The Future Farming and Environment Evidence Compendium

February 2018

Farm Economics and Accounts

Food Production

Environmental Land Management

Department for Environment Food & Rural Affairs

Government Statistical Service

The **Future Farming and Environment Evidence Compendium** provides a detailed assessment of the current state of agriculture in the UK to underpin the proposals laid out in the consultation paper: **Health and Harmony: the Future for Food, Farming and the Environment in a Green Brexit**.

Contents

This is the first version of the evidence compendium that aims to bring together a range of sources to help the reader understand UK agriculture. Revised versions will be published subsequently with greater detail.

The research and analysis in this compendium is taken from a variety of disciplines – scientific research, statistics, economics, social research or operational research, and geographical 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.gsi.gov.uk

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

Why is agriculture important?

Agriculture contributes less than 0.5% to the United Kingdom’s economy, but provides half of the food we eat, employs half a million people and is a key part of the food and drink sector which contributed £112bn to the economy in 2016 .

It is farmers and land managers who manage 72% 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?

In 2016, agriculture generated £23bn worth of produce while consuming £15bn worth of goods and services, giving a net contribution to the UK economy of £8bn.

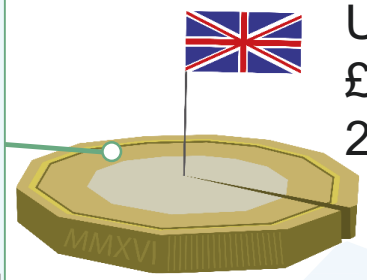
15

In 2016, the total profit (Total Income from Farming) was £3.6bn.

20

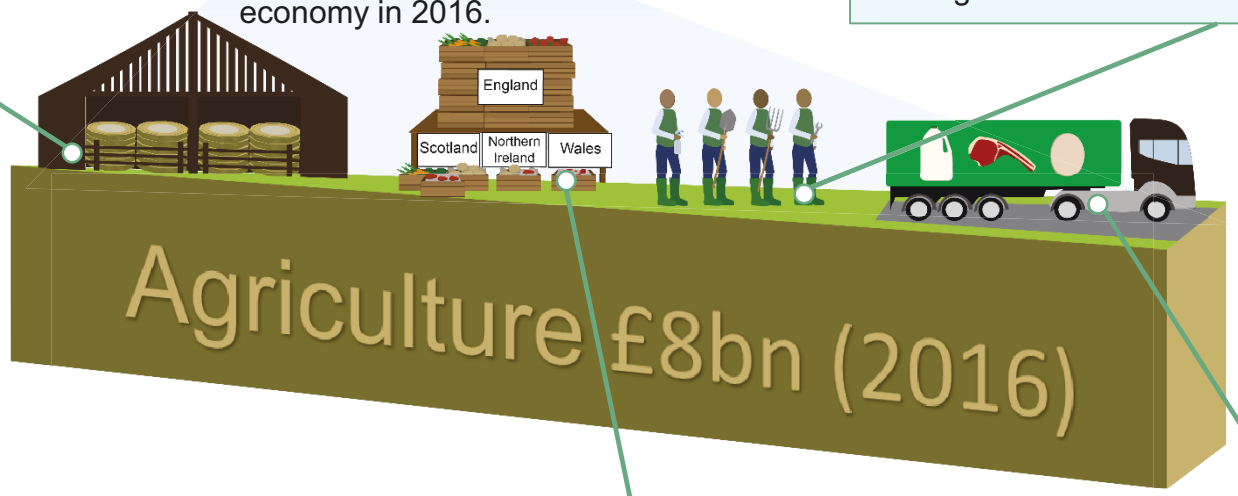
The Total Income from Farming can vary hugely from year to year and therefore it is important to consider more than just one year when interpreting the performance of agriculture.

21



UK Economy
£1.75 trillion
2016

Agriculture contributed 0.45% of the total net UK economy in 2016.



Farming, forestry and fishing contributed 2% to the rural economy in 2016, higher than the national average of 0.5%. 85% of rural businesses are unrelated to these sectors.

Agriculture employs almost half a million people in the UK, 1.5% of the total UK workforce, who are mainly involved in business ownership or management.

16

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

If you are reading a paper version please turn to page 16.

In 2016, England provided around three-quarters of the UK's net agricultural contribution to the UK economy, Wales contributed 4%, Scotland 14% and Northern Ireland 5%.

17

Agriculture is a key part of the wider food and drink sector, which had a net contribution of £112bn to the economy in 2016.

How is the agriculture industry structured?

In the UK, the agriculture industry is made up of 218,000 farm holdings, using 17.5million hectares of land (72% of UK land total in 2017).

14

In the UK 62% of those employed by agriculture are involved in the business as farmer, partner, director or spouse of the farmer.

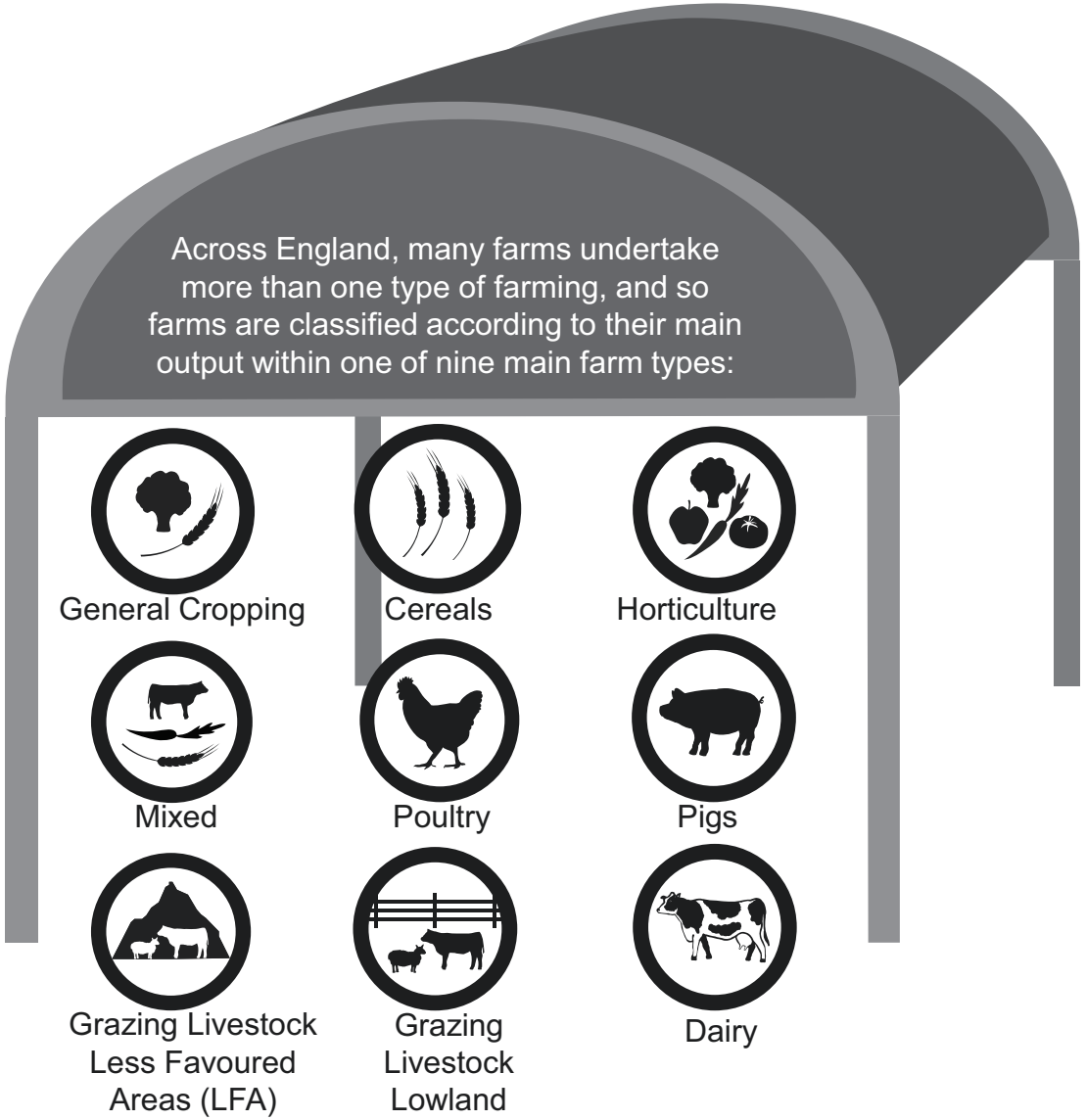
16

In England in 2016, cereals farms used the largest amount of farmed area (33% of total), and grazing livestock in lowland areas had the greatest number of farms (30% of total).

18

In England in 2016, a small number of economically large farms (7%) produced over half (55%) the agricultural output using just 30% of the total farmed land area.

19



How do Farmers' incomes vary across England and why do some continue to operate while making a loss?

Between 2014/15 and 2016/17 14% of farms made a profit of more than £75k, while 16% of farms made a loss, with an average profit for all farms of £37,000.

22

In 2016/17, almost 2/3rds of farms used farm resources to deliver non-agricultural activities, generating around £620million additional profit (£17,100 per farm).

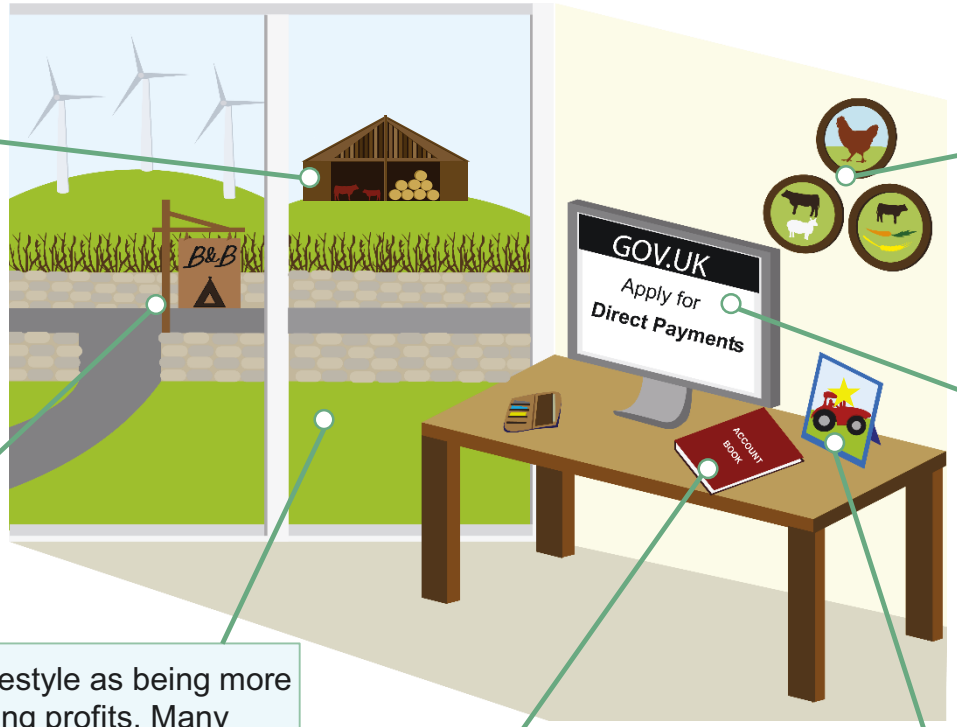
28

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.

25

Farmers are price-takers and the determinants of the prices they receive can be out of their control. Many farmers do not manage farm performance, such as analysing profits and losses.

26



Farm Business Income varies across the different farm types, and over the period 2014/15 to 2016/16 poultry farms were most profitable and grazing livestock and mixed farms the least.

24

Many farms make a loss from the agricultural side of their business, but benefit from Direct Payments, taking part in agri-environment schemes or diversifying their activities for income.

23

In 2016/17, the top 25% of farm performers were 2.5 times more likely to undertake business management practices such as looking at their profit and loss account compared to the bottom 25% of performers.

27

What costs affect farm profitability and how can farmers become more profitable?

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

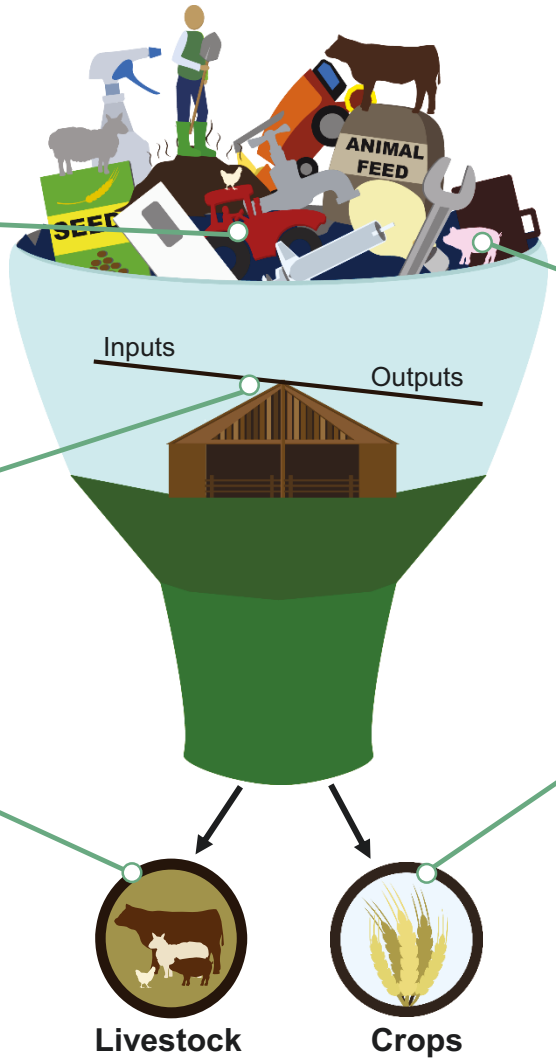
29

UK agricultural productivity has increased 64% (or 1.5% per year) since 1973 mainly through becoming more efficient by using fewer workers.

30

Reducing the level and impact of endemic disease and health conditions can not only improve the health and welfare of our livestock, but also boost productivity.

32



Across all farms types in England in 2016/17 , 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.

31

Preventing disease outbreaks and controlling pests that threaten plants in the UK helps protect the environmental and social benefits of crops and trees and reduces productivity losses.

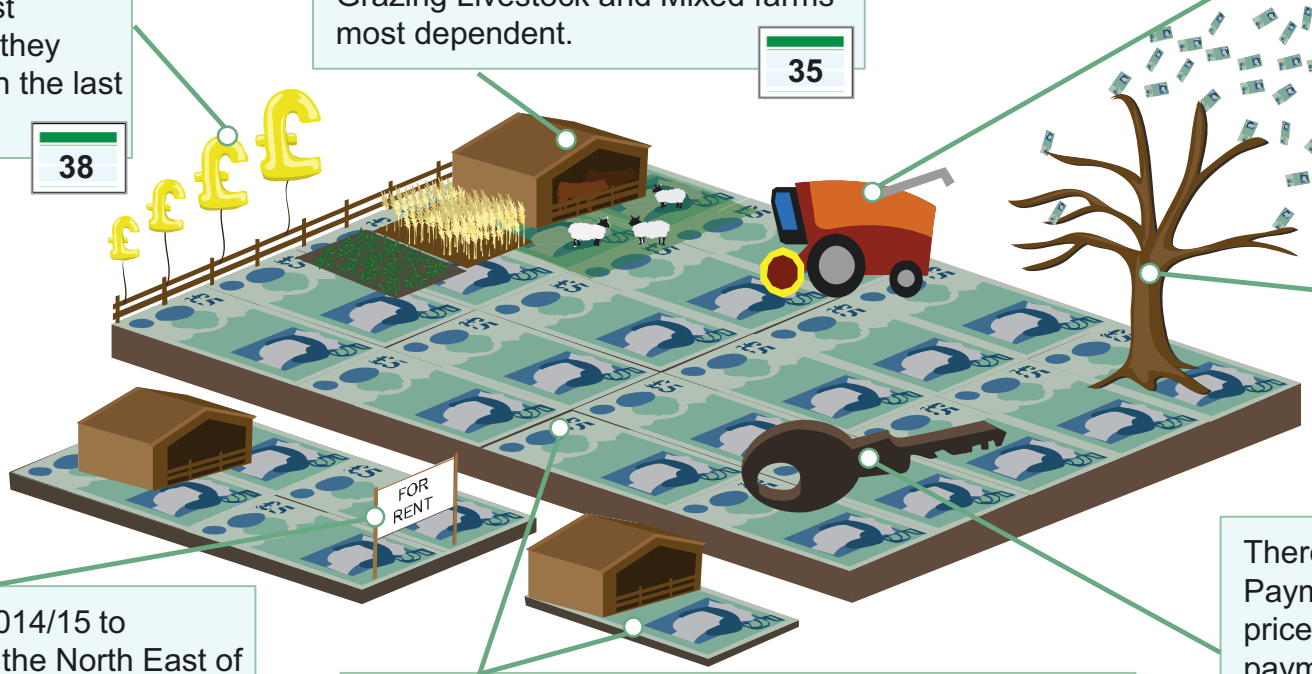
33

How are Direct Payments allocated and what has been their impact on farm profit, rents, land prices, investments and the environment?

Agricultural land prices have risen significantly faster than other land prices over the last decade, although they have fallen back in the last couple of years. **38**

Across all farm types in England 61% of Farm Business Income came from Direct Payments over the period 2014/15 to 2016/17, with Grazing Livestock and Mixed farms most dependent. **35**

In 2016/17 after excluding land value, more than half of farms (56%) in England showed a negative overall return to capital. **38**



30% of the Direct Payment is made through Greening, but these measures are currently failing to meet environmental objectives. **39**

Over the period 2014/15 to 2016/17, farms in the North East of England and those of tenant farmers were the most reliant on Direct Payments to support Farm Business Income . **36**

Direct Payments are largely allocated based on land area. In 2016, the top 10% of recipients in England received almost half (47%) of the £1.65bn total payments, while the bottom 20% received 2%. **34**

There is evidence that Direct Payments inflate farm rent prices, meaning some of the payment supports the income of the landowner, not the tenant farmer. **37**

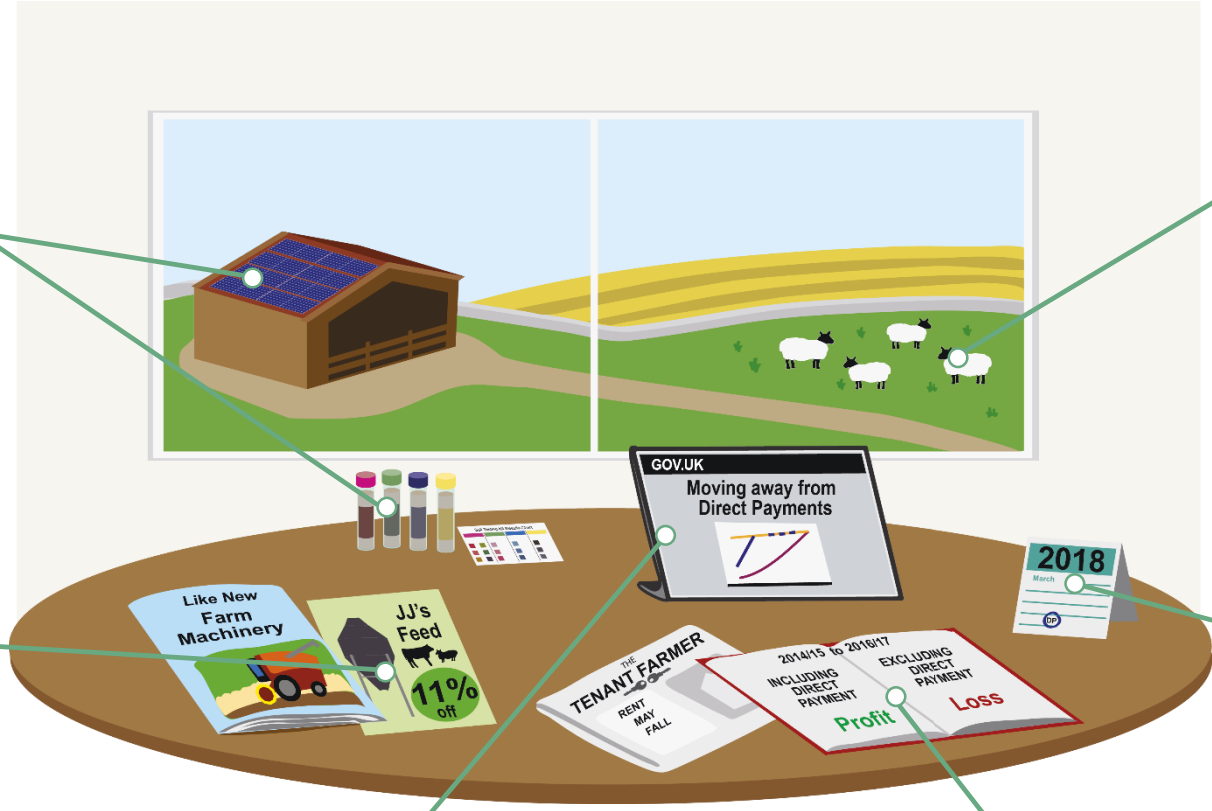
What is the impact of moving away from Direct Payments and what are the options for moving away from them in England?

Removal of Direct Payments may be offset in a number of ways, including farm efficiency improvements and diversification, although this will vary by type and location of farm.

40

On average, farms would have needed to reduce their costs by 11% in order to break even without Direct Payments, but this varies greatly across different farm types.

45



Over 2014/15 to 2016/17 19% of lowland grazing livestock and 22% of mixed farms made a loss with Direct Payments. This rises to 53% and 55% respectively if Direct Payments are removed.

42

Reductions in Direct Payments could be made via many options and over many time periods, but the shorter the transition the more money is removed from farmers each year.

43

Progressive or capped reductions could be applied to Direct Payments, affecting an increasing number of farmers over the 'agricultural transition' period. There are many possible variances of these options

44

Over 2014/15 to 2016/17, 16% of farms made a loss with Direct Payments and removing would have meant 42% making a loss, but adjustments such as lower investments and rents would be expected to offset some of the impact.

41

What do UK farmers produce and where does food consumed in the UK come from?

More than 60% of the UK's agricultural production comes from the livestock sectors (£12.7bn in 2016), of which dairy and beef are the largest.

47

The West of England is dominated by livestock production, of which dairy has the highest value. The East is generally dominated by pigs, poultry and crops.

49

Average household expenditure on food and drink has fallen from 30% in the 1950s to less than 10% today, but this this is still16% for the lowest income households.

53

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.

52

The UK's food production to supply ratio, an indicator of the ability of UK agriculture to meet domestic consumer demands, stood at 76% for indigenous foods in 2016

51

We import more agricultural or lightly-processed food products than we export, with the exception of lamb, mutton, offal, milk and cream and milk powder.

50

The prices farmers receive for their produce fluctuates and the factors behind this are often outside of their control.

48

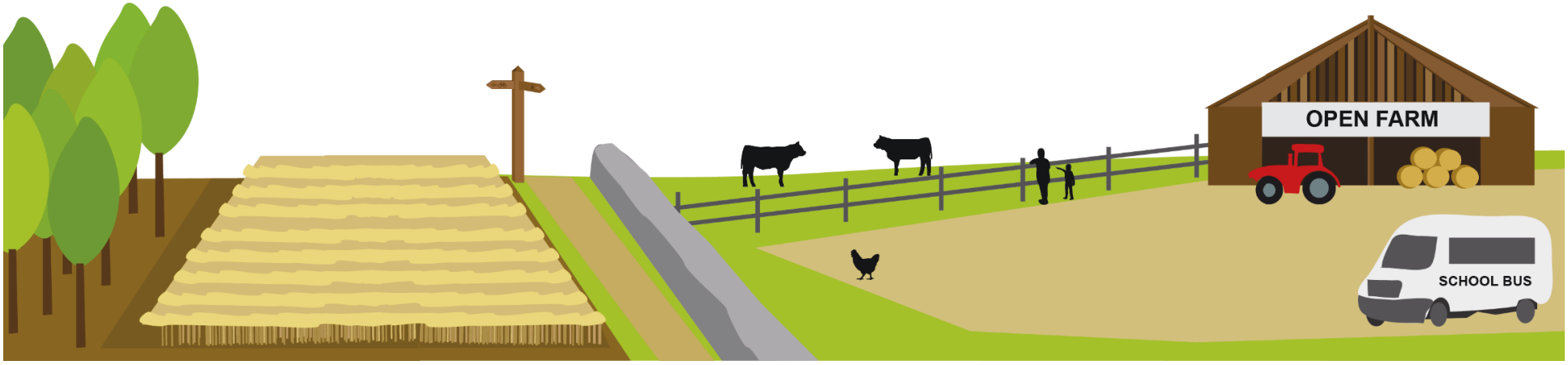
What is the benefit in investing public money into environmental land management schemes?

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

55

While farming can have a negative impact on the environment, a number of public goods arise from a well-farmed landscape, including recreational and environmental benefits.

56



Environmental Land Management schemes encourage positive farming practices through income foregone payments that incentivise the delivery of public goods.

57

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.

58

Environmental Land Management has 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.

59

How does farming impact the environment?

Agriculture is responsible for 83% of UK **ammonia emissions** mainly from livestock farming and fertiliser use. 64

Soil is an essential natural resource, with poor management causing erosion, compaction, depletion of nutrients, organic matter and biodiversity. 61

Water quality is adversely affected by farming through run-off of fertilisers, pesticides and slurry, and through erosion of soil which is washed off farmland. 60

Agriculture is responsible for 10% of the UK's Greenhouse Gas Emissions, mainly through emissions of methane and nitrous oxide from grazing livestock and fertiliser. 63

Farming practices can result in **habitat loss reducing biodiversity**. The UK farmland bird index, one indicator of the general state of wildlife, has fallen to less than half its 1970 value. 62

Almost a third of the 3.2 million hectares of the UK's **forests and woodlands** are on farmland, however agricultural land use changes can result in trees being removed. 65

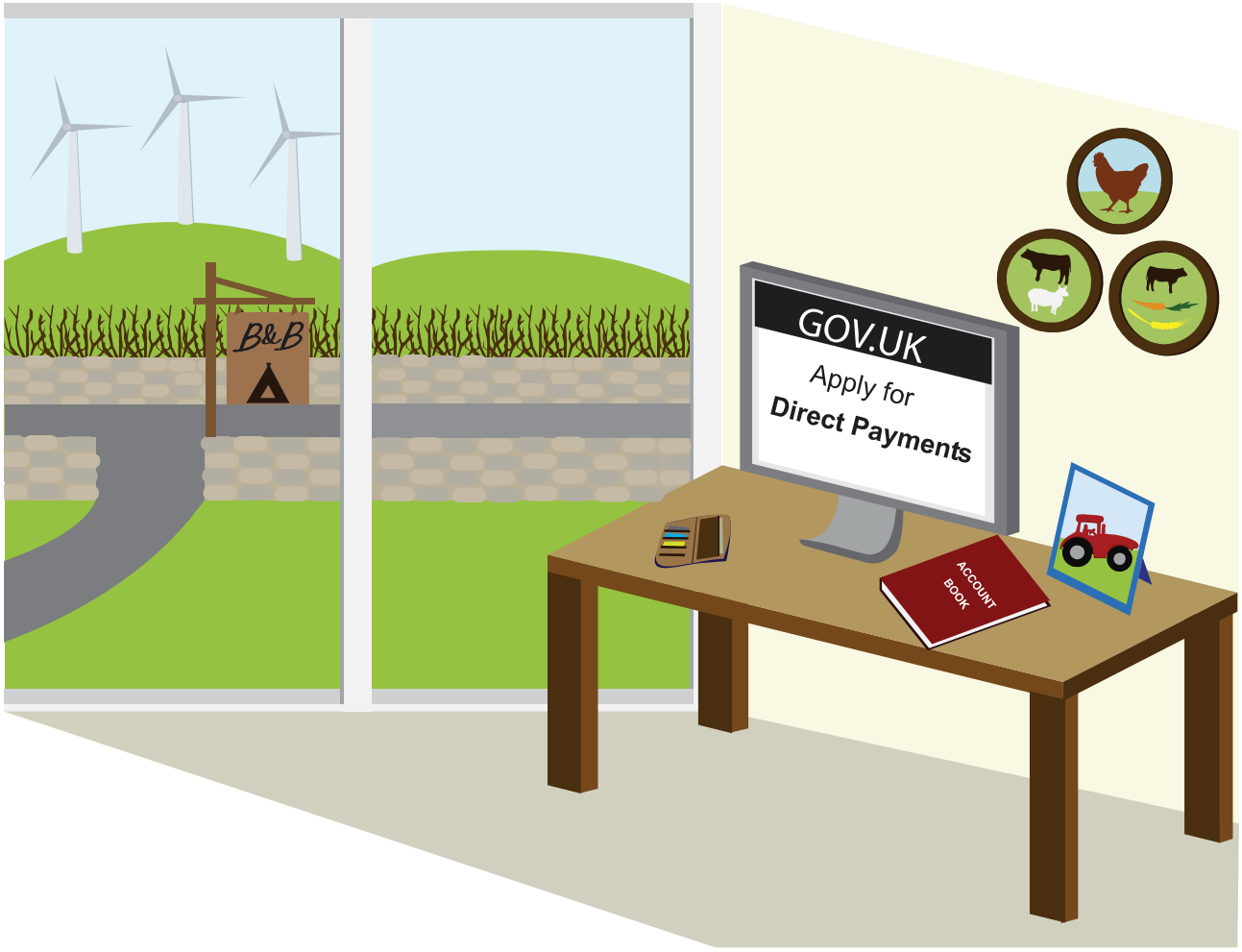
Flooding can be exacerbated by cropping practices and tree removal, but many land management practices can reduce flood risk and wider environmental outcomes. 66

Many farmers use farm management techniques that are sympathetic to the environment; however, there is a balance between production efficiency of the farm system and environmental protection. As such, the environmental impacts from farming are a result of a complex combination of farm business structure, incomes, land use, production, input use and other farm management decisions.

While good management practices can reduce the environmental pressures from farming, losses from inputs are inevitable for nearly all farming systems and these typically behave as pollutants on entering the wider environment, impacting climate regulation, air, soil and water quality. The land required to grow crops and raise livestock can affect the quality, composition and availability of soils and habitats, impacting biodiversity, and can affect the provision of clean air and water filtration.

Farm Economics and Accounts

(pages 14-45)



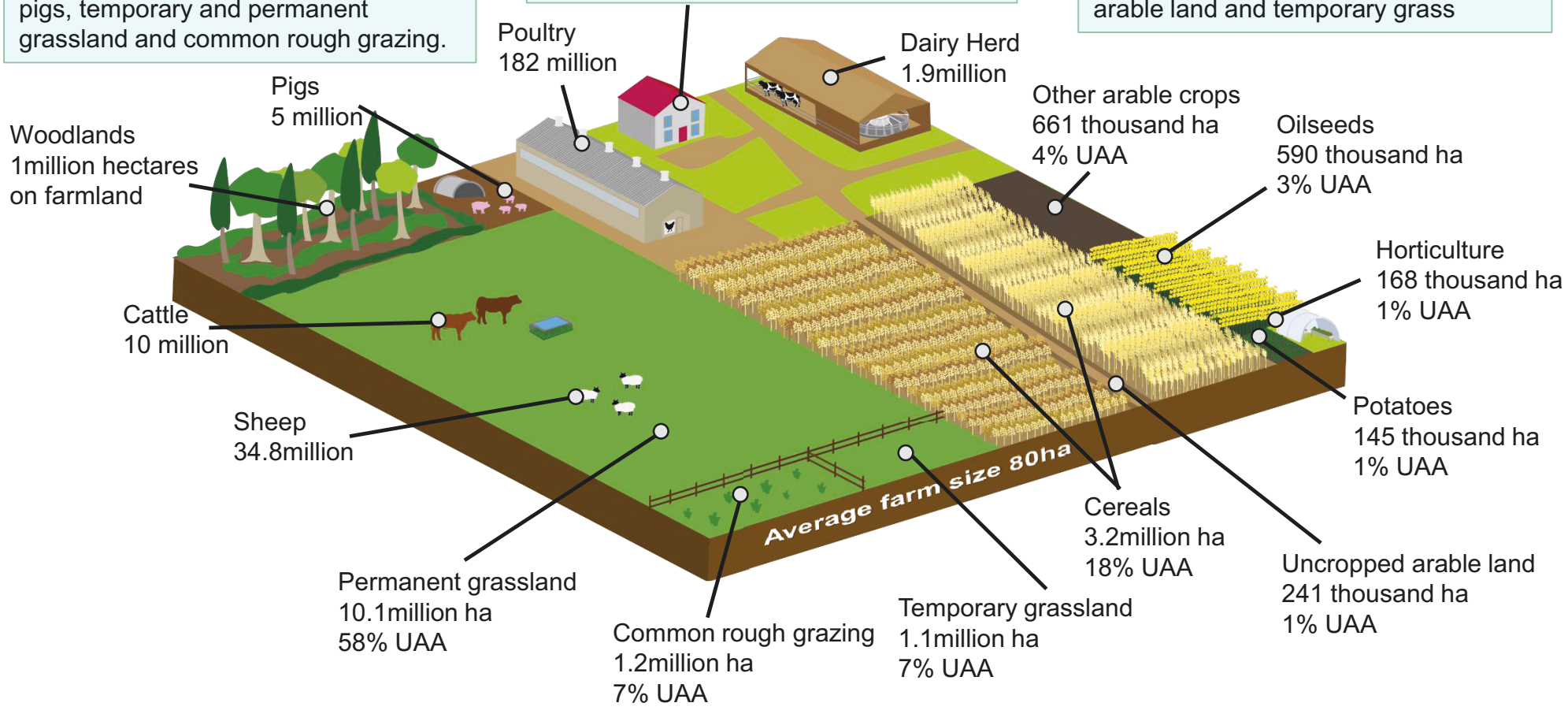
How is the UK agriculture industry structured and how is agricultural land used ?

The UK agriculture industry is made up of 218,000 farm holdings using 17.5million hectares of land (72% of the UK land total in 2017).

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.

The average UK farm size is 80 hectares, however almost half of all farms are less than 20 hectares in size.

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

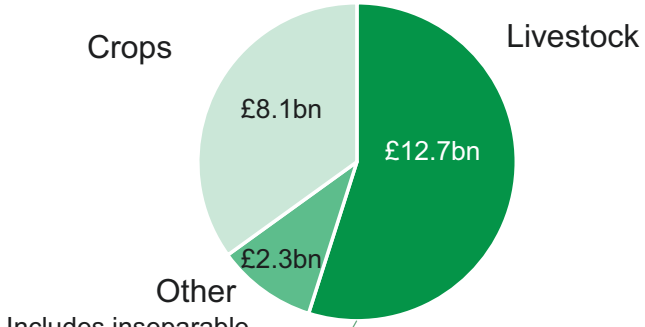


How much does agriculture contribute to the UK economy?

In 2016, agriculture generated £23bn worth of produce while consuming £15bn worth of goods and services, giving a net contribution to the UK economy of £8bn.

£23bn

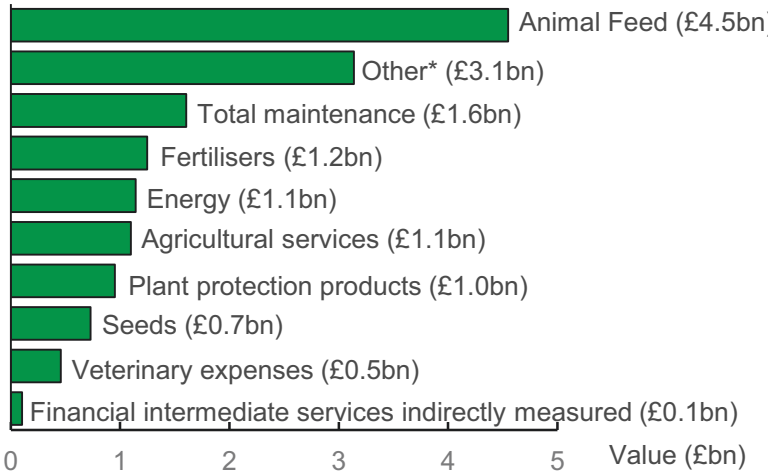
Total economic activity in the **production** of new agricultural goods and services



59% of livestock output is in the form of meat, 26% through milk, 10% though acquiring farming stock and 5% through eggs.

£15bn

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 (£23bn) less intermediate Consumption (£15bn) = Gross Value Added (£8bn)

How many people are employed within agriculture?

Agriculture employs almost half a million people in the UK, 1.5% of the total UK workforce, who are mainly involved in business ownership or management.

Focusing on the UK…

466,000 people are employed in the agricultural sector in the UK in 2016.

62% of those workers are involved in the business as the farmer, partner, director or spouse of the farmer

The proportion of the working population employed in agriculture varies for each country. The most are employed in Northern Ireland, and the least in England :

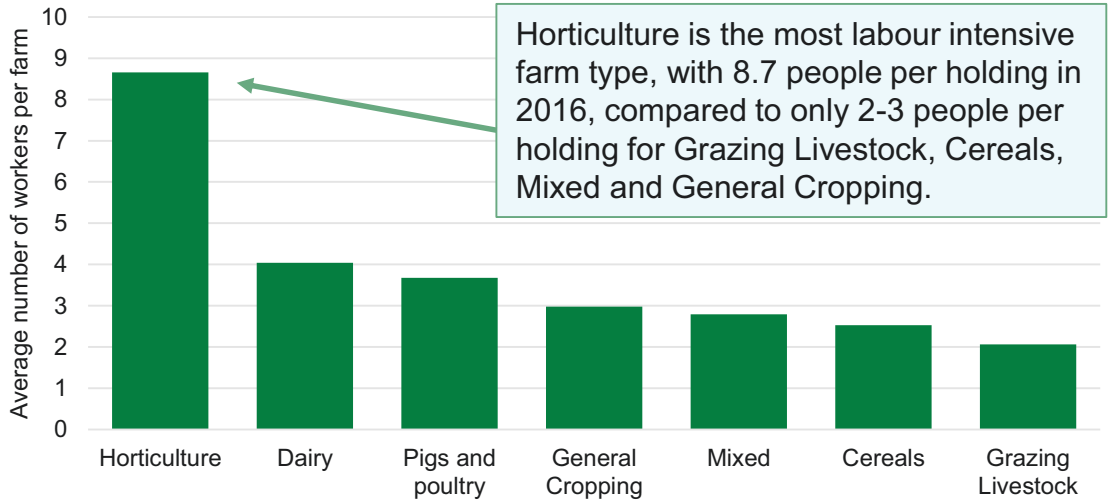
5.7% in Northern Ireland **1.0%** in England

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

Agriculture typically has an ageing workforce. In 2016, around a third of all farm holders in the UK were over the age of 65 years, although it should be noted that the holder is not necessarily the manager or active farmer. Just 3% of people were aged less than 35 years.

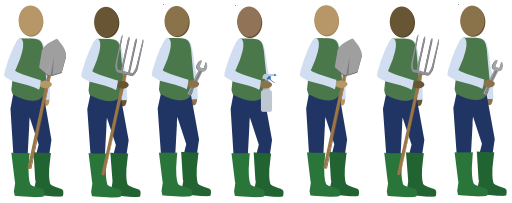
Focusing on England….

302,000 people were employed in the agricultural sector in England in 2016 . The majority (57%) was made up by farmers, partner, directors & spouses.



Horticulture is the most labour intensive farm type, with 8.7 people per holding in 2016, compared to only 2-3 people per holding for Grazing Livestock, Cereals, Mixed and General Cropping.

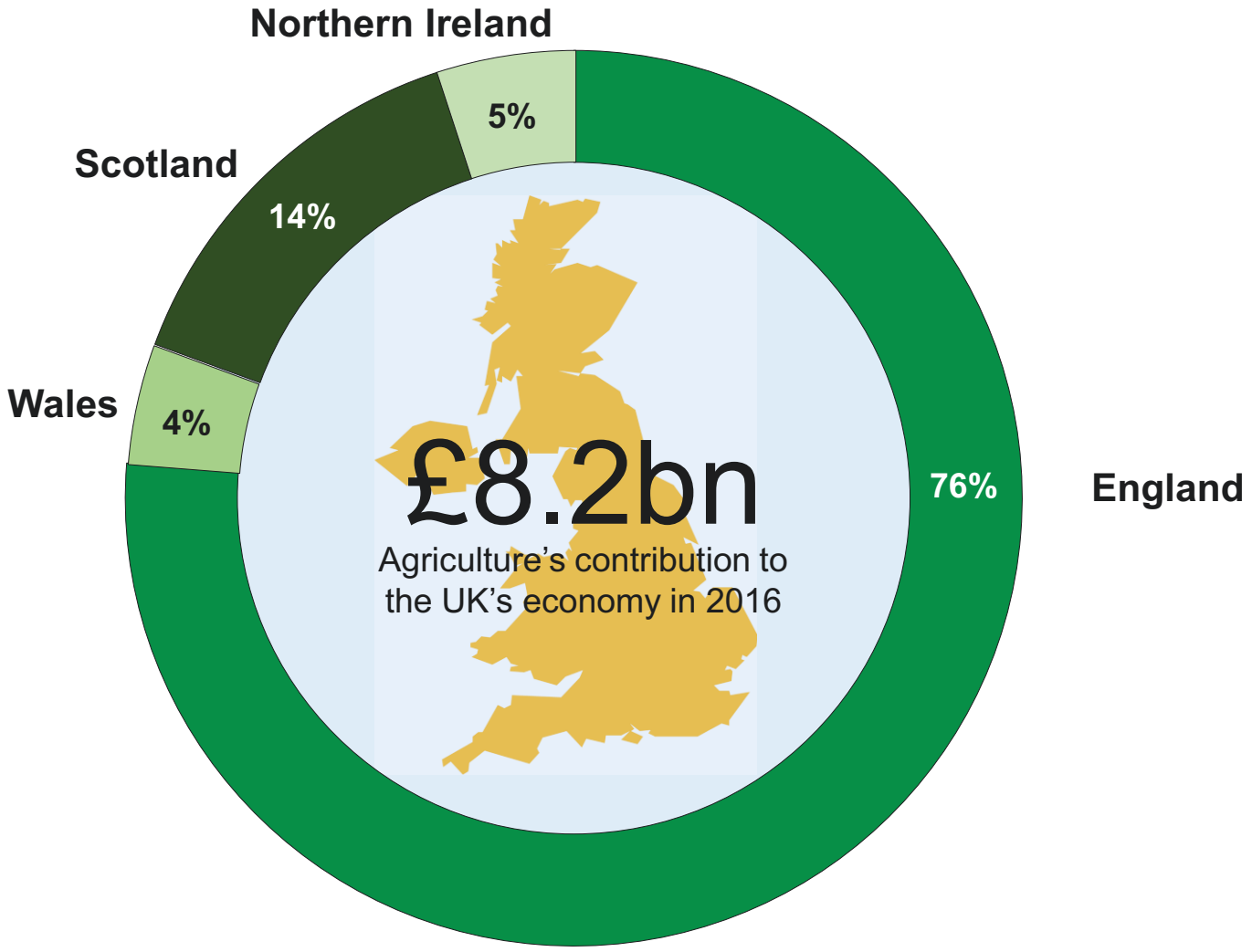
	Horticulture	Dairy	Pigs and poultry	General Cropping	Mixed	Cereals	Grazing Livestock
Percentage of agricultural employment in England	12%	9%	6%	17%	9%	16%	31%



Grazing Livestock is the sector which employs the largest number of people in English agriculture (31% of total English agricultural employment). This sector makes up 42% of total farms (see page 18).

How much of the net contribution of agriculture to the UK economy comes from each country?

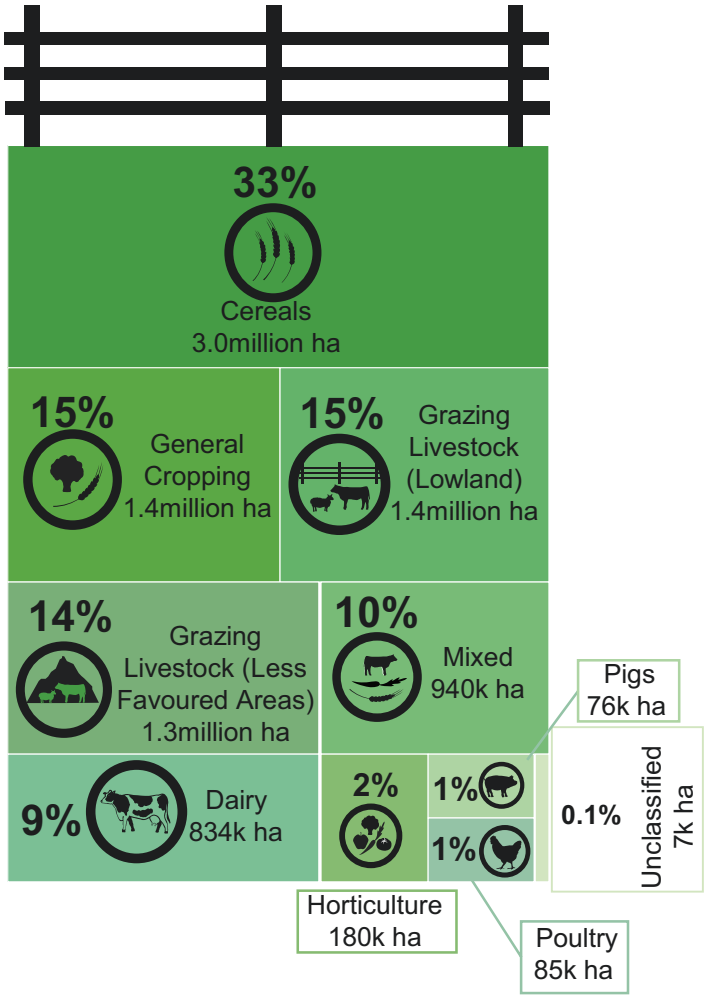
In 2016, England provided around three-quarters of the UK's net agricultural contribution to the UK economy, Wales contributed 4%, Scotland 14% and Northern Ireland 5%.



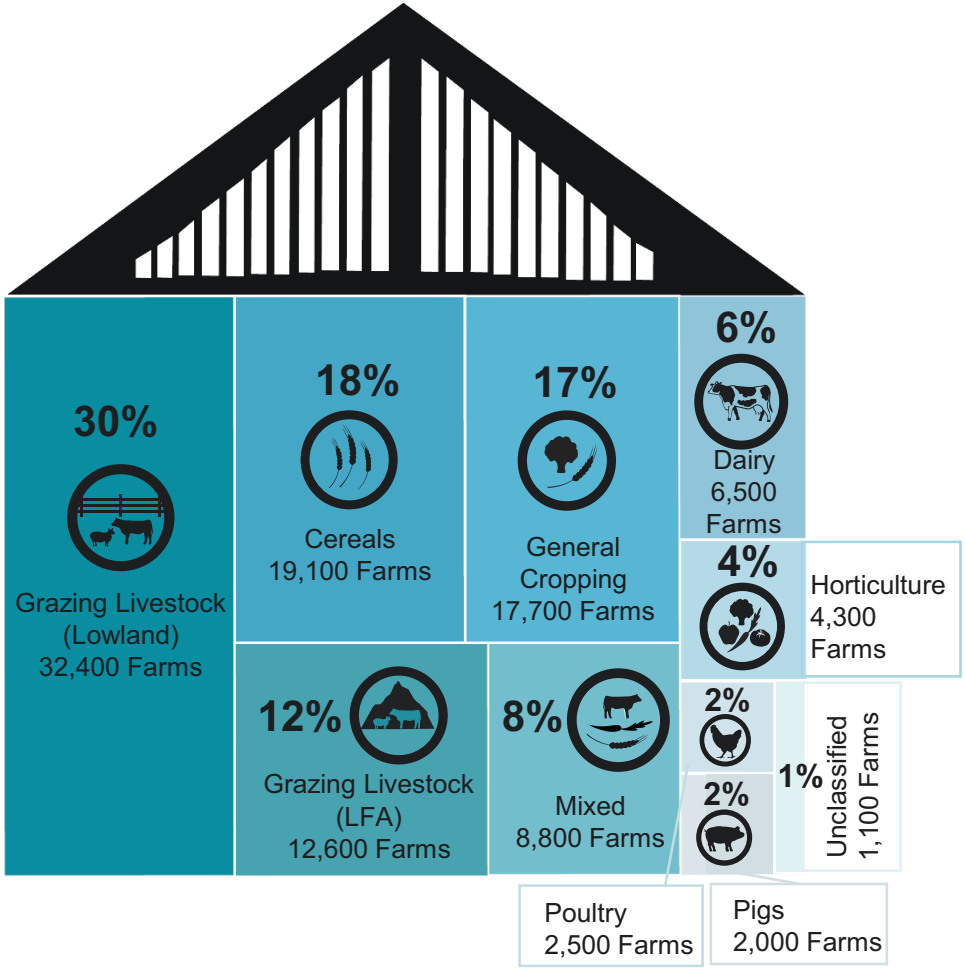
How many of each farm type are there in the England and how much land do they use?

In England in 2016, cereals farms used the largest amount of farmed area (33% of total), and grazing livestock in lowland areas had the greatest number of farms (30% of total).

Area of land used by sector type.
Total Farmed Area: 9.1 million hectares (ha)



Number of farms by sector type.
Total Farm Holdings: 107,000



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

In England in 2016, a small number of economically large farms (7%) produced over half (55%) the agricultural output using just 30% 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

	Very Small	Small	Medium	Large	Very Large	Total
% total Farm Businesses	42%	30%	11%	9%	7%	97,900 Farm Businesses
Number of farm businesses	41,200	29,600	11,200	8,900	7,000	

	Very Small	Small	Medium	Large	Very Large	Total
% total Output (€ million)	2%	11%	12%	19%	55%	€16,200 million estimated output

	Very Small	Small	Medium	Large	Very Large	Total
% total Farmed Area (thousand Hectares)	8%	23%	19%	21%	30%	9,1 Million hectares

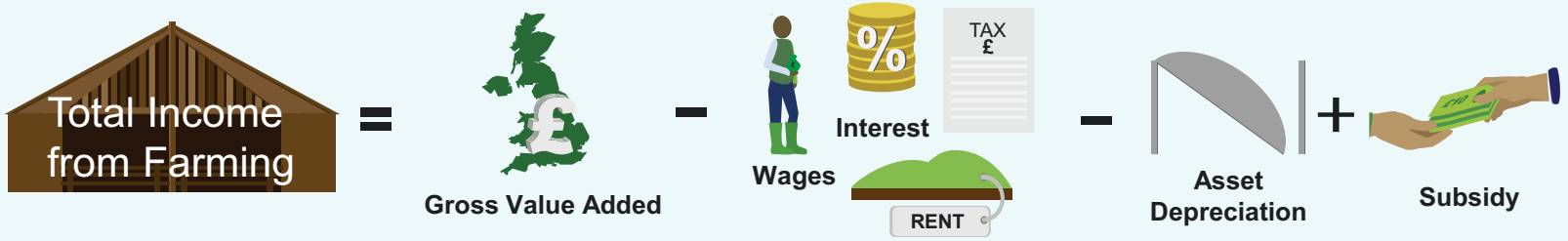
Standard Output measures the total value of output of any one enterprise - per head for livestock and per hectare for crops. For crops this will be the main product (e.g. wheat, barley, peas) plus any by-product that is sold, for example straw. For livestock it will be the value of the main product (milk,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

What is the total income or profit of farms in the UK?

In the UK in 2016, the total profit (Total Income from Farming) was £3.6bn. This is the total net contribution (£8bn) minus depreciation of farm assets (£4.1bn), payment of wages, rent, interest and taxes (£3.6bn) and addition of farm subsidies (£3.1bn).

How is Total Income from Farming calculated?



In 2016 these values were:

Wages, rent, interest & taxation
Total value: £3.6bn

Breakdown by type:

Wages (including pensions)	£2.5bn
Rent	£0.6bn
Interest	£0.4bn
Taxes on production	£0.1bn

Asset Depreciation
Total value: £4.1bn

Breakdown by type:

Equipment	£1.8bn
Livestock[a]	£1.2bn
Buildings	£1.0bn

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

Subsidies on production[b]
Total value: £3.1bn

Breakdown by type:

Scheme	£bn
Basic Payment Scheme	£2.57
Agri-environment payments	£0.40
Less favoured areas support scheme	£0.08
Other agri-environment schemes	£0.03
Animal disease compensation	£0.02

The total income from farming in 2017 is forecast to have risen to £5.3bn, although this is a provisional figure (published Feb 2018) and will be updated in April 2018.

[b] *The term "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 or profit of farmers vary from year to year?

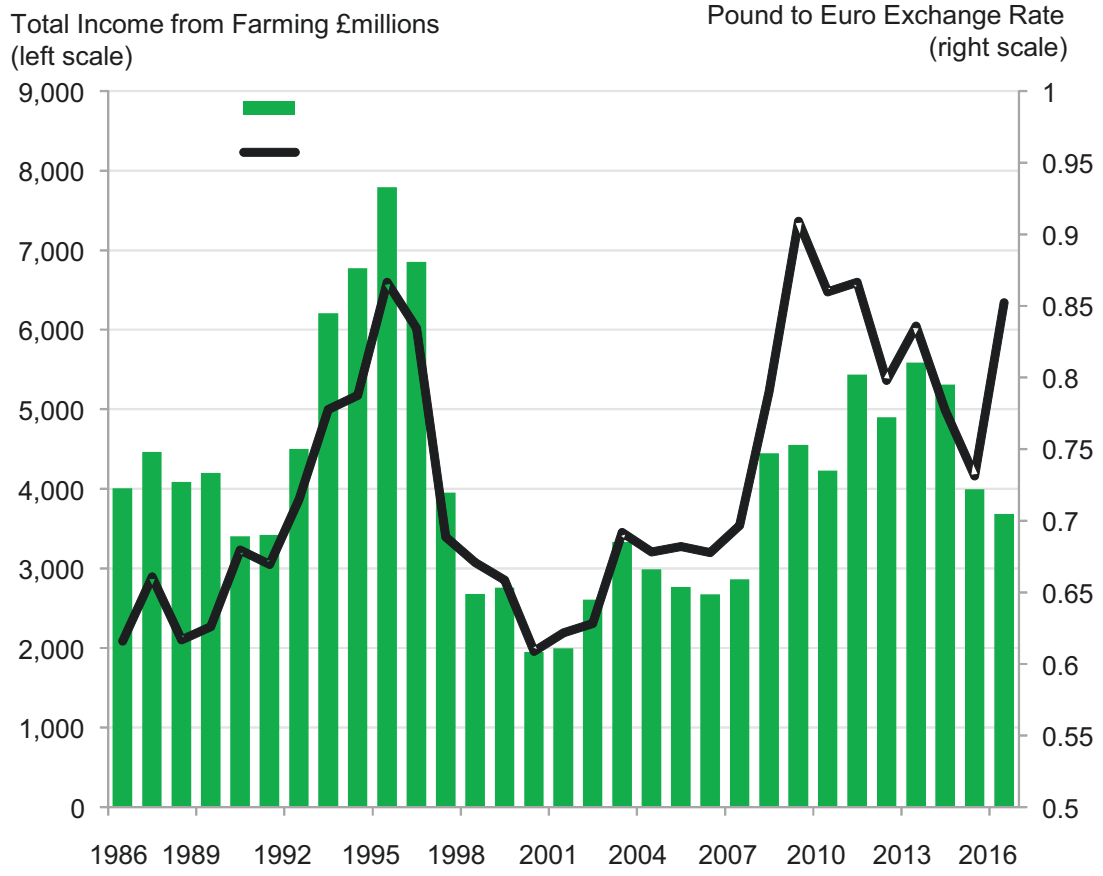
The Total Income from Farming can vary hugely from year to year and therefore it is important to consider more than just one year when interpreting the performance of agriculture.

Exchange Rates
Farm income is exposed to variations in exchange rates. A weak pound is generally good for farming as exports of goods become more competitive on the world market and import prices rise.

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

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

Weak Pound – Positive impact on farm income



Strong Pound – Negative impact on farm income

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.

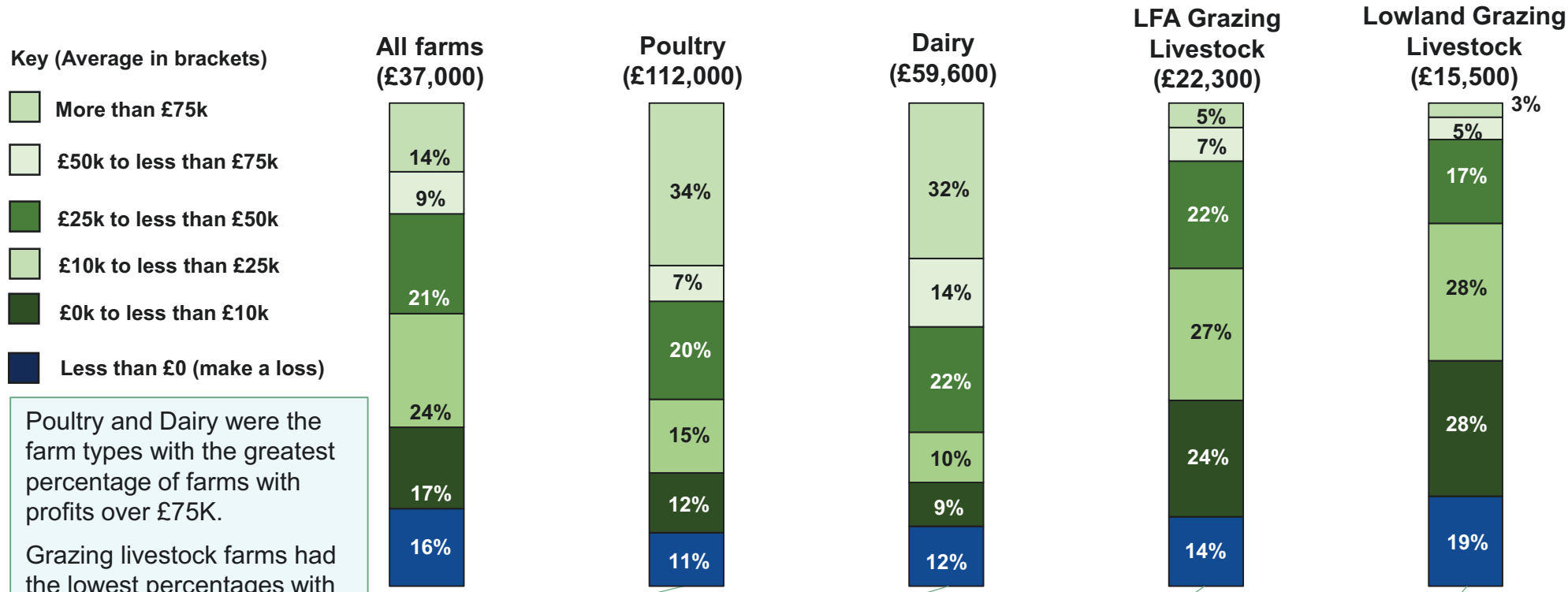
Production
Year on year, volumes of outputs remain relatively unchanged, but the prices farmers receive for what they produce varies, meaning incomes can rise and fall by up to 50%.

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

What is the percentage of farms in different income (or profit) bands in England?

Between 2014/15 and 2016/17 14% of farms made a profit of more than £75k, while 16% of farms made a loss, with an average profit for all farms of £37,000.

% of farms within different Farm Business Income bands, 2014/15 to 2016/17



Poultry and Dairy were the farm types with the greatest percentage of farms with profits over £75K.

Grazing livestock farms had the lowest percentages with profits over £75K.

A third of poultry and dairy farmers made a profit of over £75k, but even within these sectors just over 1 in 10 farmers made a loss.

66% of Grazing Livestock farms in the Less Favoured Areas and 75% of Lowland Grazing Livestock farms had a profit of less than £25k per year.

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

Many farms make losses from the agricultural side of their business but benefit from Direct Payments, taking part in agri-environment schemes or diversifying their activities for income.

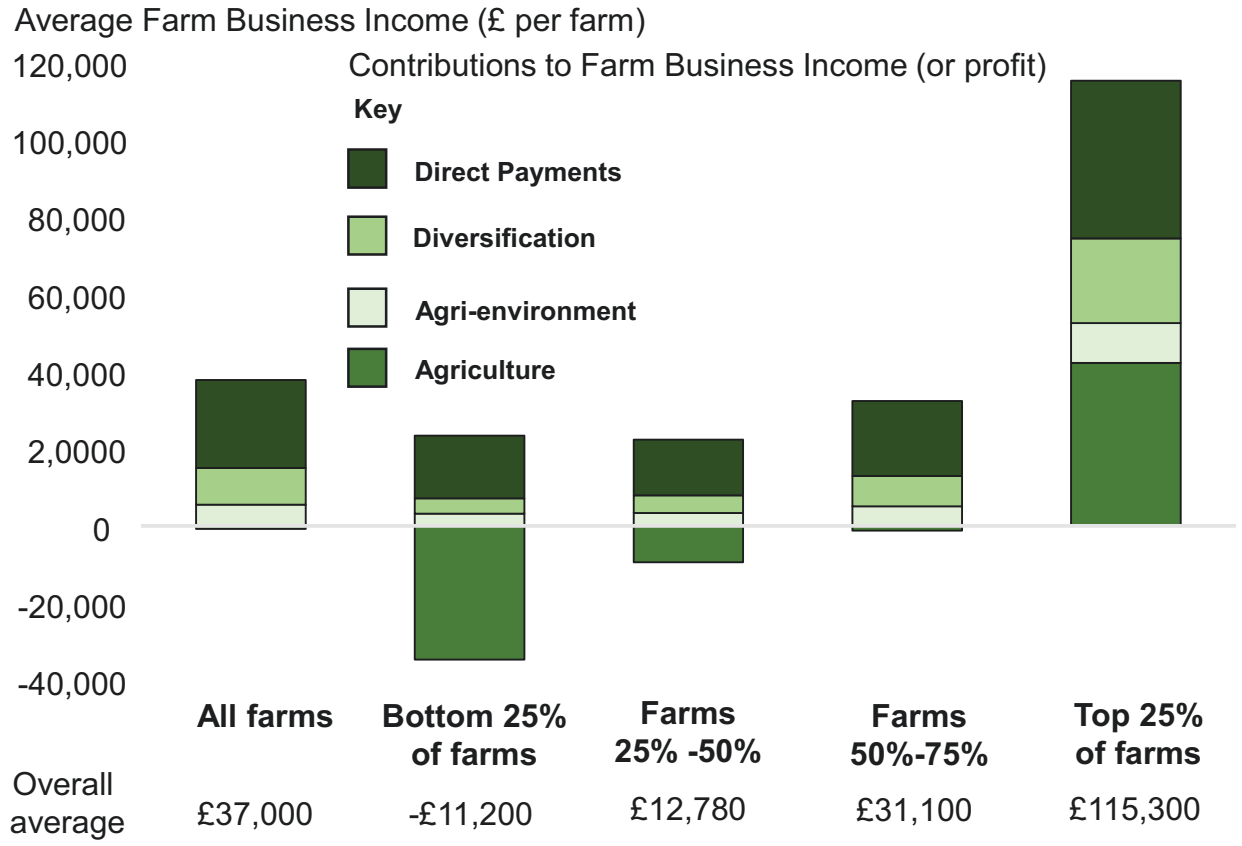
Agriculture
On average, across all farm types the agricultural part of the business **made a marginal loss** of £ 700 between 2014/15 and 2016/17. These numbers are impacted by costs associated with Direct Payments and agri-environment schemes.

Ranking farms from the lowest to highest income and putting into four equal groups shows that only the top 25% on average make a profit from the agricultural part of the business (£42,200). The bottom 25% made a loss of £34,600 from agriculture.

Diversification (see page 28)
This component captures non-agricultural work of an entrepreneurial nature, on or off farm, but utilising farm resources.

In cash terms, it contributed most (£21,900) to the top 25% of farmers but provided profits to farms in all groups. Bottom 25% (£4,000), 25%-50% (£4,600) and 50%-75% (£7,700).

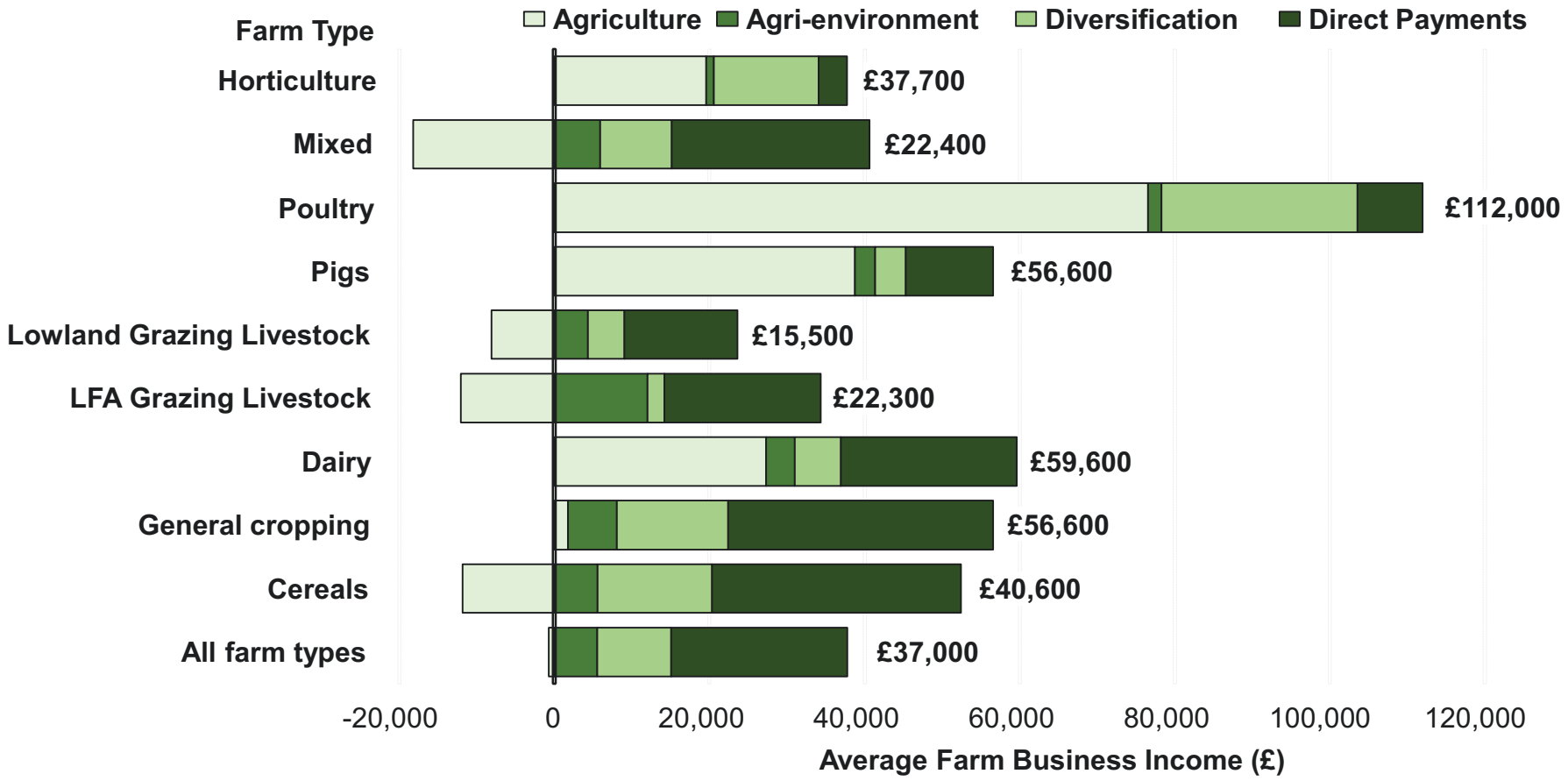
Direct Payments
Direct Payments can impact on costs which impact on profits from agriculture. Detailed analysis of the impact of Direct Payments can be found on pages 34-45.



Agri-environment
Agri-environment payments are those where a farm is paid to deliver environmental outcomes. They are paid on an income foregone basis such that a farmer may get paid to deliver an outcome which impacts on their profits from agriculture.

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

Farm Business Income varies across the different farm types, and over the period 2014/15 to 2016/17 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 75% of Farm Business Income came from Direct Payments for cereal, grazing livestock and mixed farms

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
53% of farm holdings in England are owner occupied and the average net worth of this group was around £1.93 million pounds in 2016/17. 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 £2.5 million in 2016/17, up 18% since 2013/14.

However, tenanted farms (13% of farm holdings) have fewer assets (e.g. machinery and livestock). Their average net worth was £273,000 in 2016/17, similar to 2013/14.

	Average net worth (£million)	Average total area (hectares)	Average owner occupied area (hectares)	% owned
Owner occupied	1.93	106	106	100%
Mixed - mainly owner occupied	2.47	166	129	78%
Mixed - mainly tenanted	1.36	216	55	25%
Tenanted	0.27	159	0	0%
All farms	1.80			

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

Farmers are price-takers and the determinants of the prices they receive can be out of their control. Many farmers do not manage farm performance, such as analysing profits and losses.

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.

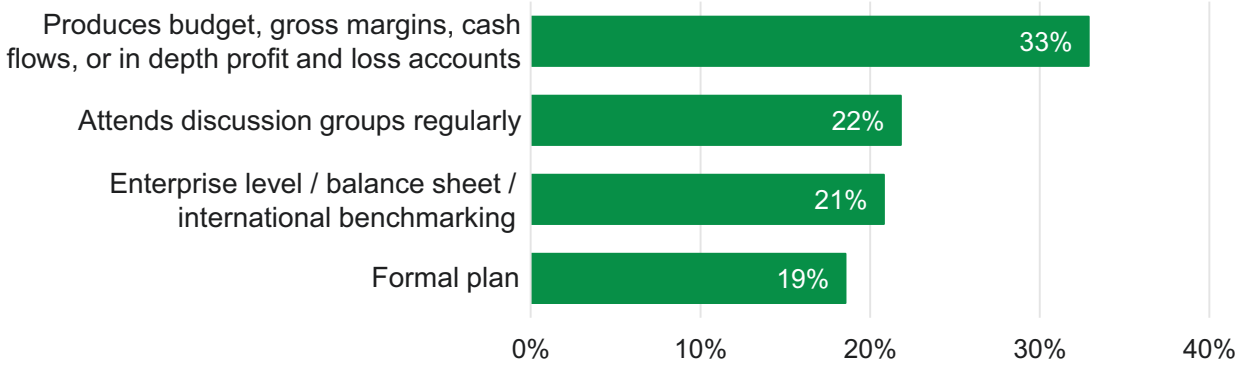
Average income (£) from agriculture only for cereal farmers, 2003/04 to 2016/17

Managing farm performance

Only 1 in 3 farms regularly produce budgets, gross margins and cash flows or carry out in depth analysis of their profits and losses.

If farmers do not monitor and analyse costs, yields, and revenues from different parts of their business it makes it more difficult to be sure whether they are making a profit or loss and to understand what drives their business performance, or what can be done to improve it.

% of farms carrying out various farm management practices, England 2016/17



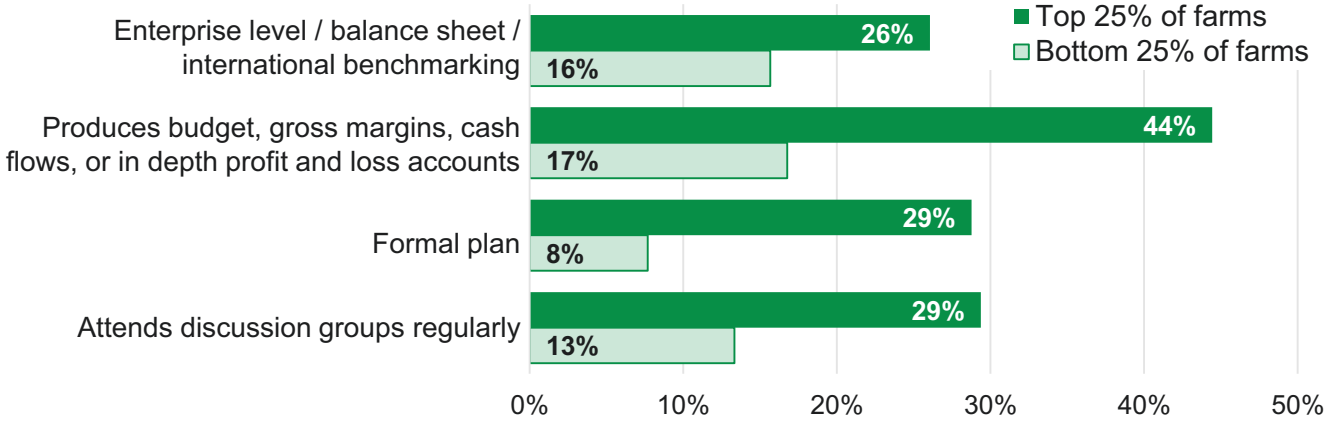
How do farm management practices vary between the top and bottom performing farms?

In 2016/17, the top 25% of farm performers were 2.5 times more likely to engage in practices such as looking at their profit and loss account compared to the bottom 25% of performers.

Farms with higher economic performance are more likely to engage in farm management practices such as business planning and benchmarking.

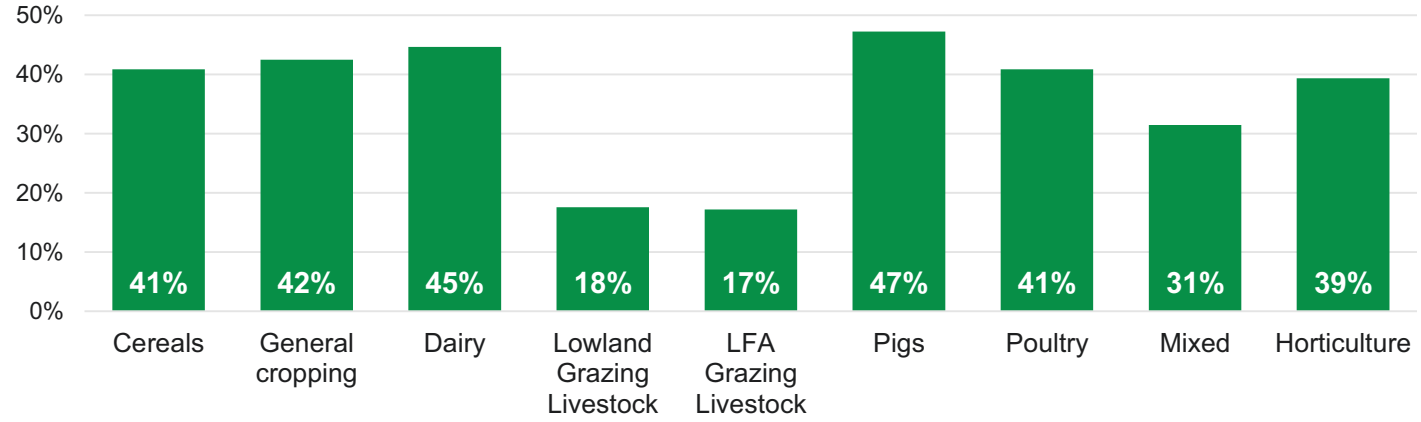
However, even for the most profitable farms the majority still do not engage in farm management practices, suggesting room for more improvement across the sectors.

% of farms carrying out various farm management practices in England by farm economic performance, 2016/17



Grazing livestock farms were the least likely to produce budgets and look at their profit and loss accounts. These farms also tended to have the lowest Farm Business Income.

% of farms that produces budgets, gross margins, cash flows, or in depth profit and loss accounts by farm type



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

In 2016/17, almost 2/3rds of farms used farm resources to deliver non-agricultural activities, generating around £620million additional profit (£17,100 per farm).

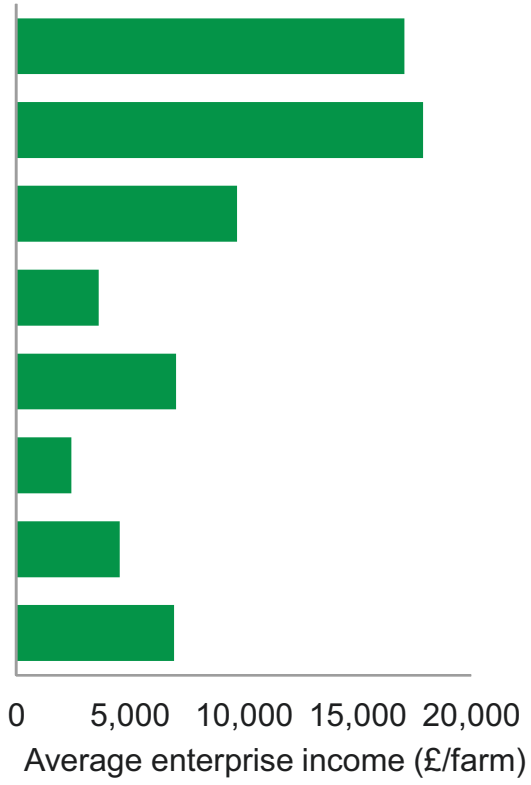
Diversified enterprises = **non-agricultural work of an entrepreneurial nature on or off farm, but which utilises farm resources.**

Over the last 8 years, uptake of diversified activities has increased from 51% of farm business in 2009/10 to 64% in 2016/17.

For those farms with a diversified activity, their income from that activity accounted for almost a third of profit in 2016/17. Just over a quarter (27%) 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 £17,900 for those carrying out this activity in 2016/17. Processing and retailing of farm produce is the second highest average income stream among the diversified activities but only 9% of farms carried this out in 2016/17.

	% of farms carrying out	Average amount for those carrying out
Diversified enterprises (all kinds)	64%	£17,100
Letting buildings for non-farming use	43%	£17,900
Processing/retailing of farm produce	9%	£9,700
Sport and recreation	13%	£3,600
Tourist accommodation and catering	6%	£7,000
Solar energy	20%	£2,400
Other sources of renewable energy	9%	£4,600
Other diversified activities	8%	£6,900



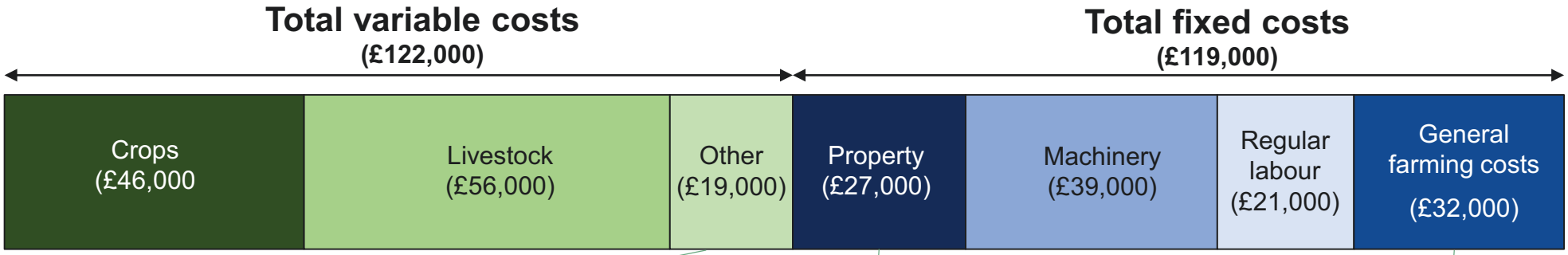
Farms can become more profitable by reducing costs, but what are the costs of production for farmers?

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.



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 44% (or £12,000) to total property costs, or 5% of all input costs between 2014/15 and 2016/17.

Many farms have no rental costs as they 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.

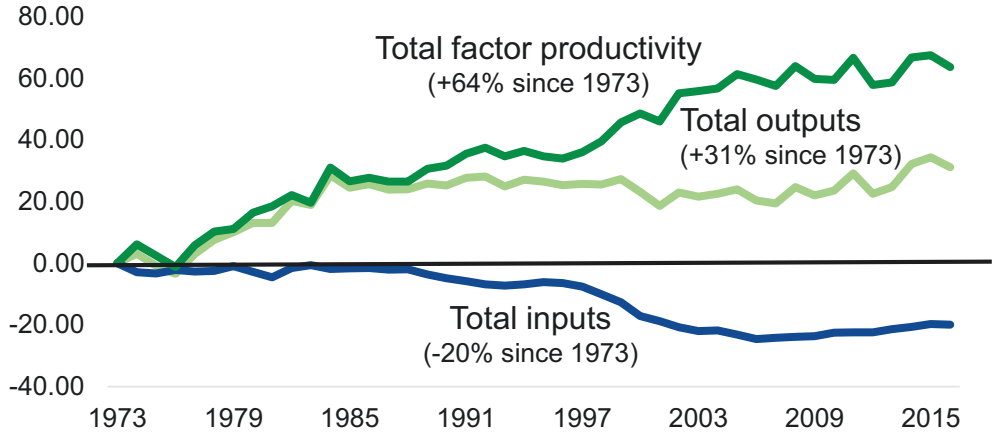
How has UK agricultural productivity changed over the past 40 years?

UK agricultural productivity has increased 64% (or 1.5% per year) since 1973 mainly through becoming more efficient by using fewer workers.

Productivity
A measure of how well inputs are converted into outputs giving an indication of the efficiency and competitiveness of the agriculture industry.

Improvements in agricultural productivity have remained relatively unchanged over the past decade.

% change in agricultural inputs and outputs and total factor productivity since 1973



Output flat since 1985
The improvement in the amount of crops and livestock outputs has remained flat since around 1985 but farms have used fewer workers which has improved the overall productivity of the sector.

Total factor productivity
(A measure of how well agriculture turns inputs into outputs)

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

Productivity increases when (1) farm output increases using same inputs, or (2) outputs remain same with less inputs, or (3) a combination of both

Outputs

Crops

Livestock

Inputs

Labour

Fixed Capital
e.g. machinery

Intermediate consumption
e.g. animal feed

Land

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

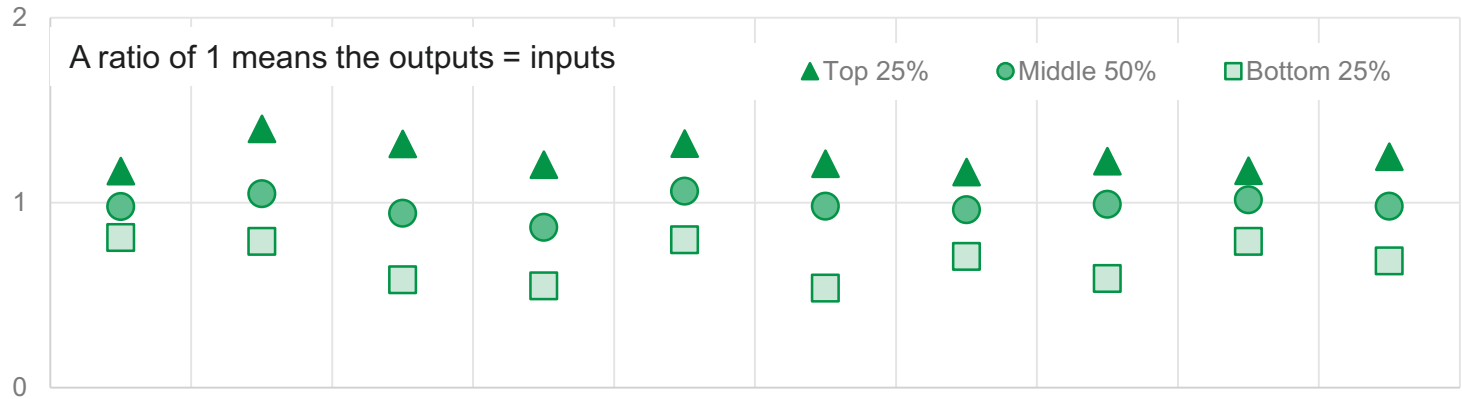
Across all farms types in England in 2016/17 , the average performance of the top 25% of farms was 1.8 times better than the bottom 25%. The largest gap was among horticulture and grazing livestock farms, and smallest within poultry and dairy.

For the top 25% of farms across each sector, cereal farmers had the best average performance with outputs 40% higher than their inputs in 2016/17.

Comparing average economic performance of the top 25% of farms to the bottom 25% of farms shows the largest performance gap was among 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, 2016/17



	Dairy	Cereals	LFA grazing livestock	Lowland grazing livestock	General cropping	Horticulture	Mixed	Pigs	Poultry	All farm types
Ratio of economic performance of top 25% vs bottom 25%	1.45	1.77	2.26	2.19	1.65	2.25	1.65	2.08	1.49	1.82

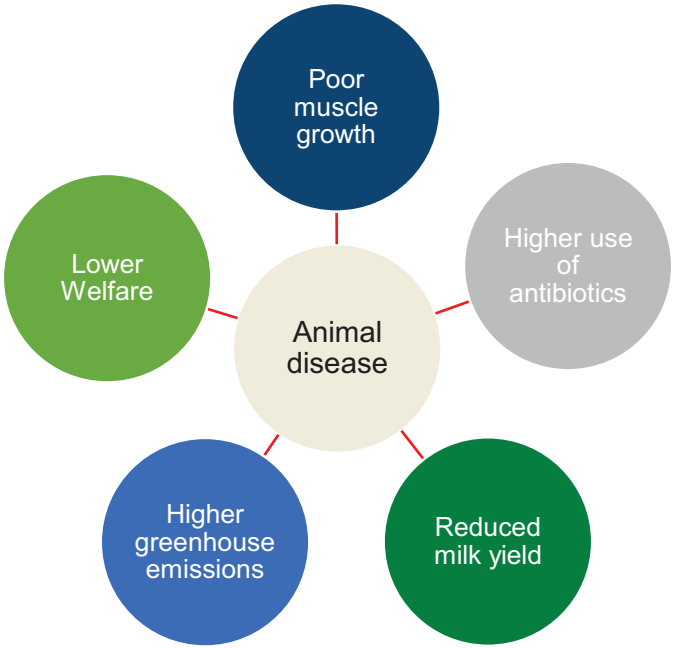
Farm Business Income (FBI) is calculated as the **difference** between Farm Business Outputs and Farm Business Inputs. It does not deduct the cost of unpaid labour. When calculating **farm economic performance**, unpaid labour is included as a cost. This allows a fairer comparison between farms with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

How does animal health impact on the productivity performance of farms?

Reducing the level and impact of endemic disease and health conditions can not only improve the health and welfare of our livestock, but also boost productivity.

Poor animal health has a direct impact on farm incomes.

Impact at farm level:
- Increased mortality/abortion rates
- Higher input costs such as more feed and medicine required per animal
- Increased levels of farmer stress
- Reduced livestock productivity (e.g. lower animal weight gain)



Poor animal health impacts the rural economy and wider society.

The diseases below have an annual national impact in excess of :
- Bovine Viral Diarrhoea (cows) + **£50m.**
- Intestinal parasites (sheep) + **£100m**
- Mastitis (cows) + **£180m**

Anti-microbial resistance (AMR) increased use of antimicrobials reduces the effectiveness of medicines for both animal and human use, and thus places a burden on the National Health Service (NHS).

The benefits of preventing and treating animal diseases include:

Reduced levels of endemic disease → Productivity savings for farmers → Supports a sustainable and competitive livestock sector → Higher Welfare → Reduced Antibiotic Use

How does plant health impact on the productivity performance of farms?

Preventing disease outbreaks and controlling pests that threaten plants in the UK helps protect the environmental and social benefits of crops and trees and reduces productivity losses.

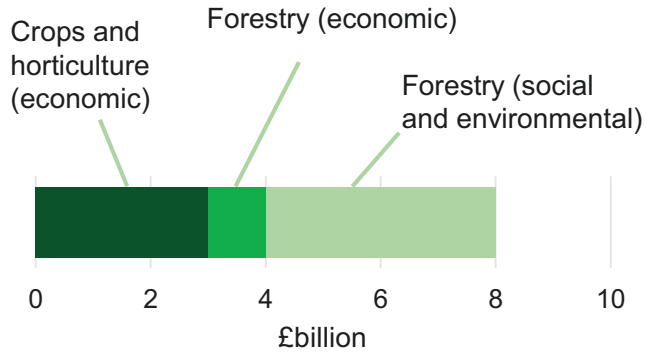
Why is it important to protect plants from pests and diseases?

- Outbreaks result in a loss of commercial value and costs to landowners,
- Farmers and foresters may suffer productivity losses, for example,

5-20% annual loss of UK cereal productivity caused by pests and pathogens,

- The public will get less value from the countryside as plants provide a wide range of benefits, including economic, environmental and social benefits,
- Pests and diseases may cost more to the taxpayer if not dealt with promptly .

Economic, social and environmental value of crops, forests and horticulture estimated to be around £8bn per year.



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 cannot easily be monetised, so will underestimate the total value.

How can 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 before plants reach the border (e.g. through sharing information across countries on disease risks), at 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.

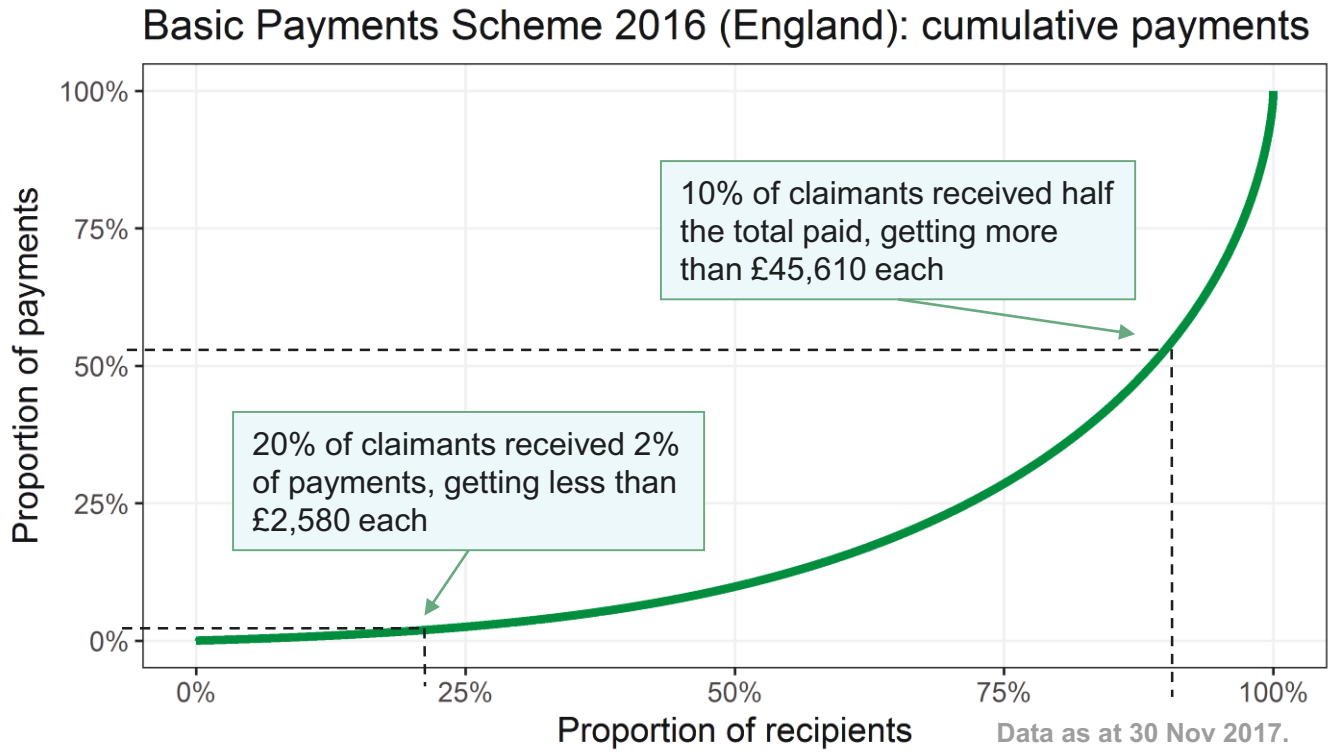
How are Direct Payments made up and how are they allocated across England?

Direct Payments are allocated based on land area. In 2016, the top 10% of recipients in England received almost half (47%) of the £1.65bn total payments, while the bottom 20% received 2%.

The total Direct Payments paid in England in 2016 was £1.65bn and the largest recipients were located across the country.

Of the top 50 recipients in 2016, 37 had mostly arable crops (e.g. wheat, oilseed rape) or legumes (e.g. peas/beans) and 9 had mostly permanent grass.

Only farms over 5 hectares can apply for Direct Payments, so many small farms receive nothing.



Direct Payment
Basic Payment
+
Greening
+
Young farmer payment

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

The **Greening** payment is a 30% portion of the Basic Payment, paid for meeting certain environmental standards (see page 39). There is also a payment for claimants qualifying as a **Young Farmer,** although this makes up a very small portion of total payments.

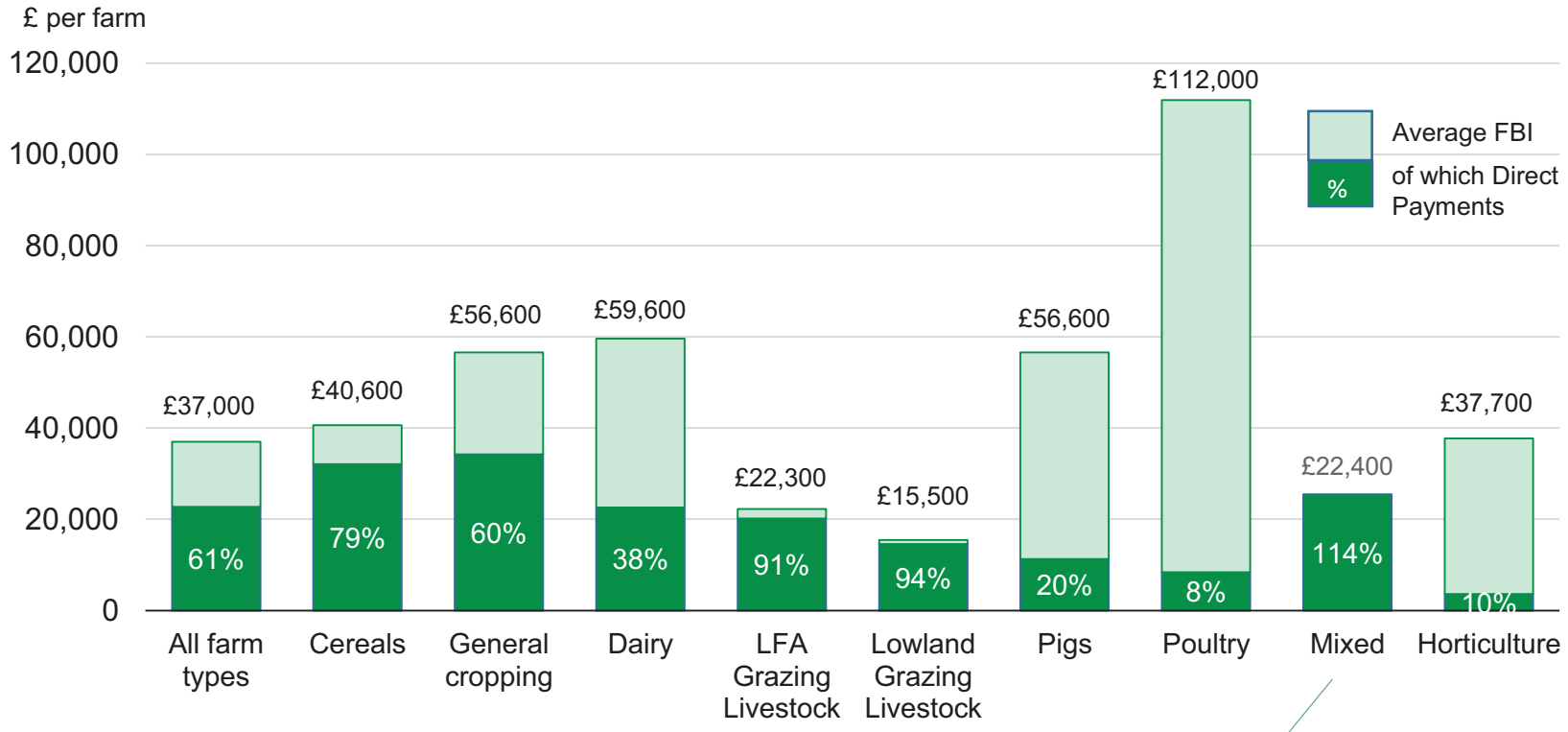
Which farm types in England are most reliant on Direct Payment subsidies to support their overall income?

Across all farm types, 61% of Farm Business Income came from Direct Payments over the period 2014/15 to 2016/17 with Grazing Livestock and Mixed farms most dependent.

The average farm makes the majority (61%) of its money from **Direct Payments.**

Fewer Pig, Poultry and Horticulture farms claim Direct Payments than other farm types. These farms tend to be smaller, and are more likely to have land that is ineligible for Direct Payments.

Average Farm Business Income (FBI) and the proportion that comes from Direct Payments by 2016 farm type (based on 3 year matched dataset 2014/15 to 2016/17



For Grazing Livestock farms almost all of their average Farm Business Income came from Direct Payments.

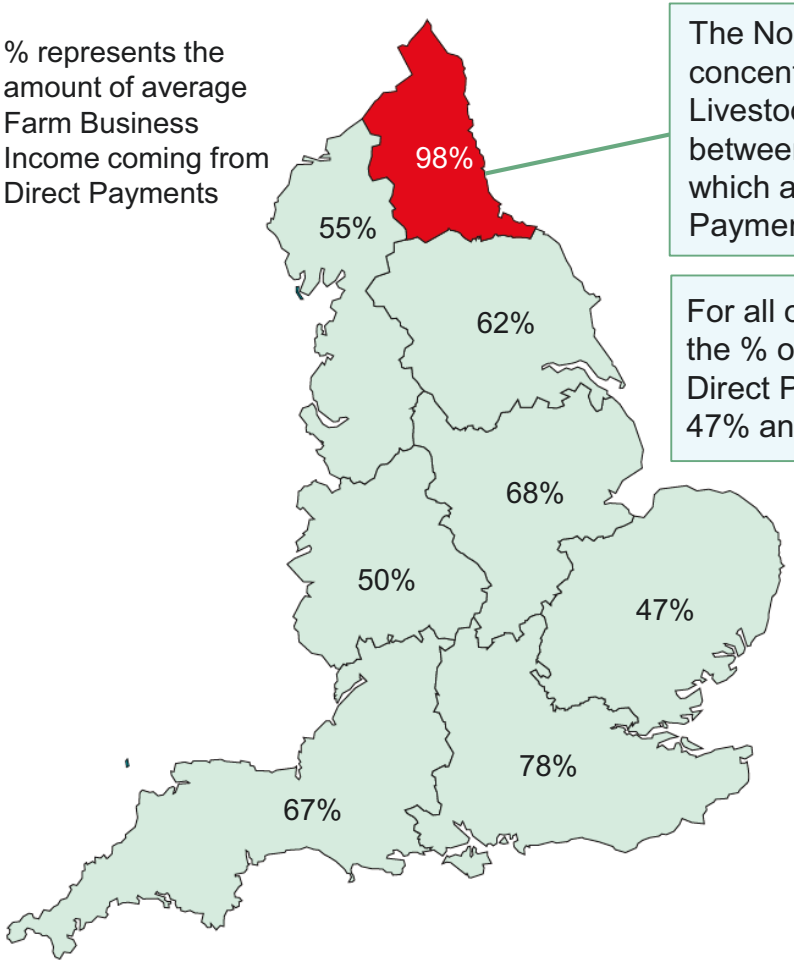
For Mixed farms income from Direct Payments was greater than their profit from agriculture, diversification and agri-environment combined.

How does the reliance on Direct Payments vary across the regions of England and by land ownership status?

Over the period 2014/15 to 2016/17, farms in the North East and tenant farmers were most reliant on Direct Payments to support Farm Business Income.

Average Farm Business Income (FBI) and the proportion that comes from Direct Payments by region in England (map) and tenancy type (bar chart), based on 3 year matched dataset 2014/15 to 2016/17

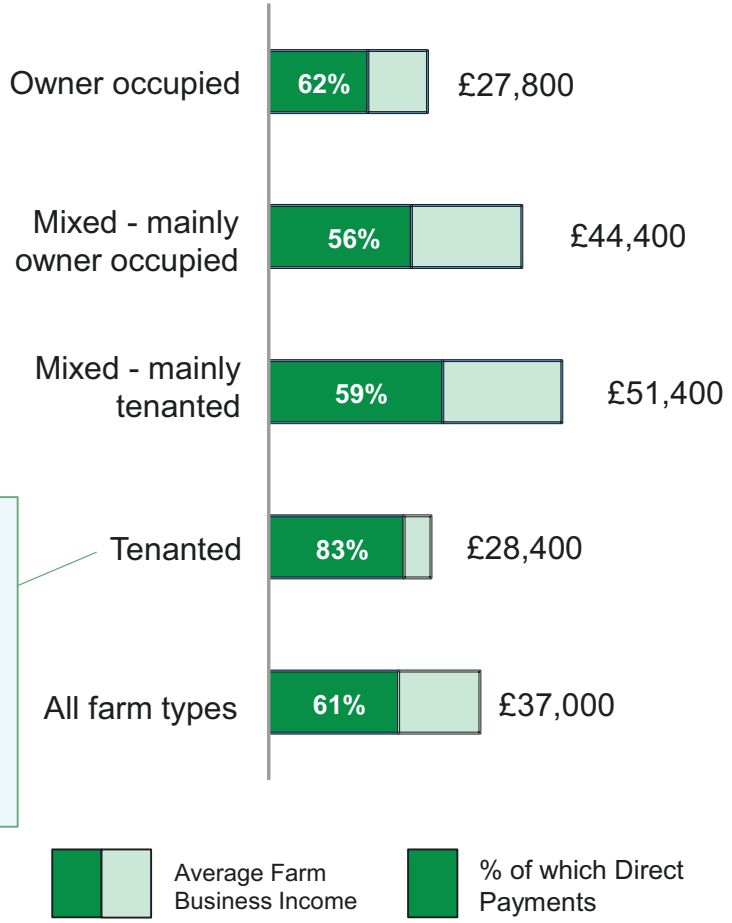
% represents the amount of average Farm Business Income coming from Direct Payments



The North East had a higher concentration of both Grazing Livestock and tenant farms between 2014/15 and 2016/17, which are more reliant on Direct Payments.

For all other regions in England, the % of income coming from Direct Payments varied between 47% and 78%.

Tenant farmers were most likely to rely on Direct Payments over the period 2014/15 to 2016/17. This group of farmers will be the main beneficiaries of any fall in rents (see page 37).



What has been the impact of Direct Payments on farm rent prices?

There is evidence that Direct Payments inflate farm rent prices, meaning some of the payment supports the income of the landowner, not the tenant farmer.

Direct Payments play a role in raising and maintaining higher farm rent levels

The provision of Direct Payments linked to the management of agricultural land increases demand for such land since farming it secures the benefit of the subsidy. The increased demand then drives up rents, which in turn increases the price of land itself.

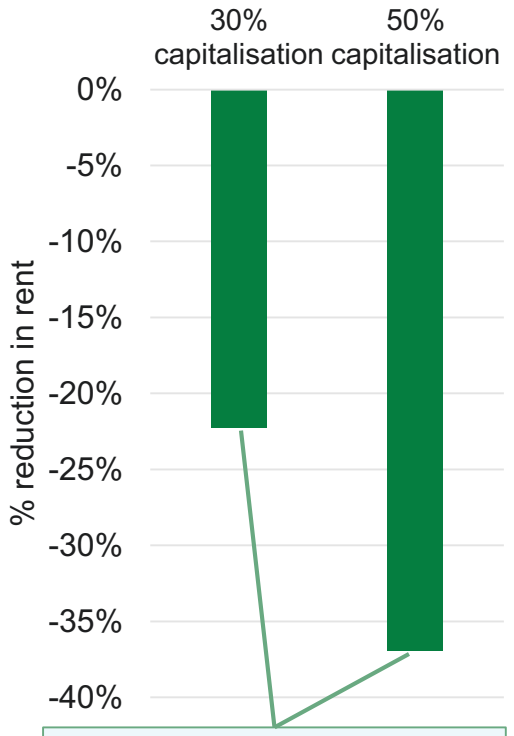
This means that while the introduction of Direct Payment may have initially benefitted existing farmers, the benefit quickly shifted from tenants to landowners as rents increased in response. Owner occupier farmers see both the direct benefit of the Direct Payment and an increase in their asset values.

A recent academic literature review of EU-wide empirical evidence on Direct Payments found a wide range of estimates for the scale of how much the subsidy inflates rents. They ranged from as low as 6-7 cents going to landlords from each euro paid to tenants (up to 80-90 cents), with a median estimate of around 20-25 cents per euro. These rates are known as 'capitalisation rates'.

The academic literature highlights that in some countries, regions and farm sectors the effect will be greater than in others. Particularly important is the ratio of basic payment entitlements to agricultural land. In England, this ratio is high, indicating that the capitalisation rate in England is likely to be higher than average.

While it is not possible to estimate the precise extent of the effect in England, we have constructed simple scenarios using 30% and 50% capitalisation rates to illustrate the potential scale of the effect of full withdrawal of Direct Payments on rents. These scenarios do not examine the potential for structural changes in land use and could be an underestimate. However, they do indicate that if the academic literature is correct, rents will respond significantly to the removal of Direct Payments. Any adjustment to rents will lower the costs of tenant farmers.

Possible change in average rents for wholly tenanted farmers following Direct Payment withdrawal



These percentage changes correspond to falls in average rents of £7,000 and £11,500 per year respectively

What has been the impact of Direct Payments on land values and investment?

Agricultural land prices have risen significantly faster than other land prices over the last decade, although they have fallen back in the last couple of years.

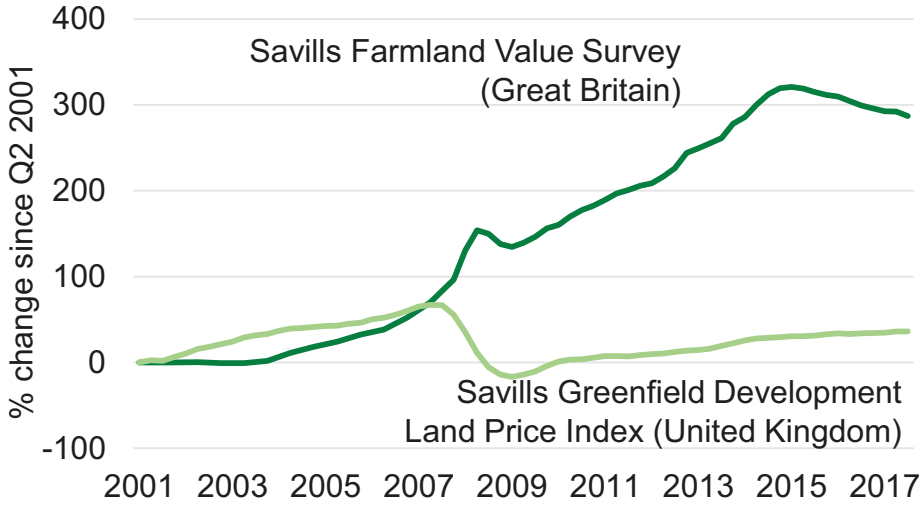
Agricultural land values have increased faster than Greenfield Development land

The Savills Farmland Value Survey showed an increase of more than 300% between 2001 and 2015, although prices have fallen back a little since.

This increase in agricultural land prices outstrips growth in some other land values, such as the Savills Greenfield Development Land Price Index, which only rose by 36% between 2001 and 2017and was in part impacted by falls during the financial crisis in 2008-09.

Only a small area of agricultural land changes ownership each year. In England and Wales in 2016 only 0.25% of the utilised agricultural area was sold. This tightness of supply, as well as Direct Payments, both act to maintain high demand and prices of agricultural land .

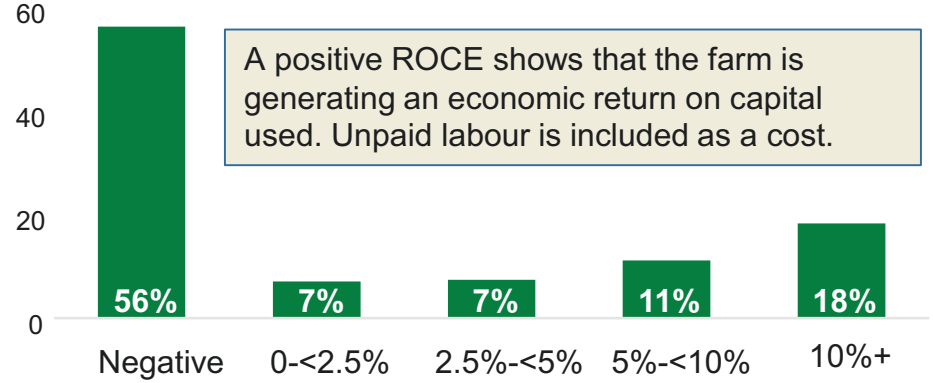
% change since 2001, Savills Farmland Value and Greenfield Development Land



Direct Payments may encourage sub-optimal investment

Direct Payments increase farmers' cash-flow, giving them greater opportunity to invest in items such as machinery. In 2016/17 after excluding land value, more than half of farms (56%) in the Farm Business Survey (England) showed a negative overall return to capital. This suggests that Direct Payments are facilitating a substantial amount of investment, which is worsening not improving farmers' returns.

% of farms and their Return On Capital Employed (ROCE) excluding the value of land, 2016/17 in England



How effective have Direct Payments been in delivering environmental objectives?

30% of the Direct Payment is through Greening, but these measures are currently failing to meet environmental objectives.

European Court of Auditors assessment found that Greening is unlikely to significantly enhance environmental performance

The greening payment makes up 30% of Direct Payments. It was introduced in 2015, designed to implement the principle that farmers should be rewarded for the public goods they provide (see page 56). Through this mechanism, greening was meant to enhance the environmental performance of the Common Agricultural Policy (CAP).

A report into Greening from the European Court of Auditors concluded that the mechanism, as currently implemented, was unlikely to significantly enhance the CAP's environmental and climate performance. It estimated that Greening resulted in a change in farming practices of only around 5% of EU farmland. The limited scale of change in farming practices brought about by Greening was linked to a significant level of deadweight. 'Deadweight' describes situations where public money (here: the Greening payment) is paid to a beneficiary (here: a farmer) for public goods (here: farming practices beneficial for the environment) that would have been provided anyway, even without public support, because they are either part of the beneficiary's normal activity or required by law (here: Cross Compliance).

How many farms are profitable without Direct Payments?

More than half of farms (58%) are profitable with Direct Payments removed from their historic accounts

Around a quarter of the total value of Direct Payments in England is estimated to have been paid to the 16% of farms that had an average annual Farm Business Income (FBI) exceeding £40,000 before receiving their Direct Payment.

Farm Business Income band (excluding Direct Payments)	% of farms	Average net income from direct payments	Direct Payment income as percentage of total FBI	Total amount of subsidy received
<£0k	42%	£ 23,000	*	42%
£0-<£10k	17%	£16,100	77%	12%
£10k-<£20k	13%	£17,700	55%	10%
£20k-<£30k	8%	£17,100	41%	6%
£30k-<£40k	4%	£25,100	42%	5%
£40k-<£50k	4%	£28,500	39%	5%
£50k-<£100k	7%	£32,500	32%	10%
Over £100k	5%	£43,900	17%	10%
All farms	100%	£22,700	61%	100%

What adjustments in costs or other activities could help offset the removal of Direct Payments?

Removal of Direct Payments may be offset in a number of ways, including farm efficiency improvements and diversification, although this will vary by type and location of farm.

Reducing input costs

There are often large variations in input costs for farmers. In some circumstances, farm businesses can work together to create a purchasing cooperative to give them greater buying power.

The ability to do this will be impacted by cash flow as some farmers may not have the capital to buy in advance. Also transport costs are higher for farmers in more remote areas, impacting both on costs of inputs and delivery of their outputs.

More efficient use of inputs

Some farm businesses are more efficient than others in the use of inputs, such as fertilisers. Altering management practices, such as changing the timing or application of fertiliser or using soil testing, could reduce the total amount needed, lowering the cost to the farmer, and helping the environment.

Adjustment in rental costs

As Direct Payments act as an inflationary pressure on rents (see page 37), their removal may cause a fall in rents.

However, there is often large demand for agricultural land and some farmers may still pay a rental premium as a way of expanding their farm when land becomes available. This makes it difficult to predict the impact on rents in the short term.

More efficient investment

As shown on page 38, 56% of English farms in 2016/17 showed a negative overall return on their capital. The total depreciation cost of assets for the UK was £4.1bn in 2016, greater than the amount farmers paid out in wages, rent and interest on loans (see page 20).

Many farm businesses may become more financially resilient by optimising investment decisions. More efficient investment, focussed on reducing inputs and costs or increasing outputs, could increase productivity.

Diversification

Around two-thirds of farm businesses carried out diversified activities in 2016/17 (see page 28) giving an alternative income stream into the farm business. Around a quarter of all farms make a greater income from diversified enterprises (e.g. such as running an on farm B&B) than from the rest of their business.

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

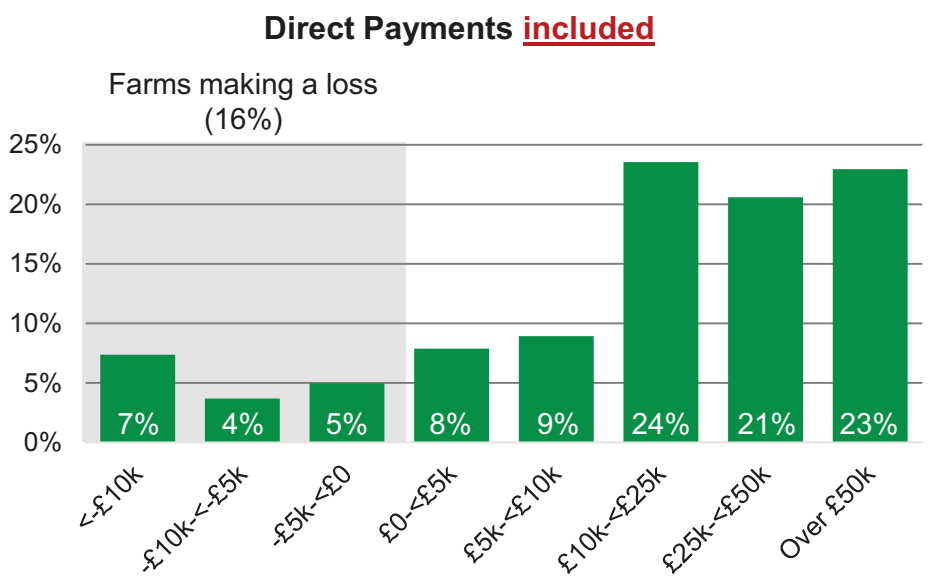
What might be the impact on the percentage of farms in different income bands with the removal of Direct Payments in England?

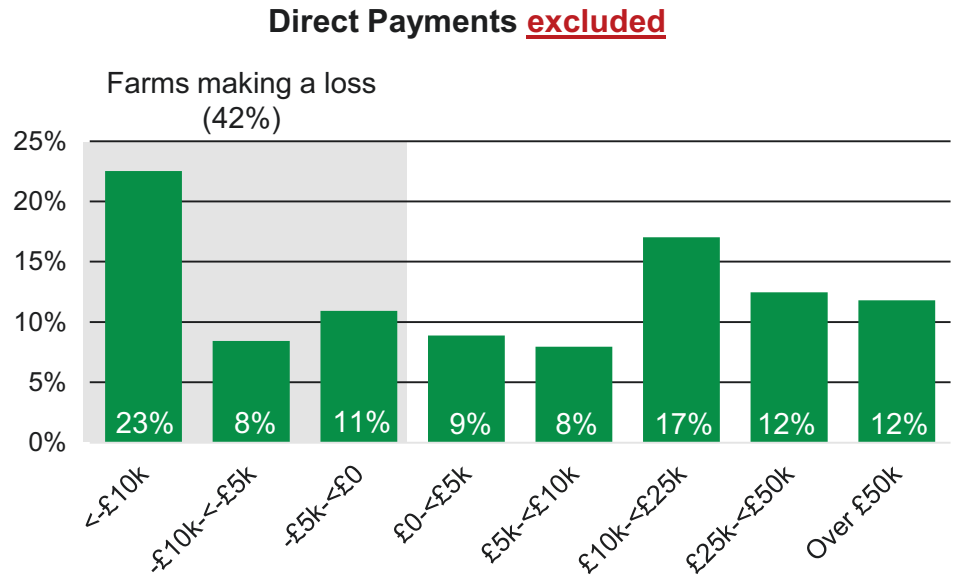
Over 2014/15 to 2016/17, 16% of farms made a loss with Direct Payments and removing would have meant 42% making a loss, but adjustments such as lower investments and rents would be expected to offset some of the impact.

Assessing the direct impact of removing Direct Payments is complex as farmers' decisions and costs are influenced by knowing they will receive them. While Direct Payments are a positive cash flow to the farmer, pages 37 and 38 show how they can also increase costs. It is difficult to make an assessment of the increase in costs that Direct Payments may have caused.

The analysis showing 42% of farms would have made a loss without Direct Payments should be considered along with the information on page 40 describing many ways farms could offset the removal of Direct Payments.

Average Farm Business Income by income band with and without Direct Payments, based on 3 year matched dataset 2014/15 to 2016/17

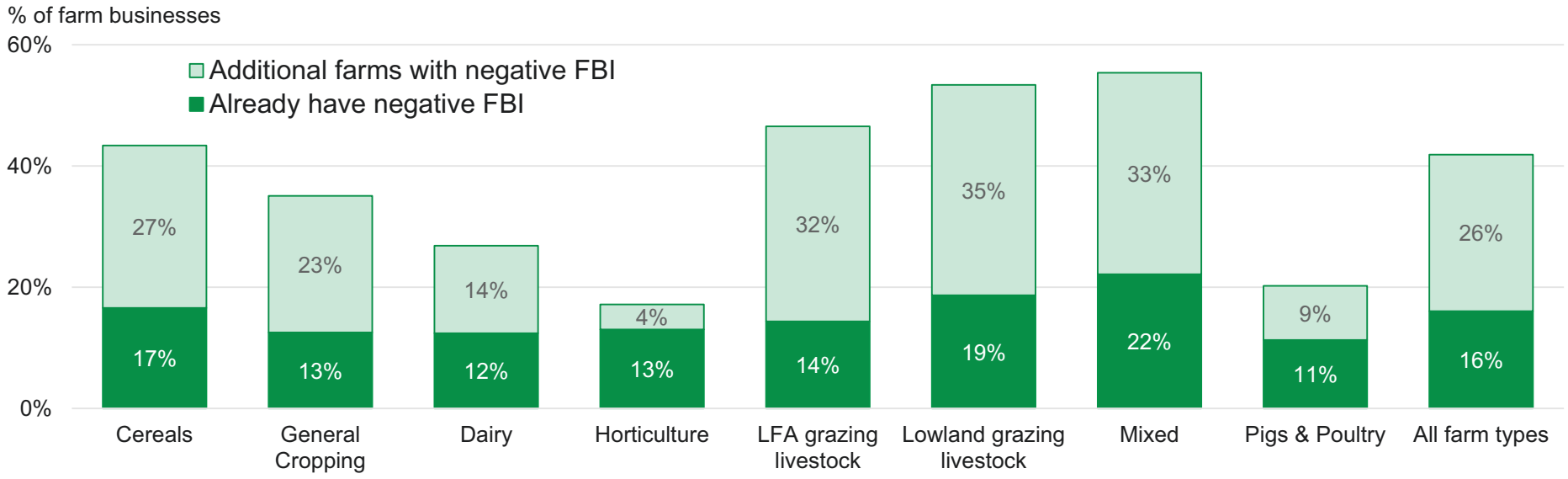




Based on their historic accounts, what would be the impact on the removal of Direct Payments on different farm types?

Over 2014/15 to 2016/17, 19% of lowland grazing livestock farms and 22% of Mixed farms made a loss including Direct Payments. This rises to 53% and 55% respectively without Direct Payments.

% of farms with a Farm Business Income (FBI) of less than zero with and without Direct Payments, based on 3 year matched dataset, 2014/15 to 2016/17 by farm type



Horticulture and Pig & Poultry farms were least impacted by the removal of Direct Payments from their historic accounts , as they receive far less subsidy. These farms tend to be smaller, and are less likely to have land that is eligible for Direct Payments.

Grazing livestock and mixed farms would have been more likely to have had a negative income with Direct Payments removed from their historic accounts.

What options are there to transition away from Direct Payments in England ?

Reductions in Direct Payments could be made via many options and over many time periods, but the shorter the transition the more money is removed from farmers each year.

The following illustrative analysis gives an idea of how two different approaches to moving away from Direct Payments may impact on Farm Business Income, depending on the approach taken to applying reductions. The following options are considered:

Option 1 – Progressive reductions, where the percentage increase reduction increases as the amount of Direct Payments a recipient has increases the amount of Direct Payment received increases

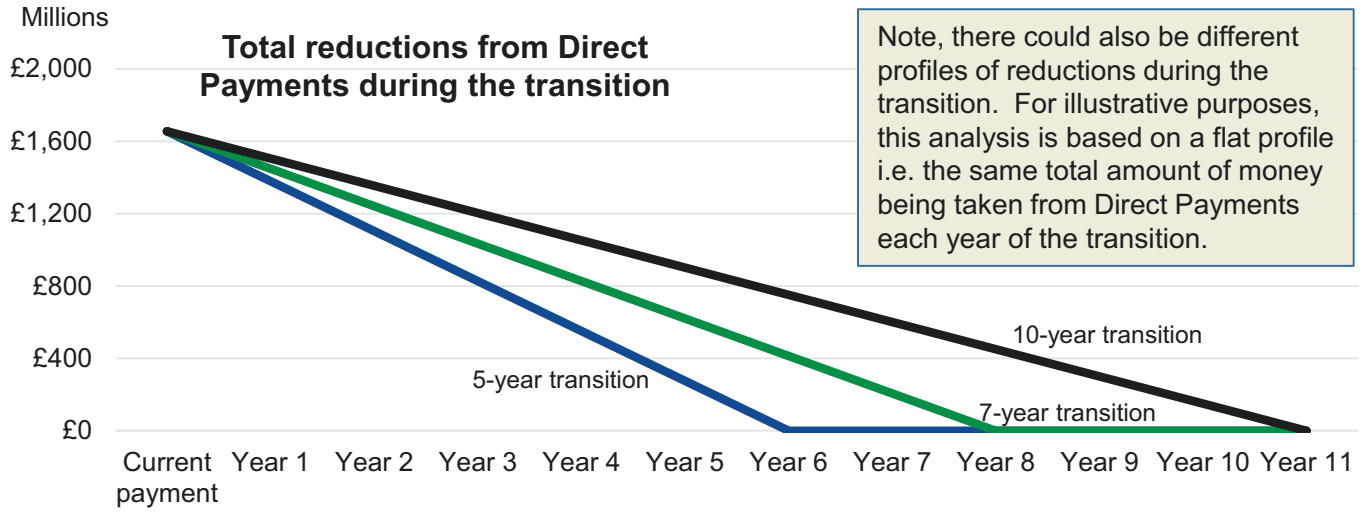
Option 2 – A ceiling (cap) to the largest payments

The transition could be undertaken across a variety of time periods, and the chart and boxes below indicate the amount reduced per year for **5, 7 and 10 year transition periods**, with the same total amount of money reduced in each year of the transition . Equally, options could be applied where larger amounts are reduced earlier or later over a transition period.

5-year transition
Reduce Direct Payments by £276 million per year

7-year transition
Reduce Direct Payments by £206 million per year

10-year transition
Reduce Direct Payments by £150 million per year



Note, there could also be different profiles of reductions during the transition. For illustrative purposes, this analysis is based on a flat profile i.e. the same total amount of money being taken from Direct Payments each year of the transition.

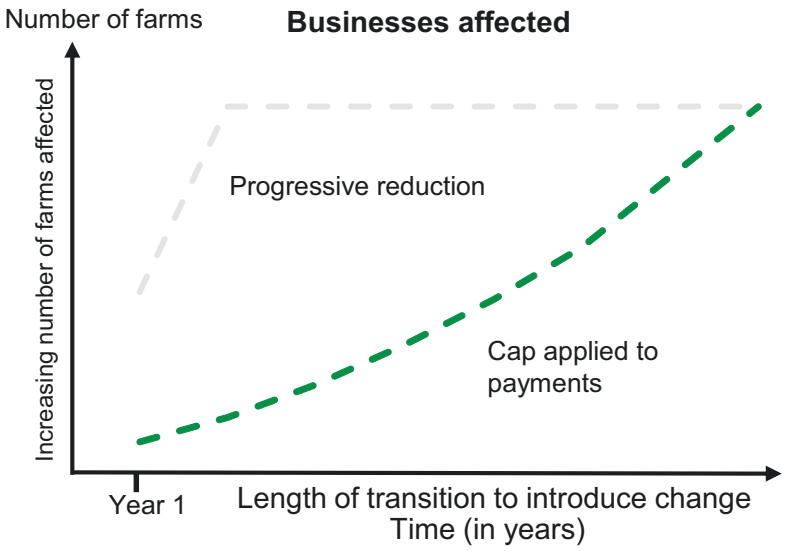
What is the impact of the different reduction options on how many farmers are impacted over time?

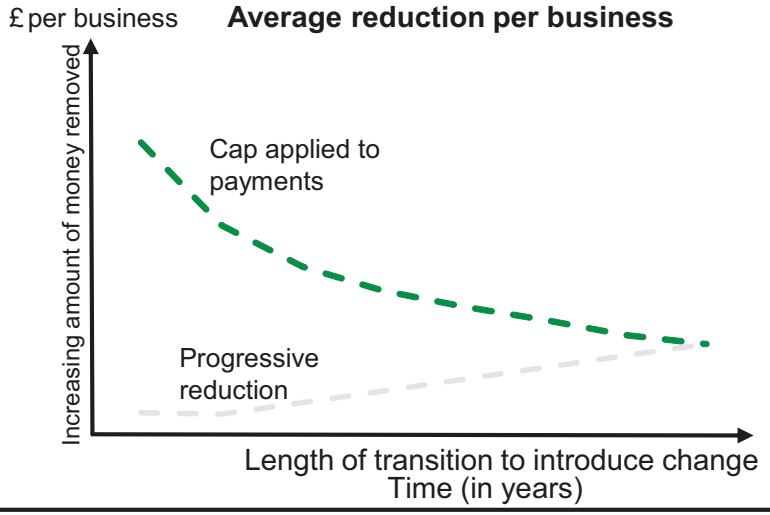
Progressive or capped reductions could be applied to Direct Payments, affecting an increasing number of farmers over the 'agricultural transition' period. There are many possible variances of these options.

Progressive reduction
Under this scenario you could reduce payments using a sliding scale of % reductions. For example, in year 1, for farms making claims above £25,000, there could be a 5% reduction for amounts between £25,000 and £30,000, a 10% reduction for amounts between £30,000 and £40,000, a 15% reduction for amounts between £40,000 and £50,000, with higher % reductions for amounts in higher payment bands. In future years you could increase the % reduction and lower the threshold to below £25,000 which would see greater amounts removed and more farmers impacted.

Applying a cap
A cap on payments would mean that no payment is made above a certain threshold. This cap would vary depending on the length of transition. To achieve a £276 million reduction in the first year of a 5-year reduction would require a cap on payments of £62,200. To achieve a £206 million reduction over a 7-year transition would require a year 1 cap of £78,700 and to achieve a £150 million reduction in a 10-year transition a year 1 cap of £99,000. The longer the transition the fewer number of farms are impacted in the earlier years.

Note, there could also be different profiles of reductions during the transition. For illustrative purposes, this analysis is based on a flat profile i.e. the same total amount of money being taken from Direct Payments each year of the transition.





How much would farmers in England need to reduce costs by in order not to make a loss without Direct Payments?

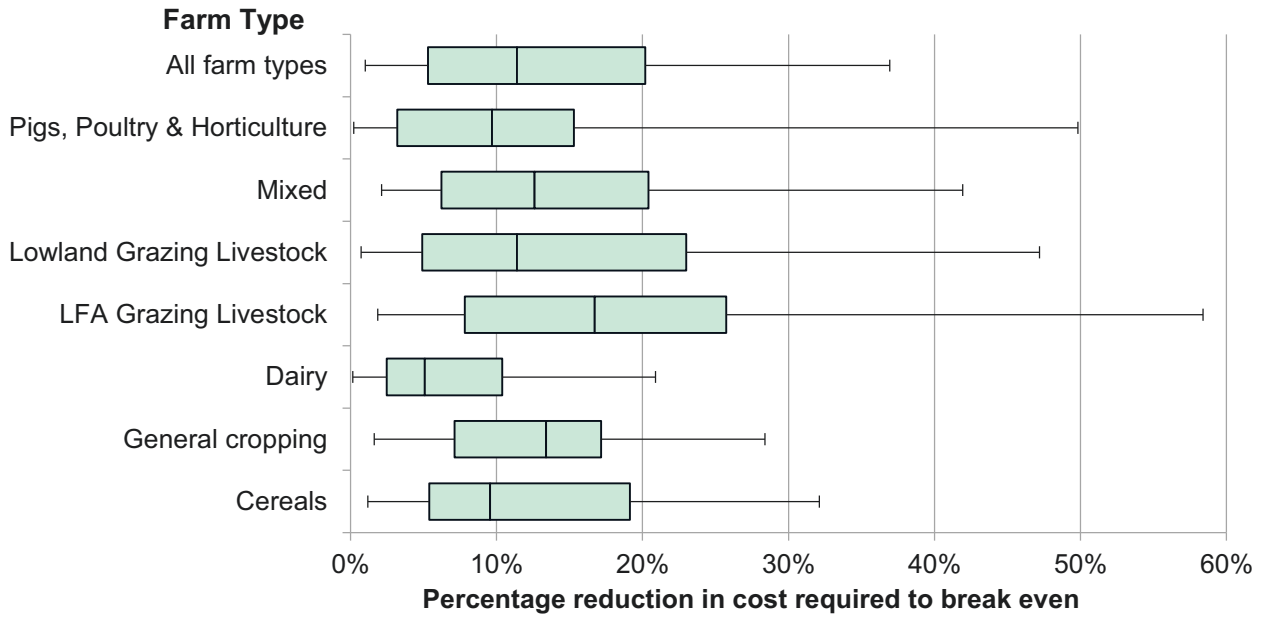
On average, farms would have needed to reduce their costs by 11% in order to break even without Direct Payments, but this varies greatly across different farm types

Of the farms that would have had a negative income with Direct Payments removed from their historic accounts, the average reduction in costs needed to break even would have been 11%.

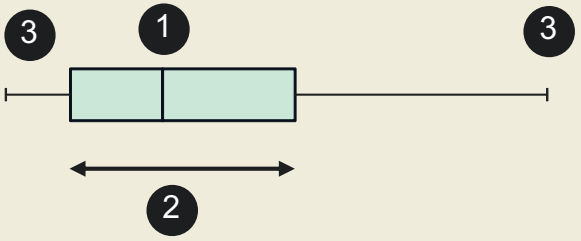
For 50% of farms the average cost reduction would have been between 5% and 20%.

For 90% of farms the cost reduction required would have been between 1% and 37%.

Reduction in costs needed to break even for those farms making a loss without Direct Payments



How to interpret this chart – If you ranked all the farms from the best to the worst, from 0-100 …



1. The line in the middle of the rectangle is the median (average). Half of farms are estimated to require an efficiency increase below this number and half above.
2. The rectangle shows the spread of the efficiency increase required for the middle 50%. The left edge of rectangle is the farm ranked 25th (out of 100) best and the right edge of rectangle is the 75th (out of 100) best.
3. The 2 lines that extend to the left and right of each rectangle indicate the range of efficiency increase needed for some more extreme farms in the ranking. The left line shows the efficiency increase for the farm ranked 5th best with the right line showing the farm 95th best.

FOOD PRODUCTION

(pages 46 -53)

What products contribute most to UK agricultural output?

More than 60% of the UK's agricultural production comes from the livestock sectors (£12.7bn in 2016), of which Dairy and Beef are the largest.

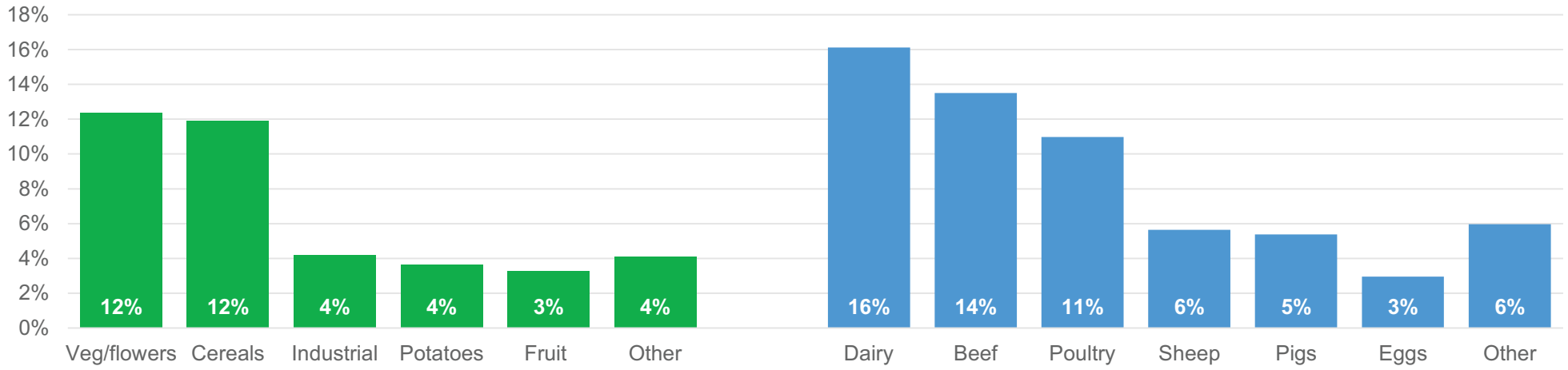
Outputs of products as a percentage of total agricultural production

Crops

Horticulture and cereals are the two largest crop outputs, account for around £ 2.5bn each.

Livestock

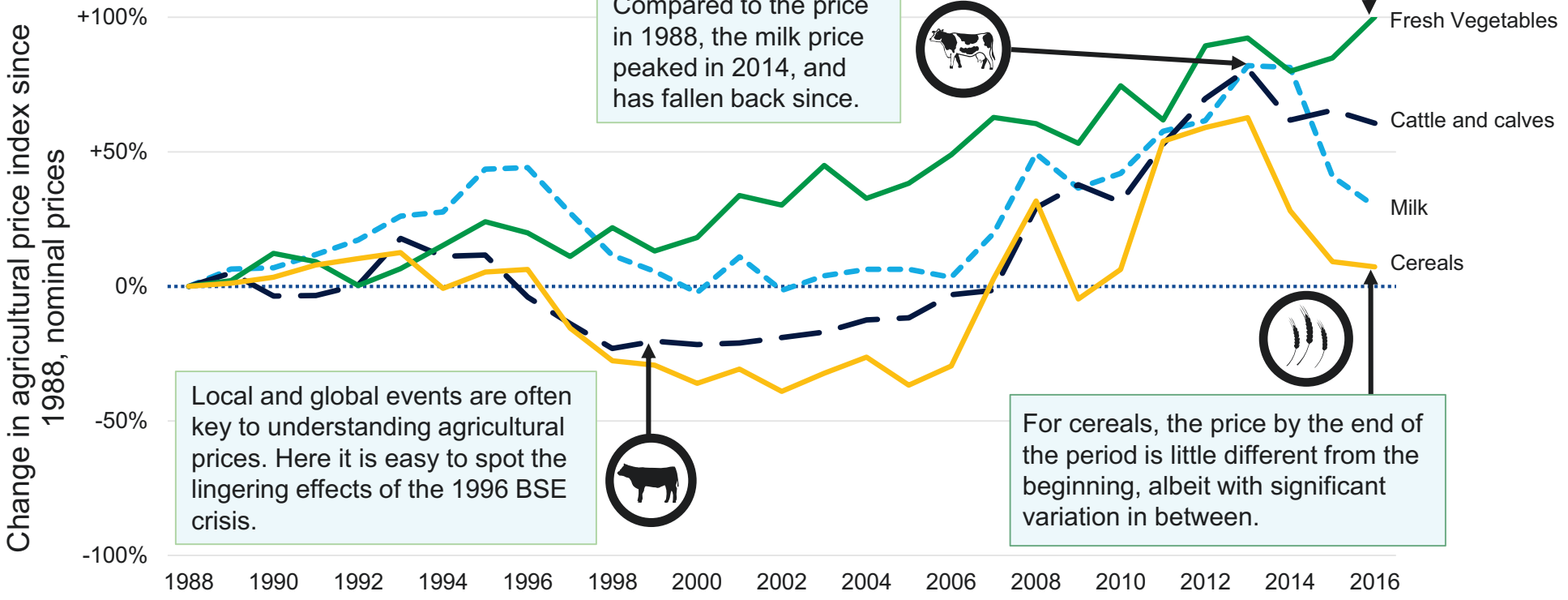
Dairy has the highest value of all agricultural sectors in the UK (£3.3bn).



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

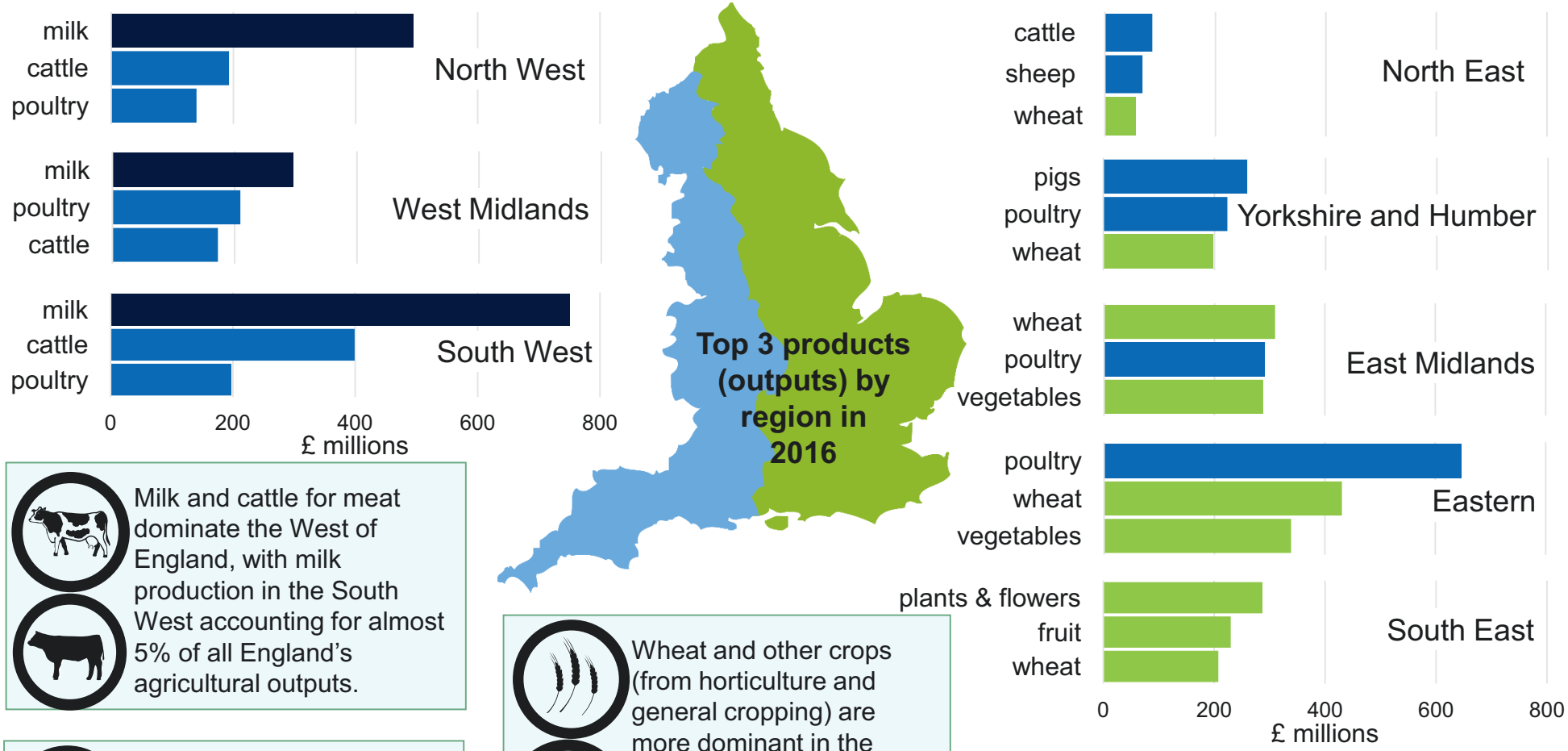
The prices farmers have received for their produce has fluctuated over time, and the factors behind this are often outside of their control.

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).



How does the output from agricultural production vary across England?

The West of England is dominated by livestock production, of which dairy has the highest value. The East is generally dominated by pigs, poultry and crops.



Milk and cattle for meat dominate the West of England, with milk production in the South West accounting for almost 5% of all England's agricultural outputs.

Poultry is within the top three outputs for most regions of England.

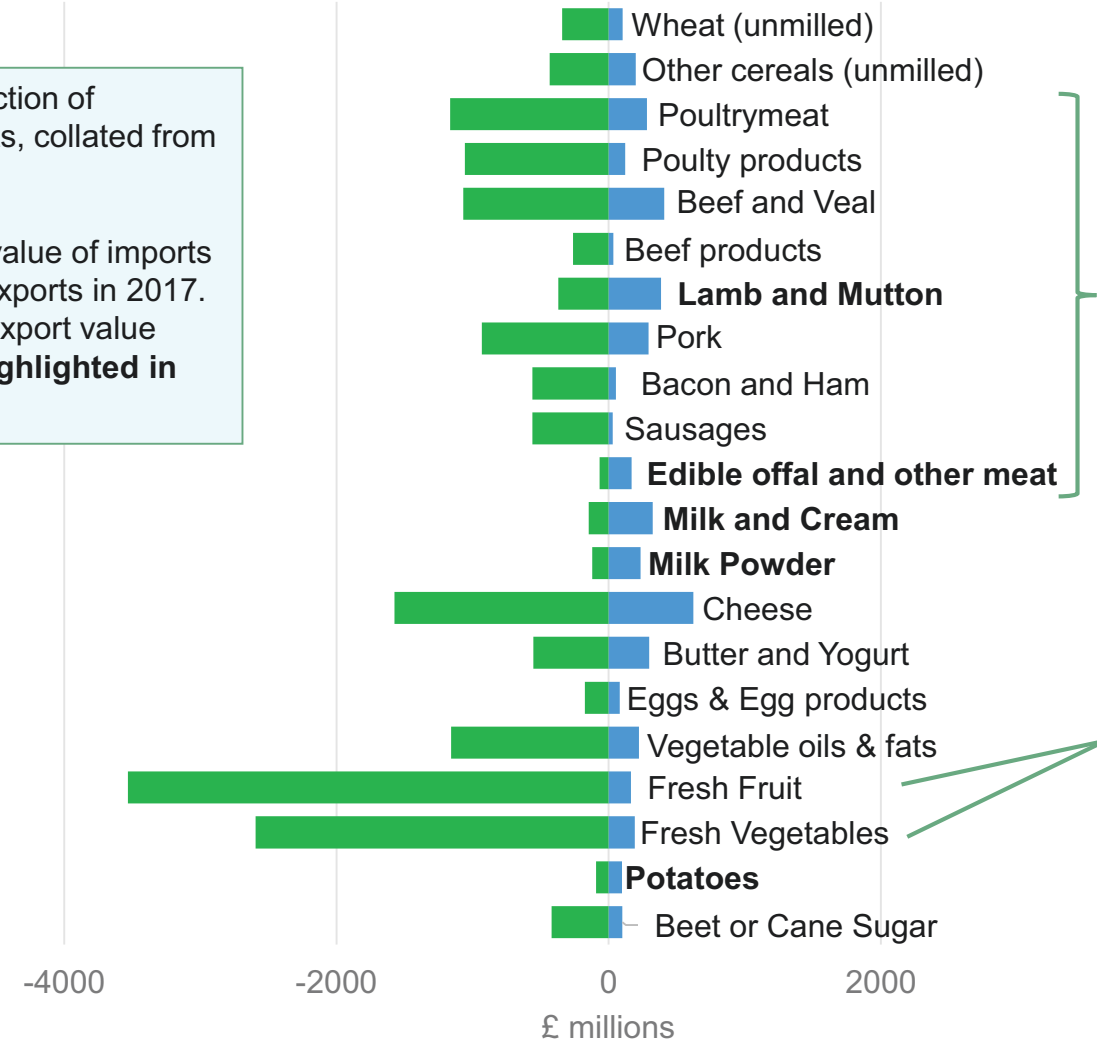
Wheat and other crops (from horticulture and general cropping) are more dominant in the East, although pigs and poultry are still in the top three outputs in places.

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

We import more agricultural or lightly-processed food products than we export, with the exception of lamb, mutton, offal, milk and cream and milk powder.

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 2017. 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 2017, other than lamb and mutton, edible offal and other meat (which includes goat for example).

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

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

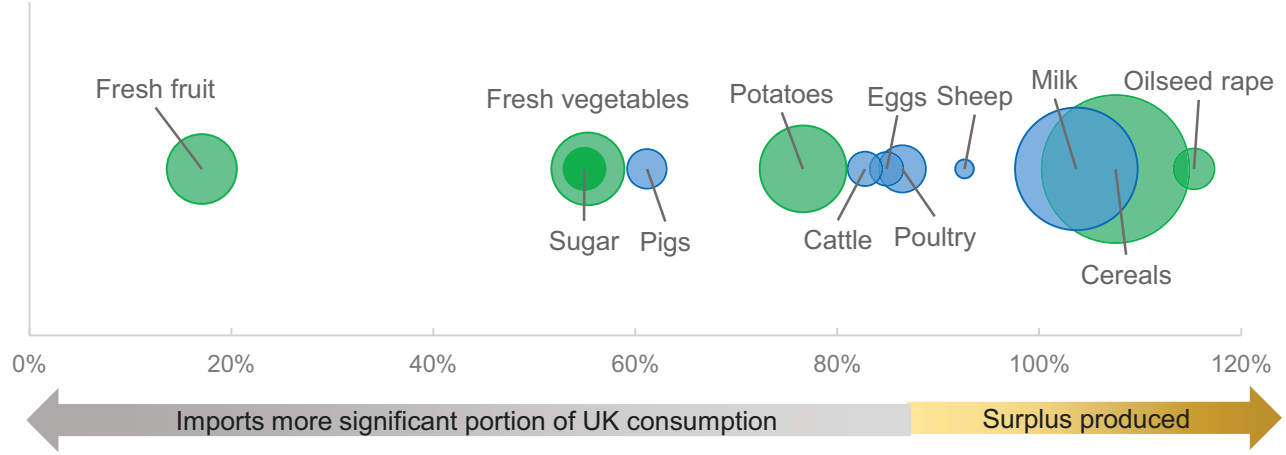
The UK's food production to supply ratio, an indicator of the ability of UK agriculture to meet domestic consumer demands, stood at 76% for indigenous foods in 2016.

76% the Food Production to Supply Ratio of indigenous food in 2016

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:

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

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.



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

The food production to supply ratios of cereals and milk were over 100% in 2016 showing that domestic production more than met domestic consumer demand.

For fresh fruit the food production to supply ratio was just 17% in 2016, highlighting the need for imports to meet domestic demand.

Do British consumers want to buy British food?

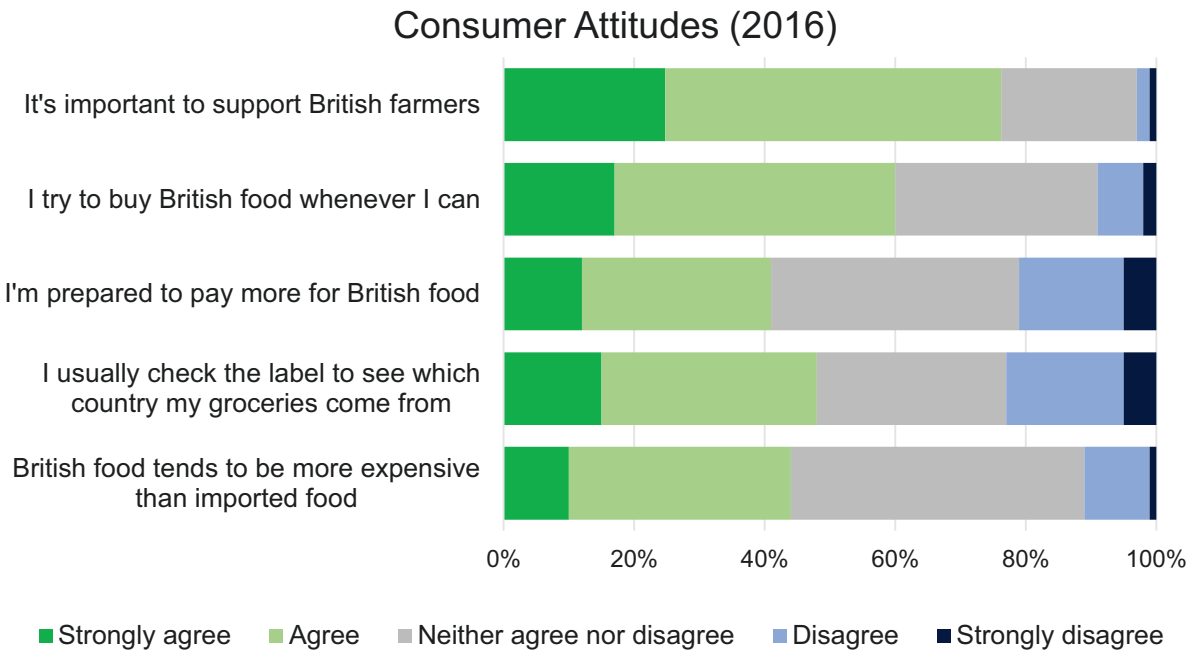
When asked, the public say they try to buy British food and believe it is important to support British farmers, but that isn't wholly reflected in consumer behaviour.

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

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

But 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 determining 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.



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).

How much do British households spend on food, and how does that compare to the past?

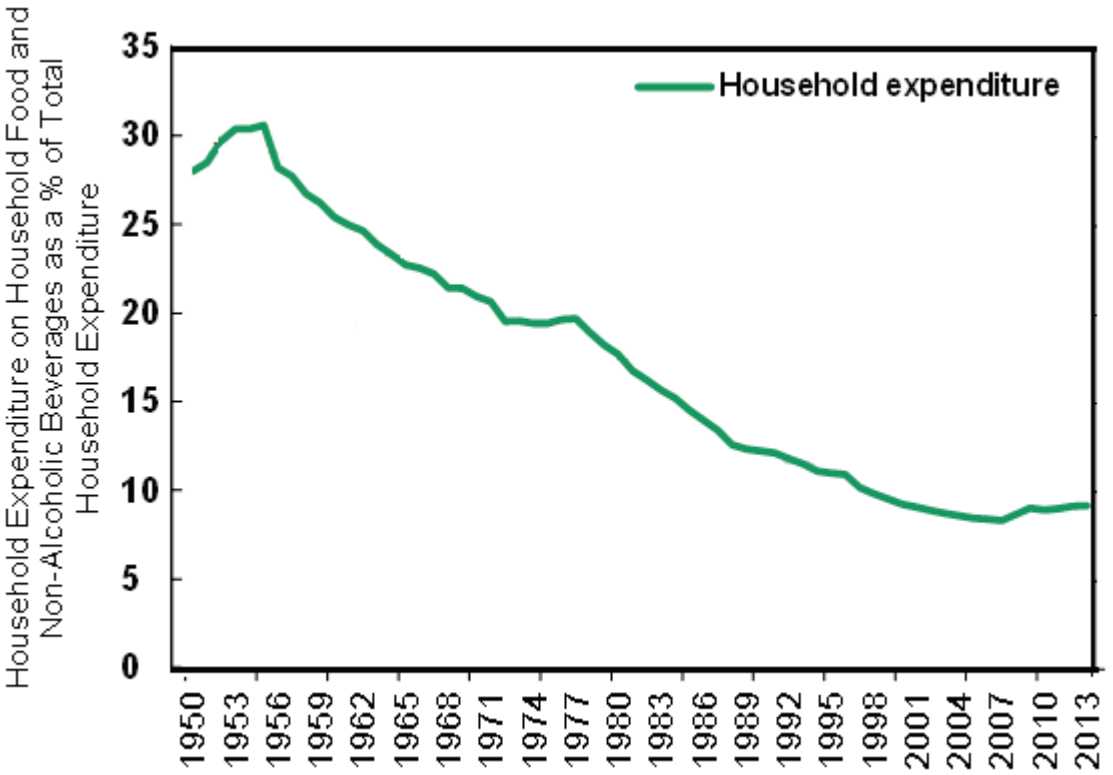
Average household expenditure on food and drink has fallen from 30% in the 1950s to less than 10% today, but this is still 16% for the lowest income households.

The share of consumer expenditure on food has fallen from 30% in the 1950's to less than 10% today. As consumers' incomes rise they tend to spend a smaller proportion of their family budget on food and drink, but focus expenditure on processed and packaged products.

Lower income families spend a higher proportion of their expenditure on food and drinks:

16% the percentage of household income spent on food by the lowest 20% households by equivalised income

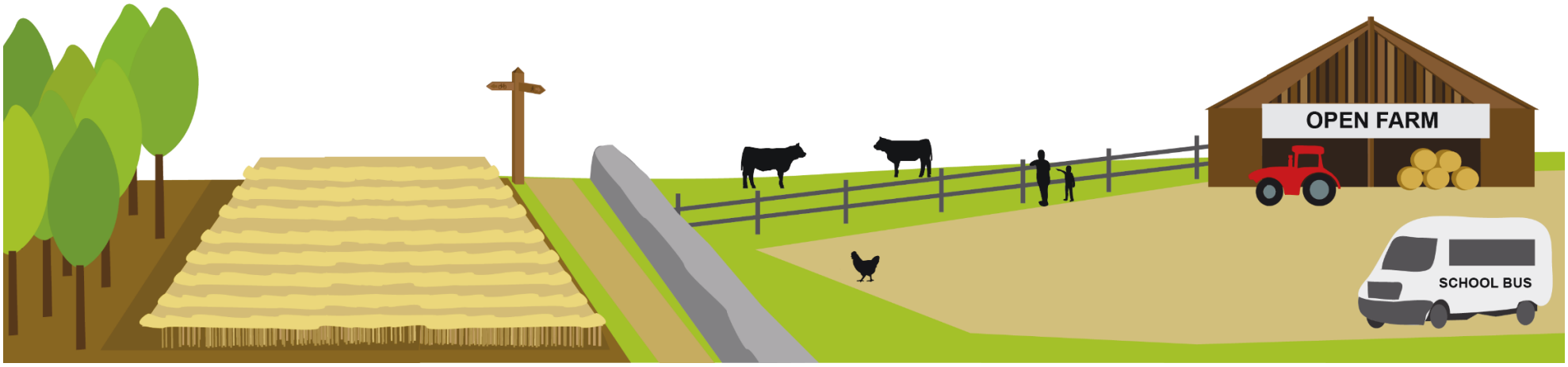
In 2015 average UK households purchased 7.2% less food than in 2007 while spending 16% more. Households in income decile 1 (lowest income group) spent 26% more on food in 2015 than in 2007 and purchased 2.6% less.



£58 the average weekly UK household expenditure on food and non-alcoholic drinks in 2016 (not including eating out)

Environmental Land Management

(pages 55– 65)



How do land owners and farmers look after our historic landscape?

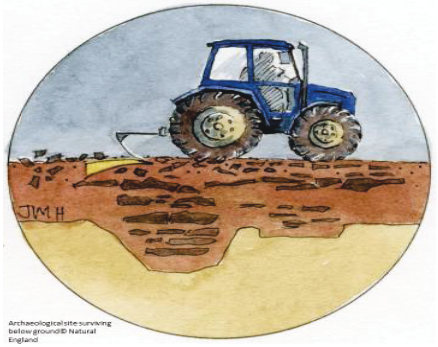
Farming is important to the stewardship of our diverse and distinctive landscapes, including the historic environment and archaeological features.

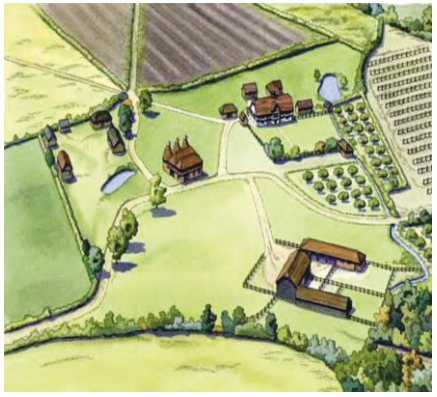
The historic environment can be seen everywhere, and provides a wide range of tangible and intangible benefits. These include socio-economic benefits, such as health and well-being, tourism, local distinctiveness, sense of place and community.

It is a non-renewable resource which, 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 Land Management has 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 which 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.

How do farms contribute to the provision of public goods?

While farming can have a negative impact on the environment, a number of public goods arise from a well-farmed 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.

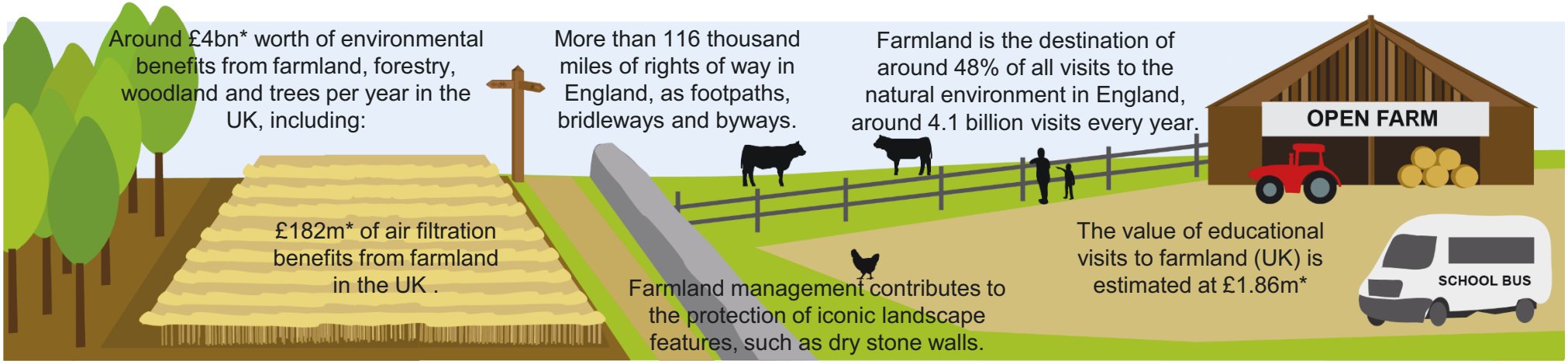
Farming and forestry can safeguard natural capital and provide public goods such as educational and recreational benefits. Farmland and woodland can provide space for biodiversity and flood prevention as well as farmland contributing to the provision of clean water, air filtration and greenhouse gas sequestration.

Economic activity to produce private goods by individuals and firms, such as farm businesses, can have a detrimental impact on natural capital, such as air and water quality, biodiversity, and landscape. Activities to improve the environmental impact of farm may affect profits by taking land out of farming, reducing animal numbers or reducing inputs such as fertilisers or pesticides, although a number of studies have shown increased yields in cropped areas where field margin have been put in place for wildlife habitat creation.

To deliver a higher level of public goods and reduce pollution, government can use policy to provide incentives to promote or protect public goods. Policies such as Environmental Land Management Schemes can deliver key public goods by rewarding farmers for adopting beneficial practices or measures.

Natural Capital

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



*2015 value in 2017 prices

What are the benefits of Environmental Land Management schemes?

Environmental Land Management schemes encourage positive farming practices through income foregone payments that incentivise the delivery of public goods.

Environmental Land Management (ELM) schemes (previously known as agri-environment schemes) were first introduced in the mid 1980s, to secure non-production natural capital benefits from the farmed landscape alongside the income farmers make from agricultural activities.

ELM practices cover very different scales, from individual fields, wetlands and nesting sites, to whole catchments. The different scales are appropriate for different outcomes, for example depending on the type of habitat being enhanced.

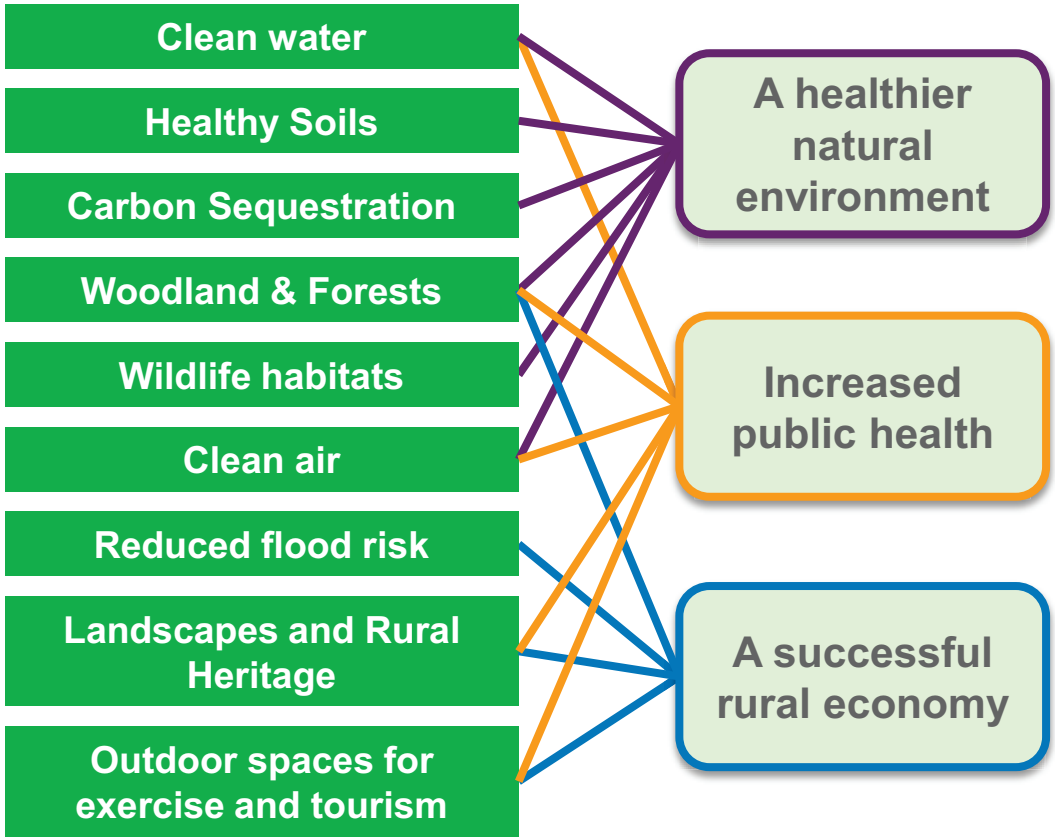
The full potential of some ELM options can only be realised where joint participation from spatially connected sites is achieved. A facilitation fund is available to encourage farmers to work together.

In 2018, the Government set out its ambition to improve the environment in the 25 Year Environment Plan for England. A new ELM system will contribute to the delivery of commitments in the plan such as:

- 75% of the 1 million hectares of terrestrial and freshwater protected sites will be in favourable condition
- Creating or restoring 500,000 hectares of priority habitats
- Planting 180,000 hectares of woodland by 2042
- That all soils will be managed sustainably by 2050
- That natural capital resources will be doubled by 2050
- That wildlife is further protected
- And ensuring that all food is produced sustainably and profitably

Our agricultural landscape delivers more than just food. The way land is managed can provide benefits to water and air quality, public health, and our well-being.

ELM systems can enhance the environment by delivering substantial improvements in the following outcomes:



How do current Environmental Land Management schemes work 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.

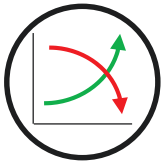
The current Environmental Land Management scheme, Countryside Stewardship was launched in 2015. This targeted and competitive scheme aims to conserve/restore habitats, manage flood risk, reduce water pollution, maintain the character of the countryside, preserve historic features, encourage educational 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.

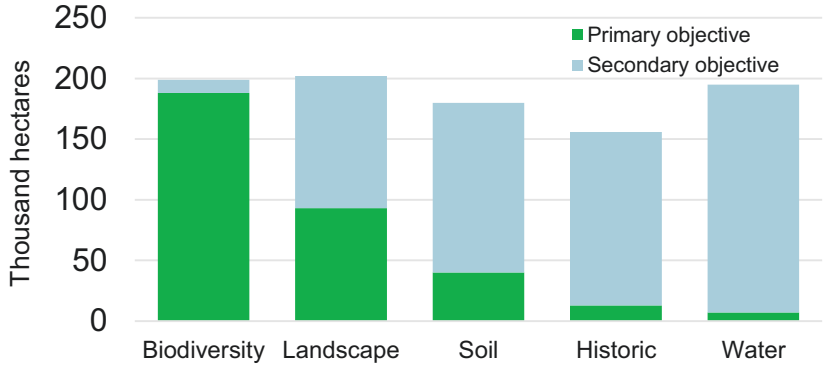


A monitoring and evaluation programme informs policy and future scheme development. Research projects investigate the impacts of Environmental Land Management practices.

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 impacts have Environmental Land Management schemes had to date in England ?

Environmental Land Management has 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 Environmental Land Management 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.

How do farming practices impact on our water?

Water quality is 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

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.

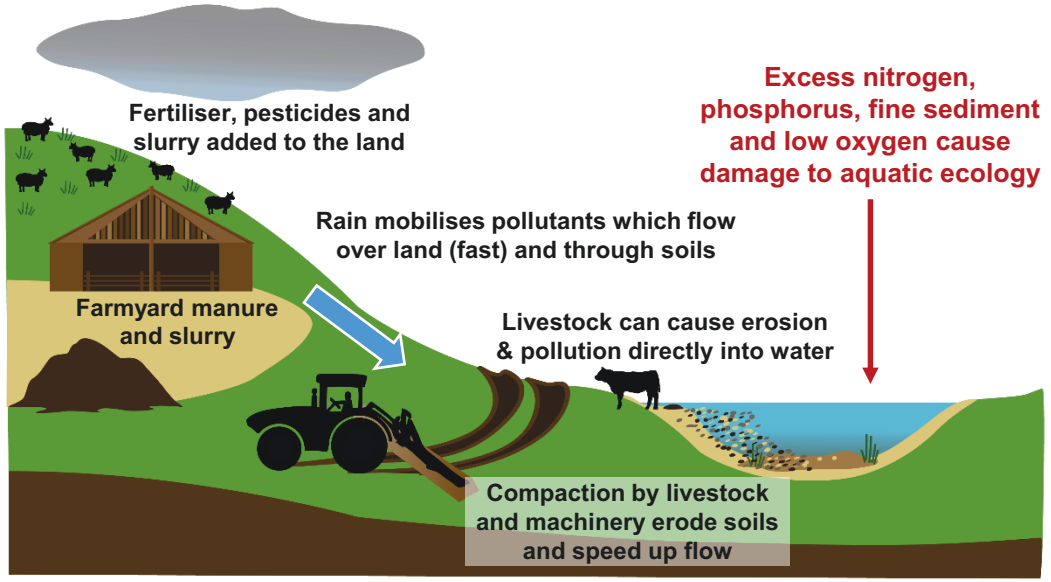
78% of all surface and groundwater bodies in England failed to achieve good status in 2013.

The majority of these water body failures are due to urban and other non-agricultural pollution, but

1/3 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.

⇩32% **Nitrogen**

reduction in total nitrogen applications in Great Britain between 1985 and 2015.

⇩56% **Phosphorus**

reduction in total mineral phosphate additions between 1985 and 2015 in Great Britain.

How do farming practices impact on our soils?

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?

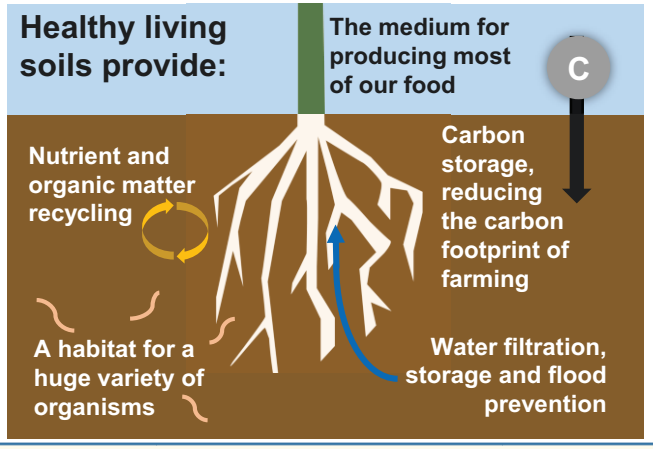
33% of UK soils are thought to be degraded with 1 million hectares (6% of the UK's agricultural land and 36% of cropland) at risk of erosion.

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.

£305m
Cost of offsite soil erosion and compaction from agriculture in 2010 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.

How do farming practices impact on wildlife and biodiversity?

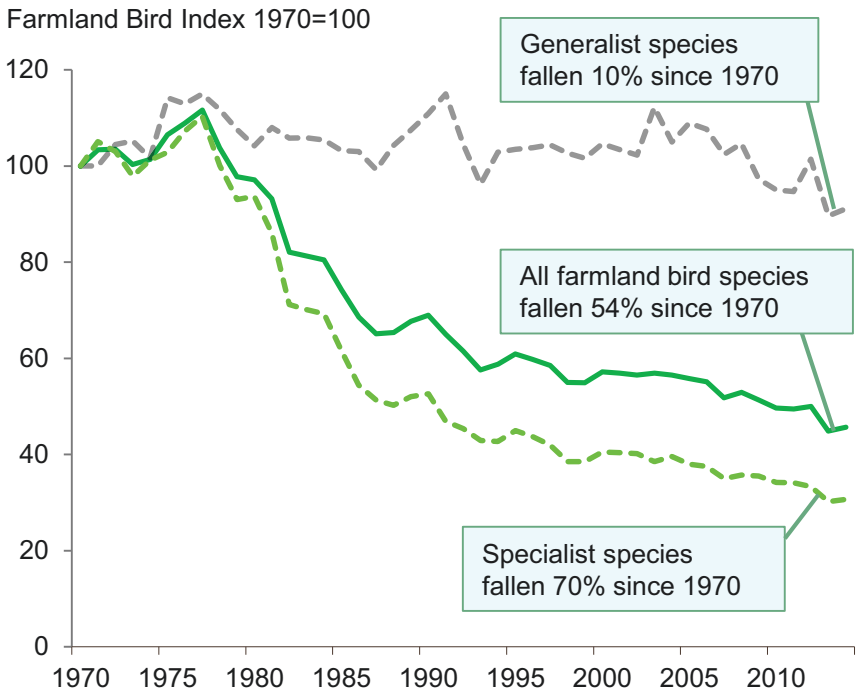
Farming practices can result in habitat loss, reducing wildlife biodiversity. The UK farmland bird index, an indicator of the state of wildlife generally, has fallen to less than half its 1970 value.

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.

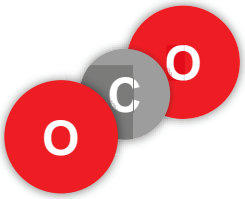
Land sharing integrates delivering environmental benefits and producing food on the same land, for example through current agri-environment schemes.

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.

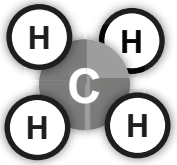
These two models benefit biodiversity on different scales, and a combination of different approaches will be needed in different landscapes and habitats.

How much does agriculture contribute to climate change through emissions of greenhouse gases?

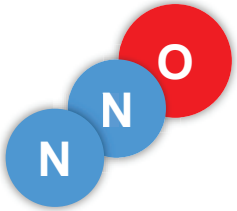
Agriculture is responsible for 10% of the UK's greenhouse gas emissions, mainly through emissions of methane and nitrous oxide from grazing livestock and fertilisers.



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, warming the atmosphere more when it is released. 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 75% of the UK total.

Carbon sequestration:

Land managers can and do help combat climate change by increasing carbon sequestration through the creation of more forests and woodland, restoration of wetlands and undertaking practices which increase the organic carbon content of soils. This takes carbon dioxide out of the atmosphere and stores it in the terrestrial environment, reducing UK net emissions, and mitigating against CO_2 released from other industries.

£3.1bn

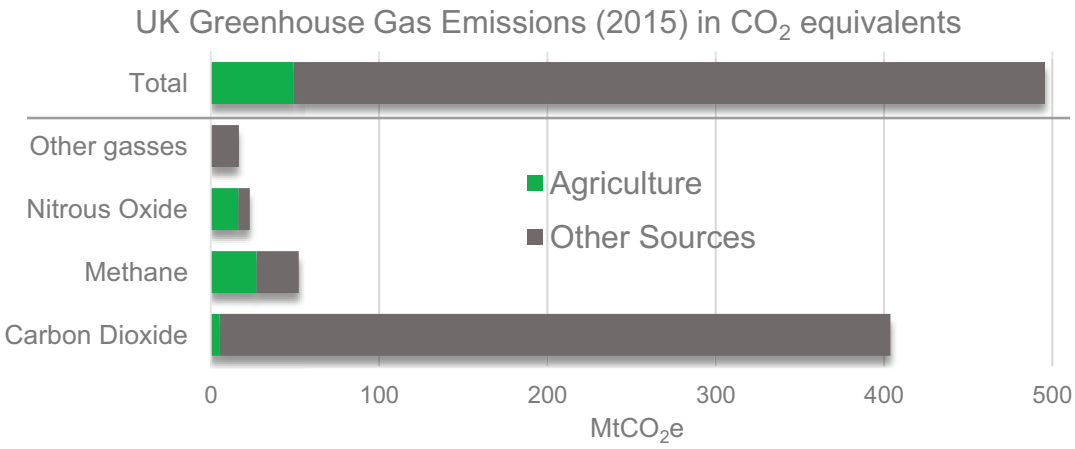
cost of UK greenhouse gas emissions in 2015 from agriculture

15%

estimated fall in agricultural emissions of nitrous oxide (N_2O) and methane (CH_4) since 1990

90% of agricultural N_2O emissions are a result of nitrogen fertiliser application

Grazing livestock are responsible for 90% of methane emissions



What is the impact of ammonia emissions from agriculture?

Agriculture is responsible for 83% of UK emissions of ammonia, mainly from livestock farming and fertiliser use.

20%
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.

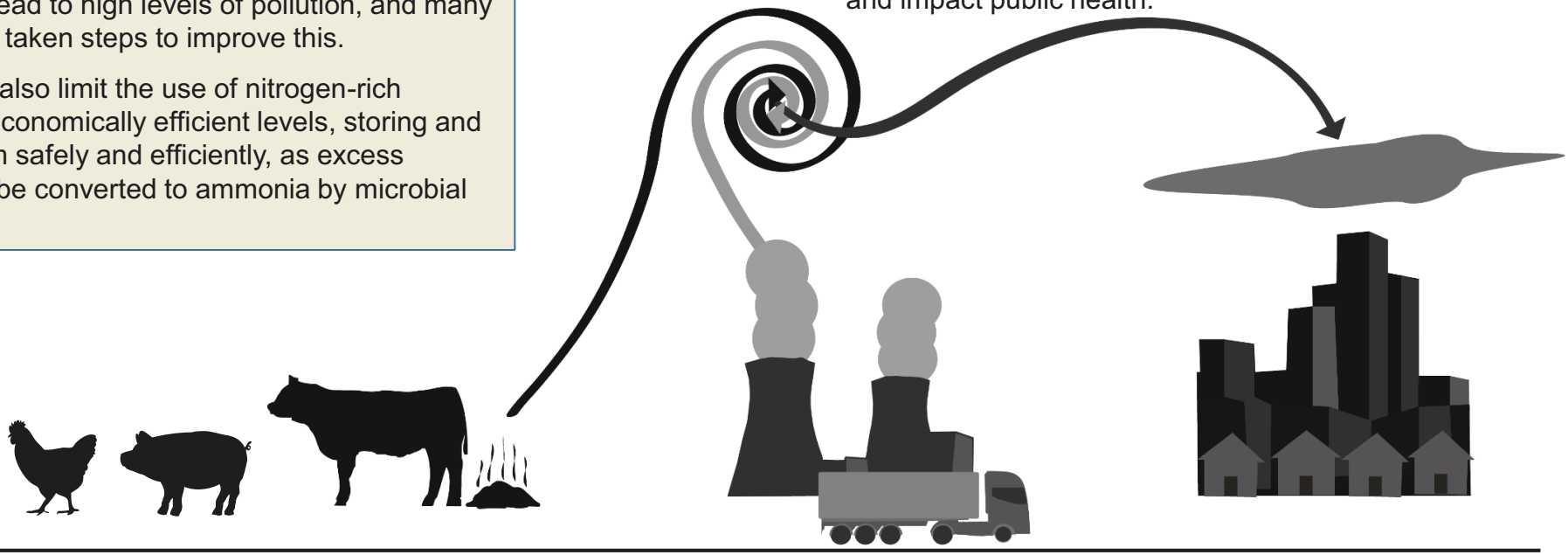
83% of UK ammonia emissions come from agriculture, mainly from livestock farming and mineral fertiliser use.

£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.



How are woodlands and forests impacted by agriculture?

There are 1 million hectares of woodland on agricultural land within the UK, almost a third of the 3.2 million hectares of UK forests and woodlands.

The woodland area of the UK in 2017 was 3.17 million hectares, covering 13% of total UK land area, of which 1million ha is found on agricultural land.

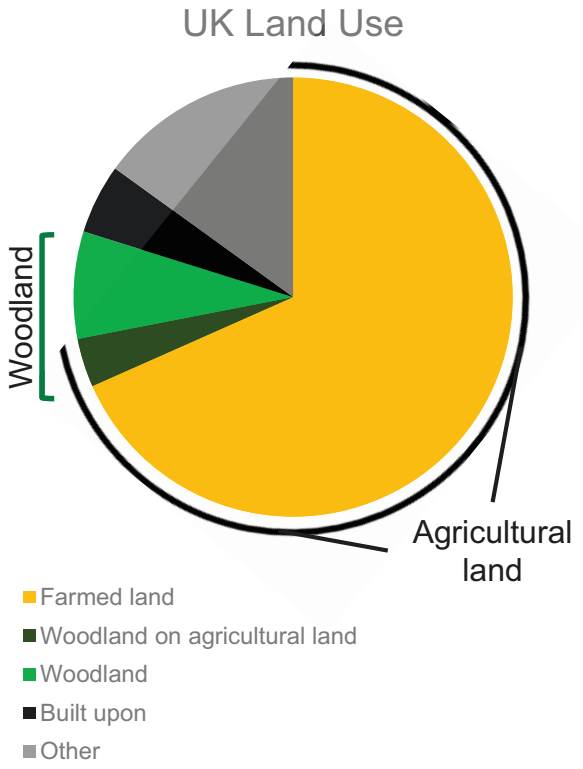
The contribution of forestry to UK economy was £630 million in 2016.

The industry supported 17,000 jobs in forestry and 26,000 jobs in primary wood processing in 2015.

245 projects were registered under the Woodland Carbon Code as of December 2017, covering 16,200 ha of woodland, with the aim of sequestering 6 million tonnes of carbon dioxide from the atmosphere.

The Public Forest Estate is the largest timber producer in England, accounting for 16% of English woodland and managed by Forestry Commission England.

Forestry Commission also licences felling and provides grants to land managers for planting, improving and managing woodlands, which, together with the Public Forest Estate, means that 53% of the total woodland area in England is under active management.



The area of farm woodland in the UK has increased from 663 thousand hectares in 2007 to 978 thousand hectares in 2016. Around one half (51%) of all farm woodland was in Scotland in 2016, with a further 38% in England, 9% in Wales and the remaining 2% in Northern Ireland.

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

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.

How can farm management practices help to reduce flood risks and provide wider environmental outcomes?

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

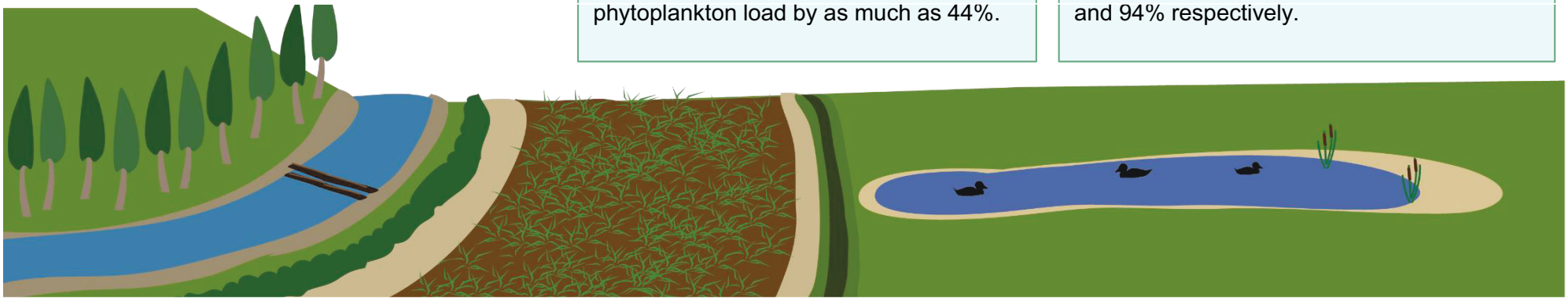
Natural Flood Management techniques can be adopted by farmers to help manage flood risk by using land management practices that slow or store water in the landscape. When properly targeted, Natural Flood Management (NFM) techniques can provide excellent value for money, with cost-benefit ratios of around 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.

Data sources used in this publication (1 of 2)

14. June Survey of Agriculture 2017 – UK
15. Total Income from Farming 2016, 2nd Estimate
16. June Survey of Agriculture 2017 – UK and Defra June Survey of Agriculture
17. Agriculture in the UK, 2016
18. June Survey of Agriculture 2017 – UK
19. Defra analysis of Defra June Survey of Agriculture
20. Total Income from Farming 2016, 2nd Estimate and Forecast Estimate Total Income from Farming in the UK 2017
21. Agriculture in the UK, 2016
22. Defra analysis of Farm Business Survey
23. Defra analysis of Farm Business Survey
24. Defra analysis of Farm Business Survey
25. Defra analysis of Farm Business Survey, Farm Practices Survey 2008, Defra June Survey of Agriculture and Farm Household Income and Household Composition, England 2014/15
26. Defra analysis of Farm Business Survey and Farm Business Management Practices in England 2016/2017
27. Farm Business Management Practices in England 2016/2017
28. Farm Accounts in England 2016/2017
29. Defra analysis of Farm Business Survey
30. Total Factor Productivity of the UK Agricultural Industry 2016, 2nd Estimate
31. Defra analysis of Farm Business Survey
32. Economic Impact of Health and Welfare Issues in Beef, Cattle and Sheep in England, Updated Estimates of the Costs Associated with Thirty Four Endemic Livestock Diseases in Great Britain (Bennett and IJpelaar, 2005, Journal of Agricultural Economics vol. 56), Costs of the Major Endemic Diseases of Sheep in Great Britain and the Potential Benefits of Reduction in Disease Impact (Nieuwhof and Bishop, 2005, Animal Science 81), all figures inflation adjusted to 2016 prices and An analysis of the effects of BVD eradication in Scotland: A farm business level impact assessment
33. www.cropmonitor.co.uk, 25 Year Environment Plan Evidence Report and Defra analysis to be published in Defra Tree Health Resilience Plan
34. Defra analysis of Rural Payments Agency data (as of Nov 2017)
35. Defra analysis of Farm Business Survey
36. Defra analysis of Farm Business Survey
37. Trade Impacts of Agricultural Support in the EU (Matthews, Salvatici & Scoppola, 2010, International Agricultural Trade Research Consortium Commissioned Paper No 19) and Defra analysis of Farm Business Survey
38. Balance Sheet Analysis and Farming Performance, England 2016/17, Savills Greenfield Development Land Price Index and Savills Farmland Value Survey (GB)
39. Greening: A More Complex Income Support Scheme, Not Yet Environmentally Effective (European Court of Auditors)
40. Balance Sheet Analysis and Farming Performance, England 2016/17 and, CAP Subsidies and the Productivity of EU Farms (Rizov, Pokrivcak & Ciaian, 2013, Centre for European Policy Studies, Factor Markets Working Paper No. 37)
41. Defra analysis of Farm Business Survey

Data sources used in this publication (2 of 2)

42. Defra analysis of Farm Business Survey
43. Defra analysis of Farm Business Survey
44. Defra analysis of Farm Business Survey
45. Defra analysis of Farm Business Survey
46. No references
47. Agriculture in the UK, 2016
48. Defra Agricultural Prices Indices
49. Agriculture in the English Regions 2016, 2nd Estimate
50. Agriculture in the UK, 2016 and HMRC 2017 Trade data
51. Agriculture in the UK, 2016 and Food Statistics Pocketbook 2017
52. Food Statistics Pocketbook 2017
53. Food Statistics Pocketbook 2017 and A Hundred Years of British Food and Farming, ONS
54. No references
55. Natural England and Heritage Counts, The Historic Environment in 2017: An Overview
56. Rights of Way Condition Survey 2000 (Countryside Agency), Natural England and ONS Ecosystem Accounts for Freshwater, Farmland and Woodland
57. A Green Future: Our 25 Year Plan to Improve the Environment
58. Rural Development Programme for England, The Rural Development Programme for England 2014 to 2020: Final Impact Assessment
59. The Rural Development Programme for England 2014 to 2020: Final Impact Assessment, Achievements of the 2007-2013 Rural Development Programme for England Environmental Stewardship Scheme (RDPE), Higher-tier agri-environment scheme enhances breeding densities of some priority farmland birds in England (Bright, Morris, Field et al., 2015, Ecosystems & Environment vol. 203), Targeted agri-environment schemes significantly improve the population size of common farmland bumblebee species (Wood, Holland, Hughes and Goulson, 2015, Molecular Ecology) Catchment Sensitive Farming Phase 3 Evaluation Report (CSF156), Developing Indicators and Thresholds for Monitoring the Landscape Impacts of Environmental Stewardship (LM0429), and Heritage Counts, The Historic Environment in 2017: An Overview
60. Agriculture in the UK, 2016 and British Survey of Fertiliser Practice 2016
61. Agriculture in the UK, 2016, Countryside Survey Report for Soils, 2007 , UK Land Use and Soil Carbon Sequestration (Ostle, Levy, Evans & Smith, 2009, Land Use Policy vol. 26) and Natural England
63. Agriculture in the UK, 2016 Status Report of the Annual Inventory of the UK 2017 UNFCCC and 2016 UK Greenhouse Gas Emissions, Final Figures BEIS
64. Agriculture in the UK, 2016 and Emissions of Air Pollutants in the UK 1970 to 2016
65. June Survey of Agriculture 2017 – UK, A Green Future: Our 25 Year Plan to Improve the Environment and Forestry Statistics 2017 (1st release), Forestry Commission
66. Environment Agency, Flood Risk Reduction Benefit Valuation for Natural Flood Management (Eftec, May 2017), Defra Mitigation Methods User Guide, Killer Facts (EA document)