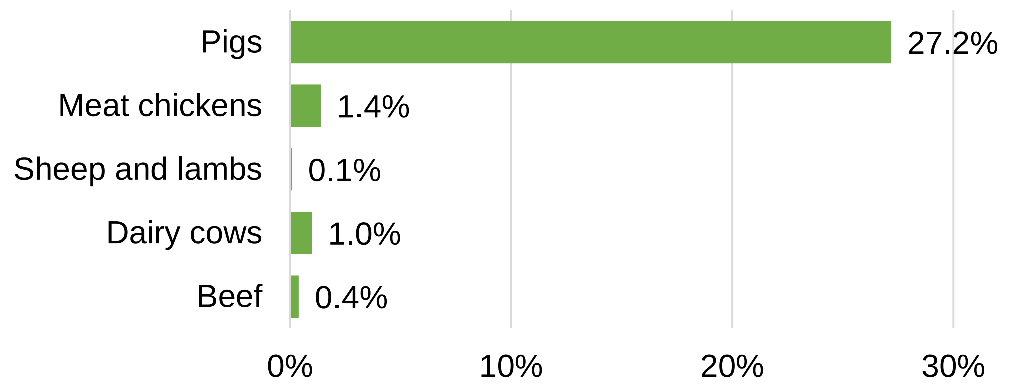
78% of UK consumers responding to a EU Survey said it is 'very important' to protect the welfare of farmed animals and 76% said farm animal welfare in the UK should be **better protected** than it is now

Despite this, studies show **low** willingness to pay for higher welfare products.

Improving aggregate levels of animal welfare can lead to benefits to farmers and social benefit to the public who value high welfare but also other benefits such as improvements in animal health and better meat quality.

RSPCA Assured is the RSPCA's ethical food label dedicated to farm animal welfare. It has seen increasing sales in recent years but the market share is still **low** for many species. The RSPCA Assured welfare standard covers the whole of the animal's life, from their health and diet to environment and care. This includes things like space, light, bedding, transport and humane slaughter. The RSPCA inspects both indoor and outdoor farms, including free range and organic.

Proportion of farms in RSPCA Assured scheme



The RSPCA assured scheme is only one measure of animal welfare being undertaken by farm businesses; many will also be undertaking good animal welfare practices outside of assurance schemes.

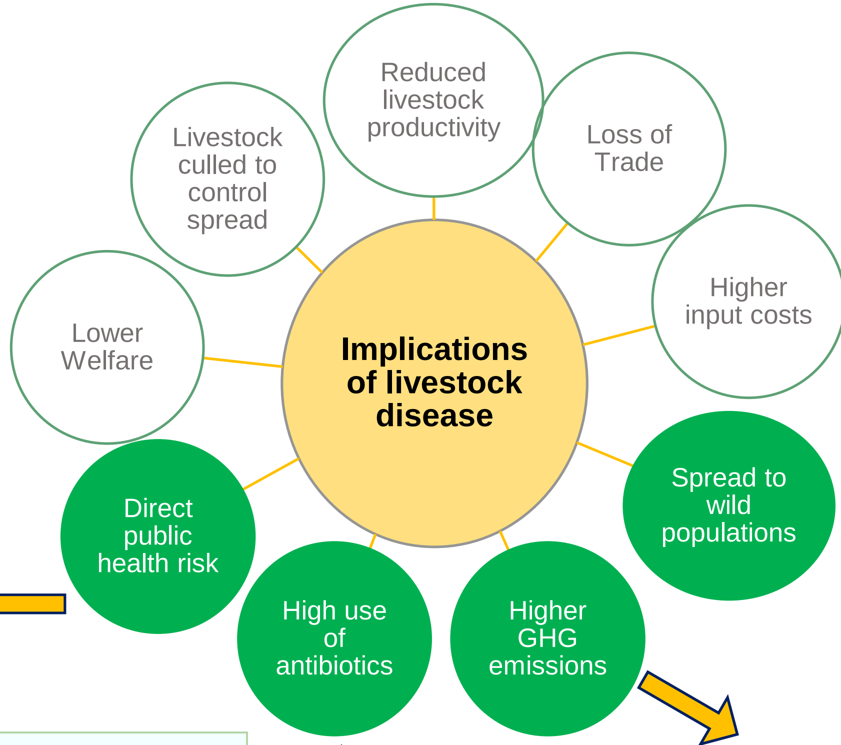
What is the environmental and public goods challenge of poor animal welfare?

As well as being detrimental to the welfare of animals on the farm, livestock diseases can impact on wildlife and human health and is detrimental to the environment, due to factors such as higher greenhouse gas emissions from diarrhoea.

According to the Farm Animal Welfare Council animal welfare encompasses both physical and mental health for farmed animals.

Good welfare is largely determined on a daily basis by the skills of the stock people, the system of husbandry and the suitability of the genotype for the environment.

External factors may have a sudden impact on animal welfare, for example, infectious disease epidemics, adverse weather conditions and the mental and physical wellbeing of those responsible for their care.



For information relating to animal health and farm business performance impacts please see p81.

The inter-relationship between wildlife and other animals is an important risk factor for changes in disease distribution.

Zoonotic diseases are diseases carried by animals that can be transmitted to humans, and are a direct public health risk. 2/3 of animal diseases are zoonotic.

Anti-microbial resistance Increased use of antimicrobials reduces the effectiveness of medicines for both animal and human use.
AMR infections are estimated to cause 700,000 deaths each year globally. That figure is predicted to rise to 10 million, alongside a cumulative cost of $100 trillion, by 2050 if no action is taken.

Poor animal heath increases GHG emissions for example diarrhoea causes more emissions. Research by Defra found that animal disease results in an increase of greenhouse gas emissions compared to healthy animals, with increases of up to 130% emissions per unit of beef carcass due to BVD, 40% for Johne's disease and 20% for Salmonella, infertility and Infectious Bovine Rhinotracheitus.

What is the environmental challenge of agriculture in relation to water quality?

Water quality can be adversely affected by farming through run-off of fertilisers, pesticides and slurry and through erosion of soil, which is washed off farmland.

Soil and Sediment

Soil and sediment enter water when rain and wind erode soil, leading to nutrient enrichment and siltation, which impact fish and invertebrates and cause ecological damage.

Nutrients from Fertilisers

Nitrogen and phosphorus enter the water cycle via groundwater and run-off, causing harmful blooms of plant life that deoxygenate rivers and lakes.

Pesticides & Ammonia

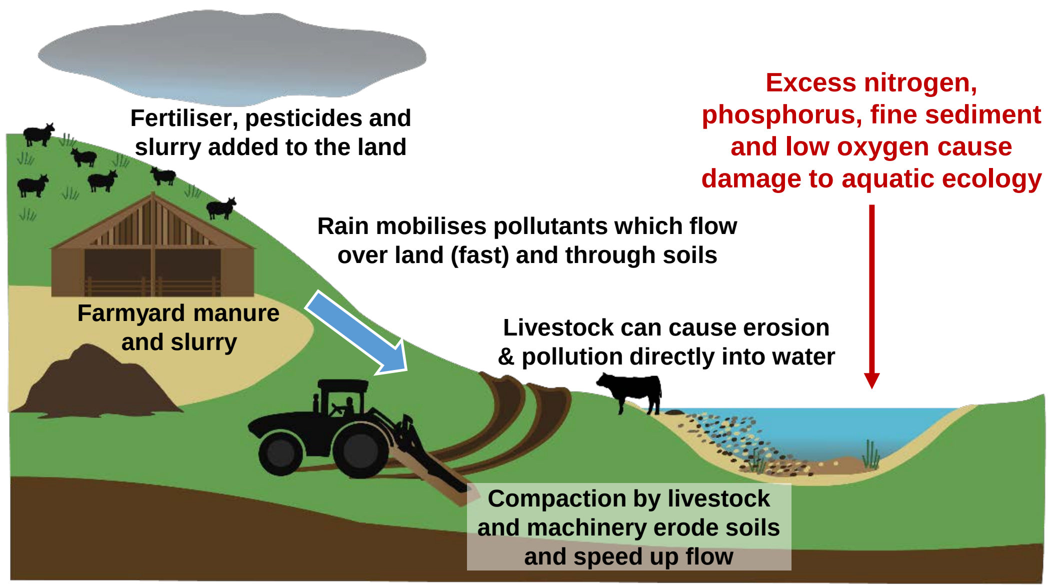
Pesticides and ammonia can be toxic to many aquatic plants & animals, killing fish and invertebrates.

65% of all surface and groundwater bodies in the UK failed to achieve good or high status in 2017.

The majority of these water body failures are due to urban and other non-agricultural pollution, but around **1/4** failed for a reason related to agriculture and rural land management.

Increased nutrients and sediment in water increase the cost of water treatment, and negatively impact bathing water quality.

More than 50% of nitrate pollution, 25% of phosphate in UK waters and 75% of sediment pollution comes from farming.



Pollutants can enter groundwater, affecting drinking water supplies and taking decades to wash away. Some of the pollution affecting UK waters is a **legacy of previous agricultural practices,** which heavily focussed on increasing production.

Excess Nitrogen and Phosphorous from manure, slurry and fertiliser application can make its way into surface waters and aquifers. Improvements in nutrient management practices and slurry and manure storage can help to reduce water pollution.

⇩ **31% Nitrogen**

reduction in total nitrogen fertiliser application in Great Britain between 1990 and 2018.

⇩ **56% Phosphorus**

reduction in phosphorus fertiliser applications between 1990 and 2018 in Great Britain.

What is the environmental challenge of agriculture in relation to soil health?

Soil is an essential natural resource, with poor management causing erosion, compaction, and depletion of nutrients, organic matter and biodiversity.

Why are soils important?

One quarter

of the planet's biodiversity is found in its soils. Soil and its organisms play vital roles in supporting food production, plant and tree health, nutrient cycling, carbon storage and sequestration, water storage and quality, and flood prevention.

Poor soil management can lead to:

- Compaction from livestock and machinery, leading to increased flood risks for downstream areas and reduced crop yields.
- Increased greenhouse gas emissions and loss of the carbon stored in soils.
- Erosion by wind and water, leading to less fertile soils and pollution in surface and coastal waters.
- Poor soil structure and nutrient balances, reducing fertility and provision of public goods.
- Loss of soil biodiversity.

What is the current state in the UK?

33% of UK soils are thought to be degraded with 1 million hectares (6% of the UK's agricultural land and 36% of cropland) at risk of erosion.

2.9m tonnes

of topsoil estimated to be lost through water and wind erosion every year in the UK, which may take centuries to replace.

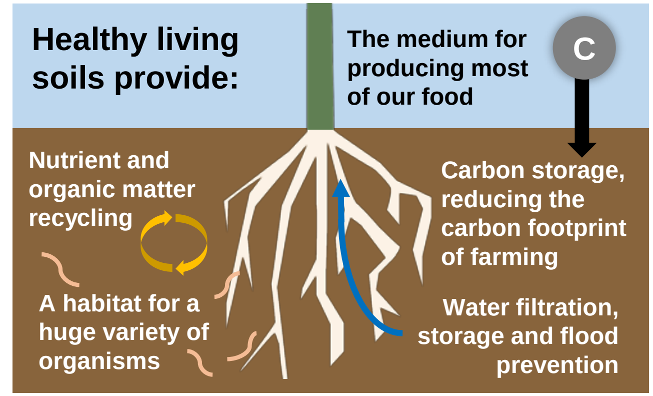
40 to 60 years

estimates of how quickly we could lose some of our most fertile soils in East Anglia at current rates.

£0.9bn to £1.4bn

estimates of cost of soil degradation per year for England and Wales.

More than **95%** of the UK land carbon stock is held in our soils.



How can agriculture help soils?

Careful management is needed to make the use of soil resources by agriculture sustainable.

Zero tillage systems may increase organic matter in the root zone, helping nutrient and water retention, and also reduce fossil fuel use.

Planting cover crops and careful management of hillside fields can reduce erosion rates.

Reducing compaction leads to increases in soil fertility and farm productivity, and helps to retain water in upland catchments.

Organic farming and other agroecological approaches can protect and enhance the health of agricultural soils, for example, through the use of legumes, crop rotations and organic manures.

What is the environmental challenge of agriculture in relation to biodiversity?

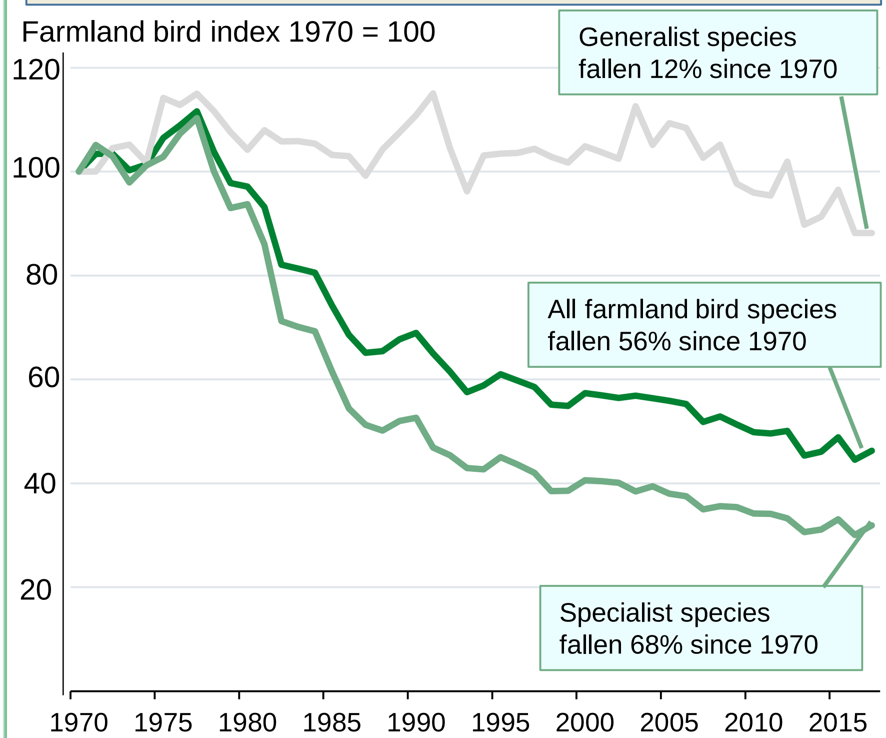
Farming practices can have many impacts that can lead to a reduction in wildlife biodiversity (including loss of habitats and food sources). The UK farmland bird index, an indicator of the state of wildlife generally, has fallen to less than half its 1970 value.

Bird populations are often used as indicators of the state of wider wildlife biodiversity, as they occupy a wide range of habitats, respond to environmental stresses that affect other groups of wildlife and are often high up their respective food chains.

Some farming practices have negative impacts on bird populations, and on wildlife more generally. The vast majority of England's wildlife depends on the remaining areas of semi-natural habitat that are less intensively farmed within the countryside.

However, many farmers and land owners are actively playing their part to conserve and enhance the countryside's wide network of trees, hedgerows, ponds, ditches and other watercourses. Many options to do so are included within agri-environment agreements.

The index measures the average rate of change in relative abundance for 19 species of wild birds which live in agricultural landscapes, against a 1970 baseline.



Agriculture and Biodiversity

There have been historic trade-offs between farming and biodiversity, with the conversion of natural habitats into intensively managed farmland.

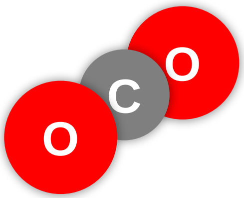
Land sharing integrates delivering environmental benefits and producing food on the same land, for example through current agri-environment schemes.

Land sparing protects natural habitats by separating them from intensive agriculture, for example through nature reserves. Sparing of land is then balanced by sustainable intensification of farming on agricultural land.

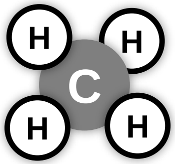
These two models benefit biodiversity on different scales, and a combination of different approaches will be needed in different landscapes and habitats.

What is the environmental challenge of agriculture in relation to greenhouse gas emissions?

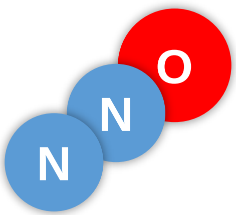
Agriculture is responsible for 10% of the UK's greenhouse gas emissions, mainly through emissions of methane and nitrous oxide from grazing livestock and fertilisers.



Carbon dioxide (CO_2) is a major greenhouse gas, but agriculture is only responsible for around 1% of UK CO_2 emissions. These are mainly though use of energy and fuel, which can be reduced by improving efficiency, and by generating energy from renewable sources on-farm.



Methane (CH_4) is a more potent greenhouse gas than CO_2, particularly over short timescales. Agriculture is responsible for half of the UK's total emissions.



Nitrous oxide (N_2O) is the most potent greenhouse gas that agriculture emits, having a warming effect that is around 300 times stronger than CO_2. Agriculture emits 70% of the UK total.

£3.1bn

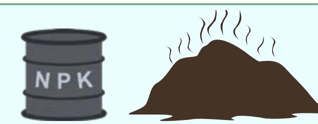
cost of UK greenhouse gas emissions in 2015 from agriculture

17%

estimated fall in nitrous oxide emissions from agriculture since 1990

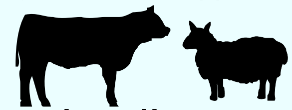
15%

estimated fall in methane emissions from agriculture since 1990



Fertilisers

90% of agricultural N_2O emissions are a result of nitrogen fertiliser application



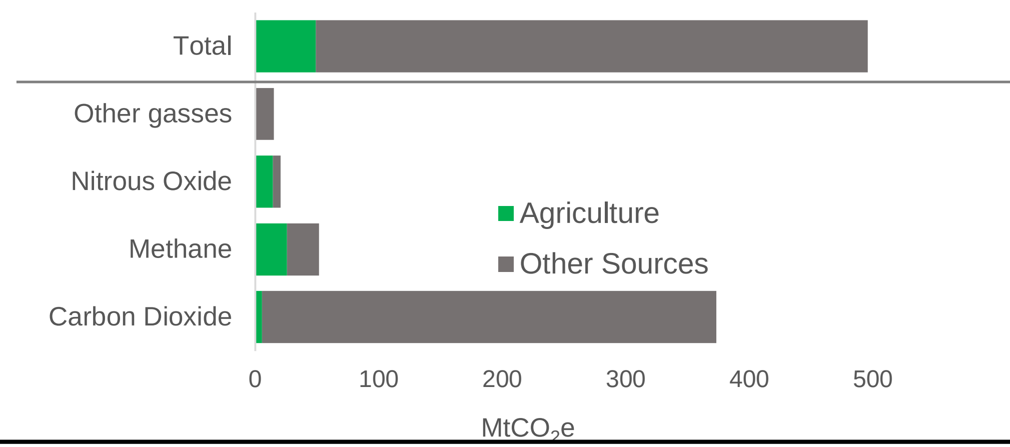
Grazing livestock

are responsible for 90% of methane emissions

Carbon sequestration:

Land managers can and do help mitigate climate change by increasing carbon storage through the creation of more forests and woodland, and to a lesser extent, through good management to restore the organic carbon content of soils to its natural maximum. These practices can also improve the nutrient and water holding capacity of soils, which provides agronomic benefits. There is also potential to reduce the contribution of degraded peatlands to GHG emissions through restoration activities

UK Greenhouse Gas Emissions (2017) in CO_2 Equivalents



What is the environmental challenge of agriculture in relation to ammonia emissions?

Agriculture was responsible for 87% of UK emissions of ammonia in 2017, mainly from livestock farming and fertiliser use.

21%
estimated fall in agricultural emissions of ammonia since 1990, due partly to declining cattle numbers, better manure and slurry management, and reduced mineral fertiliser use, although over the last 10 years, emissions have been stable or have risen.

Ammonia emissions affect human health, reduce air quality, can cause soil acidification, harm vegetation and contribute to air pollution.

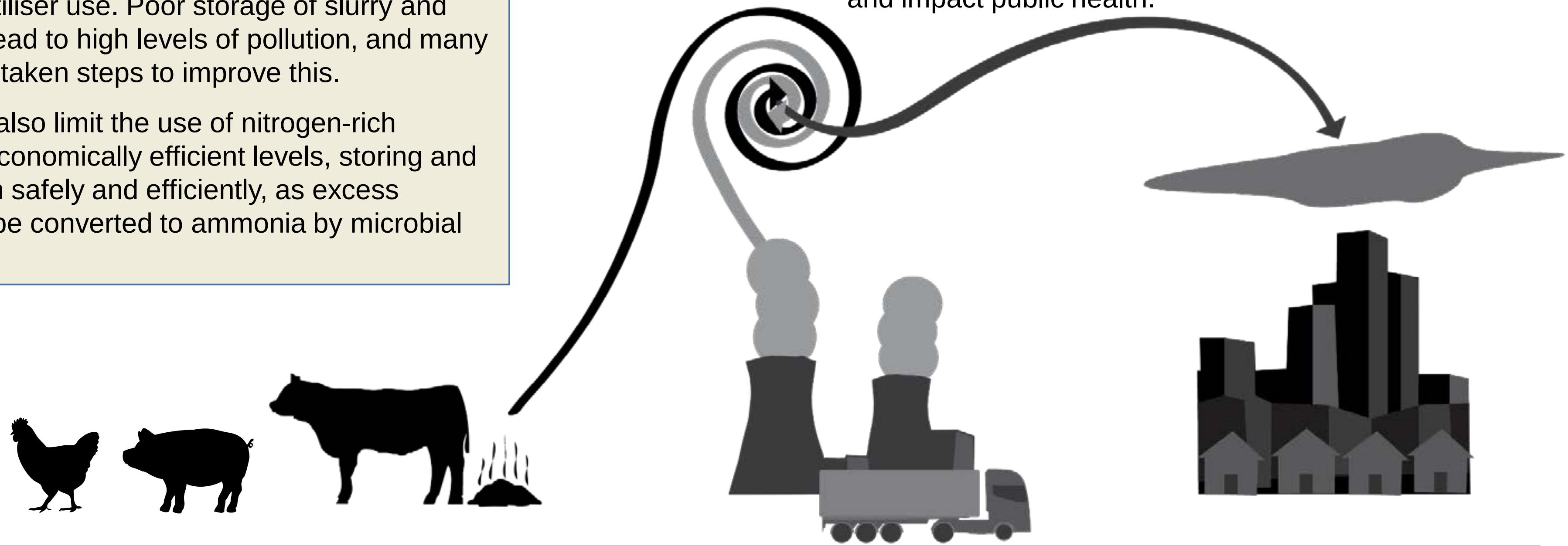
87% of UK ammonia emissions came from agriculture in 2017, mainly from livestock farming and mineral fertiliser use.

£456m
costs to human health and the environment from UK agriculturally-produced ammonia in 2015 (in 2017 prices)

Cattle are the largest source of ammonia, but it is also associated with chicken and pig farms, and with slurry and fertiliser use. Poor storage of slurry and manure can lead to high levels of pollution, and many farmers have taken steps to improve this.

Farmers can also limit the use of nitrogen-rich fertilisers to economically efficient levels, storing and applying them safely and efficiently, as excess nitrogen can be converted to ammonia by microbial processes.

Ammonia emissions can combine with industrial and transport emissions, forming harmful fine particulates which cause smog in urban areas and impact public health.



What environmental stewardship schemes have there been in England?

Countryside Stewardship is open to all farmers and land managers and allows them to select from a range of options that can be tailored to different farm types and desired outcomes.

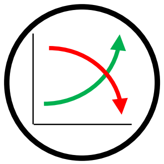
The current environmental stewardship scheme, Countryside Stewardship was launched in 2015. This targeted and competitive scheme aims to conserve/restore habitats, manage flood risk, reduce water pollution, maintain the character of the countryside, preserve historic features, encourage educational access, mitigate and adapt to climate change, and create and manage woodland. The scheme is delivered at two levels (tiers):

- The Mid Tier are simple, but effective agri-environment agreements,
- The Higher Tier covers the most environmentally significant sites, commons and woodlands.

Countryside Stewardship is open to all farmers, woodland owners, foresters and land managers. Farmers and land managers can choose from a wide range of options, depending on the outcomes they want to deliver and the priorities for the land that is being managed

In 2018, four new option bundles for wildlife are being offered in addition to the original application routes. This provides a simplified application process which is tailored to different farm types.

Payments are made as reimbursements for earnings farmers and land managers could have earned alternatively if they had not carried out the work.

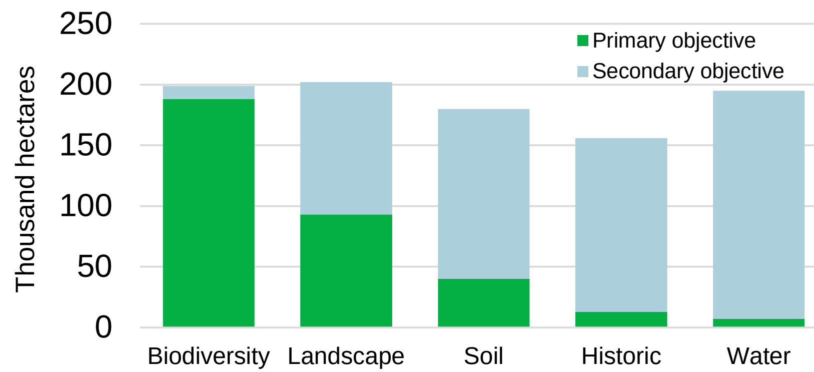


A monitoring and evaluation programme informs policy and future scheme development. Research projects investigate the impacts of land management practices.

The area of land that is under specific management options is typically low and is split between:

- Maximising the environmental benefit of non-productive features, such as hedgerows;
- A small amount of land taken out of agricultural production, for example buffer strips against water courses;
- A somewhat larger area of land that is farmed subject to management constraints, for example grassland with low fertiliser inputs.

Management is designed to address multiple aspects of natural capital, but different options receive varying levels of uptake. While an option may have a primary objective (e.g. Biodiversity improvements), it will typically deliver additional benefits.



Area of land being managed to address different priorities in Countryside Stewardship as at September 2017.

What positive impacts have environmental stewardship schemes had to date in England?

Environmental stewardship schemes have been beneficial to habitats and species, landscape character and water quality, with at least £3.20 of public goods returned for every £1 put in.

The impact of current environmental stewardship schemes

Habitats and species

23,000 hectares of food sources for farmland birds.

189,000 hedgerow trees and in field trees protected.

19,000 hectares of planted areas providing pollen and nectar sources for pollinators.

Significant, positive effects at the farm-scale were recorded for 6 out of 15 farmland bird species, on Higher Level Scheme agreements in just three years (2008-2011).

Higher Level Scheme management for pollinators can significantly increase the size of wild bumblebee populations.

Landscape character and historic environment

820 designated scheduled monuments removed from the Heritage at Risk Register.

280,000 km maintenance, management and restoration of hedgerows, ditches and stonewalls.

A positive/strongly positive effect on the landscape in 77% of National Character Areas in England.

Water Quality

£29million of farm improvements coordinated through Catchment Sensitive Farming.

1.2 million hectares of land and 14,000 farmers actively engaged with Catchments Sensitive farming.

47,000 hectares of buffer strips protecting water courses and features from agricultural impacts.

Catchment Sensitive Farming activity up to the end of May 2013 predicted (from modelling) to reduce agricultural losses of key pollutants by 4 to 12% in Catchment Sensitive Farming target areas.

A cost-benefit ratio can be calculated by monetising the environmental improvements and public goods delivered by schemes, and comparing that with their cost.

Cost benefit ratios for past environment management schemes are:

Countryside Stewardship	**£3.60**
Forestry Creation	**£3.20**
Forestry Management	**£5.60**

For every £1 of support put into a scheme, this is the value of the benefits the public receive back.

What issues have there been with environmental stewardship schemes in England?

Environmental stewardship schemes have had a number of issues impacting on environmental outcomes delivered, related to the coverage of schemes and management options, the effectiveness of management options and the effectiveness of schemes.

The impact of current environmental stewardship schemes

Coverage of schemes and management options

Even at peak scheme uptake (2013/14), when over 70% of agricultural land was entered into the Environmental Stewardship scheme, less than half of this area (equating to just 30% of total agricultural land) was subject to changes in land management practice.
Non-productive features under scheme management (e.g. hedges) and land taken out of production for environmental purposes (e.g. buffer strips) accounted for less than 2% of the total agricultural land area at peak scheme participation (2013/2014).
Free choice scheme designs can result in take up of very limited number of management options, restricting the potential environmental benefits. For example in the Entry Level Schemes (ELS), the six most popular management options accounted for 49% of all points scored and the 20 most popular options accounted for 90% of all points scored in the scheme

Management option effectiveness

Effectiveness of management options can be compromised by poor site selection, selection of the wrong option, or poor management. For example, a study of Higher Level Schemes (HLS) found that 1/3 of grassland sites had been selected for the wrong management option.
Some scheme management options are subject to considerable variability in the quality of their delivery. For example, food patches for farmland birds was rated ‘poor’ with no visible signs of seed at 25% of sampled sites.

Scheme effectiveness

Many environmental issues require intervention/co-ordination at a scale larger than the individual agreement. For example, improving water quality depends on securing widespread changes in management practises at the catchment scale.
ELS has demonstrated limited environmental benefits compared to HLS, where 75% of agreements sampled were considered likely to be effective for all or most outcomes.

The evidence presented here is based on evaluation of the Environmental Stewardship Scheme, the current scheme – Countryside Stewardship – has not been in operation long enough for its environmental effectiveness to be evaluated.

How will a new Environmental Land Management scheme contribute to the delivery of key environmental public goods?

The Environmental Land Management scheme (ELM) will contribute to the delivery of the six key environmental public goods set out in the 25 Year Environment Plan by encouraging positive farming practices.

In 2018, the Government set out its ambition to improve the environment in the 25 Year Environment Plan for England.

A new ELM scheme will contribute to the delivery of the six key environmental public goods laid out in this plan:

Clean and Plentiful water

Thriving Plants and wildlife

Protection from and Mitigation of hazards

Clean Air

Beauty, heritage and engagement

Mitigation and adaption to Climate Change

What is the Environmental Land Management Scheme?

The new Environmental Land Management scheme, underpinned by natural capital principles, will contribute to delivering against many of the key public goods inspired by the 25 Year Environment Plan. These include clean air; clean and plentiful water; thriving plants and wildlife; reduced risk of harm from environmental hazards such as flooding and drought; enhanced beauty, heritage and engagement for the natural environment and mitigating and adapting to climate change. The new scheme will be based around the provision of environmental benefits, with a flexible approach to tackling the differing environmental priorities across the country.

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To return to the corresponding detailed slide from the references on an electronic device press the slide button.

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The Future Farming and Environment Evidence Compendium: Voluntary Application of the Code of Practice for Statistics

The future farming and environment evidence compendium is a compilation of official statistics, analysis and research drawn from a range of Government Departments and other public bodies. Many of the statistics are reproduced from National and official statistics sources. Where there are gaps in the evidence base, the best available unofficial sources are used.

Although this report is not in itself an official statistic, where possible we follow the UK's Code of Practice for Statistics in its production.

National and official statistic sources have been highlighted in the references with an [NS] or [OS] suffix.

Please see the accompanying voluntary compliance statement for further information on the voluntary application of the Code of Practice for Statistics.