HOUSES OF PARLIAMENT
PARLIAMENTARY OFFICE OF SCIENCE & TECHNOLOGY

POSTNOTE

Number 557 July 2017

Environmentally Sustainable Agriculture

Agricultural practices can reduce water quality, degrade soils and cause biodiversity loss. This in turn can disrupt natural processes that support food production. Environmentally sustainable agriculture seeks to reduce environmental damage and restore such processes. This POSTnote summarises associated land management options, agricultural policies and the constraints imposed by a new trading environment.

Overview

- Environmentally sustainable agricultural measures seek to minimise environmental damage and use resources and energy more efficiently.
- What measures succeed will depend on the environmental and agricultural context. The measures may also require farmers to work together across a landscape.
- The EU Common Agricultural Policy was not conceived to reduce the environmental impacts of agriculture.
- The UK is introducing new agricultural policies following withdrawal from the EU.[1] One objective is to reduce the environmental impacts of agriculture.
- Future trade treaties and agricultural policy will shape farmers' income and land management decisions. This will have direct consequences for the environment, such as affecting the level of payments that can be made to farmers to deliver environmental benefits.

Background

The vote to leave the EU means that the UK will no longer be required to fund and comply with the EU Common Agricultural Policy (CAP) after 2020.[2] CAP was conceived to address two main concerns: assuring an adequate domestic food supply and sustaining rural communities. The majority of land in the UK is farmed (70%) with farmers receiving direct payments based on the area of agricultural land they farm.[3] On average, payments make up 50-60% of farm income.[4] CAP reforms have made attempts to address environmental damage from agriculture by paying farmers to manage farmland for environmental benefits through voluntary agri-environment scheme (AES) agreements. More recently, famers have been required to implement environmental measures in order to receive a proportion of their direct payment (Box 1). Despite these changes, the Environment, Food and Rural Affairs Committee suggested in 2012 that CAP had negatively affected the environment overall.[5]

The 2017 Conservative manifesto pledged to publish a 25 Year Environment Plan, such that this generation is the first "to leave the environment in a better state than we inherited it", although this was not included in the Queen's speech.[1,6] If implemented, this would require addressing environmental damage from agriculture that includes: water pollution (PN 478); greenhouse gas emissions (GHG) from crops and livestock (PN 486, 453); soil compaction from machinery and livestock (PN 502, 484); the effects of pesticide use on pollinators;[7] and, the degradation and fragmentation of natural and semi-natural habitats (PN 501, 442, 418). The Government has previously indicated that it is considering moving towards making payments for public goods (Box 2).[8] This would involve expanding UK agricultural policy to encompass a number of environmental targets.

These may include measures to achieve targets on natural capital – the elements of nature that directly or indirectly produce value to people (PN 542). Appropriately designed measures may also help farmers adapt to climate change, increase energy efficiency and reduce their exposure to volatility in prices of fertilisers, pesticides, labour, energy and other costs. However, these measures will not be the only drivers of change in agricultural management. New trading arrangements between the UK and the EU, as well as other countries, are likely to determine many of the challenges and opportunities for the agricultural sector,

Box 1. The EU CAP and Environmental Mitigation

The UK will adhere to CAP until it leaves the EU. The 2017 Conservative manifesto pledged to maintain levels of Pillar I and II payments (see below) until the end of the current parliament.[6] Agri-environment schemes (AES) agreements are guaranteed for their lifetime.[9] The total amount of funds is guaranteed, but how payments are made is devolved. Up to 15% can be transferred between Pillar I and II:

- Pillar I. These are direct payments (€25.1 billion over 2014-2020) that require farmers to adhere to a set of EU regulations.[10] 30% of a payment is dependent on farmers implementing 'greening' measures. These cover crop diversification, Ecological Focus Areas (5% of farmland dedicated to environmental benefits) and measures to maintain permanent grassland. Organic farmers automatically qualify for the greening payment.
- Pillar II. These include payments (€2.6 billion over 2014-2020) to provide environmental benefits, principally through AES with responsibility devolved.[10] In England, schemes are focused on woodland creation, biodiversity and water management.[11,12] The Scottish, Welsh and Northern Irish schemes also focus on biodiversity and water management, but include an additional focus on reducing GHGs and adaptation strategies.[13,14]

The effectiveness of 'greening' under Pillar I for enhancing farmland biodiversity has been questioned,[15] although it may provide other environmental benefits.[16] However, AES under Pillar II has been shown to increase wildlife locally.[17] Some argue that rather than greening being complementary to AES, they are competing approaches.[18]

including the scope to make changes. There will also be limits on what environmental improvements can be achieved through changes to agricultural payments.

Reducing Environmental Impacts

There is no agreed definition of what constitutes environmentally sustainable agriculture. It encompasses a range of possible measures that aim to reduce the effects of agriculture on the environment and to conserve the aspects of the natural environment on which agriculture relies. The most relevant measures will vary from farm to farm and on their wider environmental context. These measures fall into two broad categories: restoring natural capital and improving resource efficiency.

Natural Capital

Agriculture relies on a number of natural capital assets such as soil, water and biodiversity (PN 542).[19] The benefits derived from these assets include nutrient cycling, pest control, pollination and water purification.[20] Overall the natural capital of UK farmland has declined as agricultural production has increased.[21] Measures that maintain and restore natural capital, such as improving soil and water quality and conserving biodiversity would address this. While this may require some land to be taken out of production, yield increases in the remaining cropped area could offset losses under some conditions over a number of years.[22,23] The Natural Capital Committee has argued that the Government should take more action on natural capital (PN 542) and the Committee on Climate Change has also noted that climate change presents risks to natural capital, especially soils and biodiversity.[24]

Improving Soil Quality

Soil is a natural capital asset that underpins agricultural production.[25] Agricultural soils could benefit from improved management practices for crops or grazing livestock. Poor management results in soil erosion, compaction and the loss of soil fertility. There is currently a lack of widespread monitoring to identify the state of agricultural soils and how best to improve them (PN 502). Farmers routinely measure soil nutrients and pH, but often overlook other important factors, such as organic carbon stored in soil, soil structure and biological activity, all of which are critical for nutrient cycling.[29] These soil properties vary according to farming activity and the environmental context and how improvements in soil quality can be achieved will vary. For instance, increases in the organic carbon stored in arable soils have been linked to increases in yield.[30] However, there are difficulties in measuring the amount of carbon stored (PN 549).[31] In order for lowland peat soils to store more carbon, the water table may need to be raised.[32]

Box 2. Public Goods and Agriculture

A pure public good is a benefit, such as clean air, with two characteristics: 1) its consumption does not exclude others from its availability and 2) its consumption does not reduce the amount available to others. The lack of incentive to pay for public goods can lead to their under supply and over-exploitation, which means intervention is required to maintain their provision.[26] It has been argued that national food security is a public good, justifying the current model of support.[27] The Government has not stated what it considers to be a public good. However, successive UK Governments have argued for reform of CAP to shift spending to protect public goods, such as benefits derived from the environment.[28]

Managing Water Quality

The Natural Capital Committee has highlighted that any replacement for CAP should consider other policy objectives, including water quality.[33] Farming activities account for around a third of diffuse water pollution (e.g. runoff from fields). Fertilisers, pesticide residues, sediment and faecal bacteria are the main agricultural pollutants. Water quality can be improved by more effective use of pesticides and fertilisers, slowing the movement of water with better soil management and adopting measures in vulnerable areas that catch pollutants before they enter water courses (PN 477).

Maintaining Biodiversity

Biodiversity is an important natural capital asset that provides benefits to farming (such as crop pollination and pest control).[34] Many species in the UK have adapted to live in agricultural landscapes, but are sensitive to changes in agricultural practices.[35] Specific measures to improve farmland biodiversity will depend on the species, size of local population, farm management and landscape. For example, planting of field margins with flower mixes or seed mixes to provide food for wild birds at a sufficient density can improve species diversity and abundance.[36] However, species restricted to semi-natural habitats would benefit more from changes in land use than from changes to agricultural management. This may require taking larger areas of land out of production for conservation. Under CAP, the creation of semi-natural habitats on farmland would be contrary to requirements for 70% of the payments (PN 418, 537). There are concerns that taking land out of production has implications for food security (PN 556, 418), but some have raised questions about this assumption.[37]

Technology and Practices to Improve Efficiency

There is significant scope to make agriculture more resource efficient by changing practices and using new technologies. Nitrogen fertiliser production is an energy intensive process reliant upon fossil fuels.[38] Changing practice to use nitrogen fixing plants in livestock and arable systems can reduce the need for nitrogen fertiliser.[39] Precision farming technology to improve the application of nitrogen fertiliser use would also reduce GHG emissions (PN 486) and the build-up of excess nutrients in water courses (PN 505). However, volatility in food prices discourages investment in technology and government intervention may be required (PN 556).

Improving Agricultural Technologies

The UK Strategy for Agricultural Technologies aims to support the development of new technologies that increase yields "without adverse environmental impact and without the cultivation of more land".[40] For example, precision farming techniques incorporate sensors, information technology and accurate delivery systems to ensure the right agrochemical input is applied in the right place at the right time and at the right dose (PN 505). Investing in such technology can make farming more efficient.[41,42] Precision crop protection techniques can reduce pesticide use which may also be beneficial for pollinator populations (HC SN06656).[43] Biotechnology can also deliver efficiencies. For example, new plant breeding techniques, such as gene editing, can produce varieties with better resistance to disease and pests (PN 548). The HoC Science and Technology Committee has suggested public acceptance of novel crop technologies may increase if their potential environmental benefits were better communicated.[44]

Energy Efficiency

Resource Efficiency Assessments compare GHGs emissions and yields between similar farms in order to identify areas for improvement.[45] Technology can be used to increase efficiency of resource use. For example, automatic control of agricultural vehicles using satellite navigation minimises overlaps, such as fertiliser applications, reducing the cost of inputs and machinery use. Soil compaction caused by machinery is usually addressed by tillage, which is energy intensive. Controlled traffic farming (CTF) is a technique that often uses satellite navigation to ensure machinery keeps to specific routes across the field in order to limit the area affected by soil compaction (PN 505). CTF requires a suite of machinery with matching axle widths (e.g. tractors, harvesters), but there is currently a limited range of suitable commercially available equipment. Research and development is being carried out in the UK on a complete new mechanisation system called robotic agriculture.[46]

Policy Options

The 2015 Government has stated that it was not going to revoke existing decision making powers on CAP held by the devolved administrations. To maintain the integrity of the UK single market, the HoL EU Energy and Environment Sub-committee has suggested the need for a UK wide framework or the negotiation of co-ordinated agricultural policies with the devolved administrations.[8,47] There are likely to be differences in priorities between regions, which will have implications for farming and the environment across the UK. For example, changes in agricultural employment may affect rural communities and policies may be implemented to support diversification of income sources in some areas.

The Economic Framework for Agriculture

A combination of both trade and agricultural policy will drive farming practice post-Brexit. Potential trade relationships with the EU (Box 3) and WTO membership (Box 4) constrain policy options, such as those on the amount of money that can be paid to change farming practices. However, the Government has pledged to provide stability for farmers during withdrawal from the EU.[1]

The 2017 Conservative manifesto has pledged to design a new AES in this Parliament, but this was not in the Queen's speech.[1,6] Under CAP, AES payments are made for the measures adopted and not for the environmental benefits delivered. Moving towards a system that offers incentives for the delivery of benefits may deliver better value for taxpayer money. There are currently two payment-by-results schemes being piloted that examine aspects of monitoring and remuneration, one with a focus on specific habitats, the other taking a whole-farm approach.[48,49] Typically, payment-for-results schemes are complex and need active monitoring of scheme implementation and outcomes.[50] Payment-by-results schemes may require simplification to be more attractive to farmers.[27] The HoC Environmental Audit Committee reported that farmers were not engaging with England's existing Countryside Stewardship scheme because of its complexity.[27]

Providing tax relief or loans for the purchase of technology or infrastructure that improves environmental performance could also stimulate investment. In response to a HoL report on the resilience of the agricultural sector, the Government agreed that financial instruments, such as insurance against crop failure, and improving farmers' access to finance will be important in addressing future volatility in prices.[51] Whatever mechanisms are used farmers' bodies have asked for a transitional period giving farmers time to plan for a new payment system.[8]

Box 3. EU Trade and Farmers' Payments

The Government is negotiating a free trade arrangement (FTA) with the EU which has two potential outcomes:[52]

- **FTA with the EU.** This would likely mean that UK standards will need to reflect current and future changes to EU environmental standards in order to sell into the Single Market, such as on pesticides.[53] Environmental standards could be negotiated as part of the FTA.
- **WTO default position.** This will likely lead to higher trading costs on UK-EU trade (to and from) which could depress agricultural produce prices and introduce non-tariff barriers, such as animal and plant health inspections at borders.[8]

A National Farmers' Union report examining farmers' income under the two scenarios above, in combination with different levels of direct payment (0%, 50% & 100% of current levels) found that the largest changes came from decreasing payments. Abolition of direct payments led to between 15-25% of farms becoming unviable depending on the trade scenario.[54]

Box 4. World Trade Organisation Rules

The WTO Agreement on Agriculture sets out four categories of domestic support for farmers:[8]

- Blue Box payments are made as part of a specific government program to limit production.
- Amber Box payments are considered to distort trade and production. The EU can make amber box payments but has committed to limit these payments to a maximum allowable level known as the 'Aggregate Measurement of Support (AMS)'. The HoL EU Energy and Environment Sub-Committee has recommended that the Government should negotiate a share of the EU's Amber Box allowance to maximise its options for designing an effective post-CAP support scheme.[8]
- *De minimis* payments allow trade-distorting product specific support up to 5% of total agricultural output and another 5% for non-product specific support.
- Green Box payments are made by government and should have no, 'or at most minimal', trade distorting effects. There is no limit on payments as long as they are decoupled from production and prices.[55] These include AES payments, but only if limited to the cost of compliance or loss of income. Payment-by-results AES may have to come under Amber Box or *de minimis* allowances. However, payments between farmers and the private sector are not subject to WTO rules (Box 5).

Procurement and Assurance Schemes

In 2014, the Government published a plan for public procurement of food and catering services, which took the impacts of food production into account.[56] Environmental impact was one of four criteria within production, but the Government has not stipulated how they weight the relative criteria.[57] The Government recognises British Lion Quality, Red Tractor, the LEAF marque and various organic certifications as schemes relevant to the UK farmed environment. All of these schemes satisfy the plan's environmental impact criteria, although the schemes vary in their environmental standards.

Decision Making and Co-ordination of Activities

The delivery of some environmental benefits requires local action to be co-ordinated across a number of farms to be effective (Box 5). For example, improving water purification and flood management is most effective when there is co-ordination among farmers and landowners across a river catchment (PN 478). Biodiversity improvements could be achieved by using AES more strategically to link up nature reserves into ecological networks (PN 300).[58] As part of the Countryside Stewardship Scheme, a facilitation fund is seeking to incentivise co-ordination of local action. [59] The Government has also pledged to support farmers to deliver countryside wide environmental improvements.[6]

Pre-existing groups such as river trusts, wildlife groups or national park authorities may be best placed to act as co-ordinators.[60] Natural capital accounting (valuation of natural capital assets such as biodiversity, PN 542) could create a platform to trade credits between land managers across a landscape, but it remains to be shown whether it can deliver the intended outcomes. Difficulties in co-ordination may also arise if landscapes or catchments crossover administrative or devolved boundaries.[61] Lack of communication between farmers and a culture of independence could also present challenges to implementation.[62]

Box 5. The Fowey River Improvement Auction

South West Water (SWW) calculated that for every pound invested, reducing pollution at source could generate £65 in benefits. SWW funded a pilot scheme, match-funding the capital investment made by farmers to deliver water quality improvements within key catchments. At a later date, a 'reverse auction mechanism' was introduced. The design of this involved providing farmers with a list of eligible capital investments (e.g. improved slurry storage) and asking them to bid for the level of grant (e.g. £550) needed to implement their chosen investment. Each capital investment was scored by how effectively it would improve water quality. Bids were evaluated on the basis of a value-for-money measure calculated by dividing the score by the quantity of money requested. The reverse auction approach, compared to the first scheme, was 20-40% more cost-effective.[63]

Knowledge Exchange

Farmers will need the skills to deliver some public goods, such as the creation of habitat for biodiversity;[64] the 2017 Conservative manifesto stated the provision of technical expertise by Natural England to farmers will be increased.[6] The HoL European Union Committee has described existing farmer advisory services in the UK as fragmented, disjointed and lacking strategic oversight.[65] Some argue that public investment to improve farmers' skills should be focussed on the delivery of public goods as opposed to improving production.[66]

Private Sector Investment in Natural Capital

UK farmers have the most control over natural capital assets underpinning the food system compared to retailers, but receive a relatively small proportion of the market value of food (~10%). By contrast, manufacturers and retailers have little direct control over natural capital, but benefit from a significantly higher proportion (~90%) of market value.[67] Natural capital accounting would allow businesses along the supply chain to assess the state of these assets and thus understand their reliance on natural capital.[68,69]

This could encourage businesses to invest in natural capital in the long term, but short-term competitive disadvantage may discourage them.[68] The Natural Capital Committee recommended that legislation should be used to compel companies to carry out natural capital accounting, but this was not accepted by the Government.[70] Encouraging investment might be easier for some natural capital assets than others. For example, there is a clear business case for improving soil quality, as the improvements in food production and reduction in fertiliser inputs are measurable.

Endnotes

1 Queen's Speech, 2017, *Background briefing notes*
2 European Parliamentary Committee on Agriculture, 2017, *Preliminary assessment of the implications of the UK withdrawal from the EU (Brexit) on the Common Agricultural Policy*
3 UK Government, 2011, *The Natural Choice: securing the value of nature*
4 Defra, 2016, *Total Income from Farming in the United Kingdom: Second estimate for 2015*
5 HoC Environment, Food and Rural Affairs Committee, 2012, *Greening the Common Agricultural Policy*
6 The Conservative and Unionist Party, 2017, *Forward Together: Our Plan for a Stronger Britain and a Prosperous Future*
7 Woodcock, B, *et al*, 2017, Science, 356 (6345), 1393-1395
8 HoL EU Energy and Environment Sub-Committee, 2017, *Brexit: Agriculture*
9 *Chancellor Philip Hammond guarantees EU funding beyond date UK leaves the EU*,
10 *UK CAP allocations announced*,
11 HoC Library Debate Back, 2017, *Effect of the UK leaving the EU on the rural economy*

POST is an office of both Houses of Parliament, charged with providing independent and balanced analysis of policy issues that have a basis in science and technology. POST is grateful to Sam Leigh for researching this briefing, to BBSRC for funding his parliamentary fellowship, and to all contributors and reviewers. For further information on this subject, please contact the co-author, Dr Jonathan Wentworth.

12 Natural England, 2017, *Countryside Stewardship: Higher Tier Manual*
13 Welsh Government, 2017, *Glastir Advanced 2018: Rules Booklet 1*
14 Daera, 2017, *Guide to the Environmental Farming Scheme (EFS)*
15 Pe'er, *et al*, 2014, *Science*, 344, 1090-1092
16 Dicks, *et al*, 2014, *Conservation Letters*, 7, 119-125
17 Batáry, *et al*, 2015, *Conservation Biology*, 29,1006-1016
18 Matthews, 2013, *Bio-based and Applied Economics*, 2, 1-27
19 Rockstrom, *et al*, 2017, *Ambio*, 46, 4–17
Pretty & Bharucha, 2014, *Annals of Biology*, 114, 1571-1596
20 Maseyk, *et al*, 2017, *Conservation Letters*, 10, 211–22
Power, 2010, *Phil. Trans. R. Soc. B*, 365, 2959-2971
21 Office for National Statistics, 2016, *UK natural capital: monetary estimates*
22 Pywell, *et al*, 2015, *PROC:B*, 282, 20151740
23 Blaauw & Isaacs, 2014, *Journal of Applied Ecology*, 51, 890-898
24 Committee on Climate Change, 2017, *UK Climate Change Risk Assessment Synthesis report: priorities for the next five years*
25 McBratney, *et al*, 2014, *Geoderma*, 213, 203–213
Cong, *et al*, 2014, Agricultural Systems, 129, 30-39
26 Cooper, *et al*, 2009, *The Provision of Public Goods through Agriculture in the European Union*
27 HoC Environmental Audit Committee, 2017, *The Future of the Natural Environment after the EU Referendum*
28 House of Commons Library Briefing Paper, 2016, *EU Referendum: Impact on UK Agriculture Policy*
29 House of Commons Environmental Audit Committee, 2016, *Soil Health Inquiry*
30 Brock, *et al*, 2011, *Journal of Plant Nutrition and Soil Science*
31 Powlson, *et al*, 2014, *Nature Climate Change*, 4, 678-683
32 Morris, *et al*, 2010, *Restoration of Lowland Peatland in England and Impacts on Food Production and Security*
33 Natural Capital Committee, 2017, *Improving Natural Capital: An assessment of progress, Fourth report to the Economic Affairs Committee*
34 Brooker, *et al*, 2016, *Functional Ecology*, 30, 98–107
Landis, 2017, *Basic and Applied Ecology*, 18, 1–12
Cunningham, 2017, *Austral Ecology*, 42, 1, 2–8
Maseyk, *et al*, 2017, *Land Use Policy*, 61,160–170
Erisman, *et al*, 2017, *AIMS Agriculture and Food*, 2157-174
Paula Barral, *et al*, 2015, *Agriculture, Ecosystems and Environment*, 202, 223-231
Tiemann, *et al*, 2015, *Ecology Letters*, 18, 761-771
35 State of Nature Partnership, 2016, *State of Nature Report UK*
36 Sutherland, *et al*, 2017, *What Works in Conservation*
Jönsson, *et al*, 2015, *Biological Conservation*, 184, 2015
Roberts & Pullin, 2007, *Collaboration for Environmental Evidence review*, 05-005
Scheper, *et al*, 2013, *Environmental factors driving the effectiveness of European agri-environmental measures in mitigating pollinator loss – a meta-analysis*, 16, 912-920
Grass, *et al*, 2016, Agriculture, Ecosystems and Environment, 225, 45-53
37 Fischer, *et al*, 2017, *Trends in Ecology & Evolution, 32, 335–345*
38 Woods, *et al*, 2010, *Philos Trans R Soc Lond B Biol Sci*, 365, 2991-3006
39 Reckling, *et al*, 2016, *Frontiers in Plant Science*, 7, 699
Tonitto, *et al*, 2006, *Agriculture, Ecosystems and Environment*, 112, 58-72
40 UK Government, 2013, *A UK Strategy for Agricultural Technologies*
41 Kindred, *et al*, 2016, *Automating nitrogen fertiliser management for cereals (Auto-N)*
42 Hallet, *et al*, 2012, *Studies to inform policy development with regard to soil degradation: Cost-curve for mitigation of soil compaction*.
43 Godfray, *et al*, 2014, *PROC:B*, 281, 20140558
44 HoC Science and Technology Committee, 2015, *Advanced genetic techniques for crop improvement: regulation, risk and precaution*
45 SRUC Rural Policy Centre, 2015, *Resource Efficiency: Making the most of farm resources to reduce greenhouse gas emissions and improve financial performance*
46 Simon Blackmore, *pers comms*
47 UK Government, 2017, *Legislating for the United Kingdom's withdrawal from the European Union*
48 Results Based Agri-environment Payment Scheme - Wensleydale
49 Natural England, 2017, *Results-Based Agri-environment Payment Scheme (RBAPS) pilot study in England newsletter: issue 1*
50 National Audit Office, 2015, *Outcome-based payment schemes: government's use of payment by results*
51 Government Response to The House of Lords European Union Committee, 2016, *Responding to Price Volatility: Creating a More Resilient Agricultural Sector*
52 UK Government, 2017, *The United Kingdom's exit from and new partnership with the European Union*
53 HoL European Union Committee, 2017, *Brexit: environment and climate change*
54 Van Berkum, *et al*, 2016, *Implications of a UK exit from the EU for British agriculture; Study for the National Farmers' Union*
55 World Trade Organisation, 1994, *Agreement on Agriculture*
56 Defra, 2014, *A Plan for Public Procurement: Food & Catering Balanced scorecard for public food procurement*
57 UK Government, 2014, *A Plan for Public Procurement: Food & Catering services Guidance on Assurance Schemes*
58 Lawton, 2010, *Making space for nature': a review of England's wildlife sites*
59 Guide to Countryside Stewardship: facilitation fund
60 Helm, 2016, *British Agricultural Policy after Brexit: Natural Capital Network - Paper 5*
61 Prager, *et al*, 2012, *Land Use Policy*, 29, 244-249
62 Emery & Franks, 2012, *Journal of Rural Studies*, 28, 218-231
63 Day & Couldrick, 2013, *Payment for Ecosystem Services Pilot Project: The Fowey River Improvement Plan*
64 Guillem, et al, 2013, Land Use Policy
65 HoL European Union Committee, 2011, *Innovation in EU agriculture*
66 Charles Godfray, *pers comms*
67 Defra, 2016, *Food Statistics Pocketbook 2016*
68 Brown & Tipper, 2017, *Natural Investment: Futureproofing food production in the UK*
69 Natural Capital Committee, 2015, *Third State of Natural Capital Report*
70 Defra, 2015, *The Government's response to the Natural Capital Committee's third state of Natural Capital Report*