Cutting the climate impact of land use

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Foreword
Sir Graham Wynne

The evidence is unequivocal that more and faster action is needed to tackle climate change across the world. Translation of this need into real and positive change across the economy is highly uneven. In the often overlooked land use sector, the UK now has an unprecedented chance to set a clear course and accelerate the pace of change, as it develops a new system to support land management. This report maps out how this opportunity can be seized.

Those who work and manage the land have much to lose and gain from climate change. Farming and other forms of land use will be adversely affected by a changing climate, but efforts to mitigate against it can bring multiple additional benefits.

A policy framework to reduce carbon emissions from land use could also deliver improvements to nature, natural infrastructure and public health. Restoring our peatlands not only traps carbon, but also improves biodiversity. Planting trees helps to mitigate against climate change, but it also improves people's quality of life and helps to prevent flooding. Reducing our consumption of red meat will not only lower greenhouse gas emissions, but also help to prevent disease whilst lessening the strain on the NHS. And investing in sustainable, low carbon farming will be essential to secure the long term productivity and resilience of our food system.

A coherent policy framework is essential to drive and reward decisions that farmers and land managers make towards a low carbon future, and to shape demand for products from more sustainable land use. This requires cross government co-operation and ownership.

Political distractions and upheaval cannot be used as an excuse for delay. Rather, this moment of change should be harnessed to drive positive disruption and encourage the development of new, low carbon models of land management.

I am hugely grateful to the members of the expert steering group I chaired which has supported Green Alliance in the production of this report: Professor Tim Benton, Ruth Davis MBE, Professor Dame Georgina Mace and Professor Peter Smith.

Executive summary

The need for ambitious measures to reduce the UK's greenhouse gas emissions has never been more urgent. The IPCC has warned that we only have 12 years to design the right policies and take meaningful action to contain global warming to 1.5 degrees. To achieve the scale of change needed, action must be taken now to reduce emissions and lay the foundations for the longer term transformation required.

Rapid decarbonisation requires all sectors to act urgently and land use will play an essential role in supporting the UK's efforts. Leaving the European Union is an opportunity to introduce the policies, regulations and incentives to catalyse ambitious and sustainable land use change. It is a chance to enable farmers and land managers to cut their emissions, whilst supporting thriving businesses and delivering a range of other environmental benefits.

The UK is well placed to lead on this action, with its research and innovation capabilities and its global leadership of climate policy. By developing new solutions and a robust policy framework, the UK could support international efforts to limit temperature rise to 1.5°C.

The scope for climate change mitigation in the land use sector is significant. Building on the work of the Committee on Climate Change (CCC) and the Royal Society, we show that, by cutting emissions from agriculture, locking emissions into restored ecosystems, sequestering more carbon in trees and soil, and promoting demand for low carbon foods, the UK could reduce its land use emissions by nearly 60 per cent, from 47MtCO_2e per year in 2016 to approximately 19.6MtCO_2e per year by 2030.

This would put the UK on track to meet the ambitious target set by the National Farmers' Union (NFU) of net zero emissions across the farming and related land use sector by 2040. Rapid progress in the short term, over the next ten years, will be critical to support this long term ambition and send a signal to farmers and land managers to invest in low carbon practices.

For the UK to be on track by 2030 to meet this target, change in both policy and practice is needed now. Measures to reduce emissions from agriculture, discussed in this report, are already cost effective and should be implemented as soon as possible. Higher levels of ecosystem restoration and afforestation should be implemented now to allow soils to recover and trees to mature, to maximise their climate change mitigation potential by 2030. Delay will make the challenge bigger and increase the cost of action.

If we get it right, there are many benefits beyond reducing emissions. Many of the measures to decarbonise land use will also contribute to greater soil protection, improved water and soil quality, flood mitigation, biodiversity and recreational benefits, and they will support a more productive and resilient food system and greater societal wellbeing.

UK farmers and land managers will be central agents in cutting emissions from land use and will also benefit from low carbon practices. But policy needs to support them through this transition, providing the incentives to innovate and adopt new measures, and ensuring that best practice is supported by consumers and supply chains.

While our analysis of the measures to 2030 looks at the whole of the UK, in line with the CCC's approach, the

policy interventions we recommend are tailored to England's context. But, as the principles apply to land use beyond England, we hope that some of these proposals may also provide useful insights for Scotland, Wales and Northern Ireland, as well as further afield.

To bring about a rapid transition to low carbon land use, the government should:

1. Drive forward low carbon best practice by farmers and land managers

Land use policies lack coherence and urgency to provide farmers with consistent objectives to motivate low carbon investment and rapidly reduce emissions. To address this, Defra should:

- Make decarbonisation a central objective of transitional support and the new Environmental Land Management (ELM) scheme, to direct immediate investment into low carbon farming. This should be underpinned by a strong regulatory and enforcement regime.

- Immediately establish concrete policies to drive much higher rates of afforestation, ban practices that damage peat and promote peatland restoration.

2. Shape demand for low carbon food and biomass production

While regulation and incentives can directly encourage low carbon practices on farmland, there has to be a strong business case for changes at the scale needed for rapid decarbonisation. The government needs to:

- Develop a cross departmental strategy for dietary change, to promote the consumption of less and better meat, and an increase in plant-based foods; and ensure

the supply chain drives uptake of low carbon, sustainable food production in the field.

- Trade policy should align with domestic land use policy to support the highest environmental standards and reward farmers and land managers who invest in low carbon solutions.

3. Invest in key enablers to guide action

A strategic and integrated approach to land use will require investment in a set of tools, including spatial mapping of the climate change mitigation potential of land, harmonised metrics for food production and a robust emissions accounting system. The government should take action immediately to put them in place and use them to guide policy development and delivery of low carbon solutions.

Cutting emissions from land use is not a challenge that the UK faces alone. Keeping temperature rise to 1.5°C requires global effort and countries worldwide face similar challenges. Through innovative solutions and a robust policy framework for low carbon farming and land management, the UK could lead international action to decarbonise land use.

A vision for low carbon, sustainable land use

Land is a critical asset fundamental to all human activity and, at a global scale, net sequestration by the land use sector is vital to keep temperature rise to 1.5°C.[1] The UK should play its role by protecting and restoring carbon rich ecosystems, promoting sequestration in trees and soils and reducing emissions from agriculture.

Alongside climate change mitigation, land also provides goods and services vital to the UK's economic activity and societal wellbeing. A future vision should address the role of land use in adapting to climate change impacts and delivering the wider set of outcomes outlined in the government's 25 year environment plan, including restoring nature and supporting a resilient food sector which operates within environmental constraints and delivers health promoting food.

Finally, land is a limited resource, constrained not only spatially but by natural processes. Its capabilities and value to local communities will also vary across the country. Gaining a better understanding of the land system will help to identify the positive synergies of different land uses as well as to prevent or manage potential conflicts.

Untapped potential

"Emissions from agriculture have not fallen since 2008."

According to the Intergovernmental Panel on Climate Change (IPCC), there is less than twelve years to contain global warming to 1.5°C above pre-industrial levels and every sector will have to play its full part in reducing carbon emissions. To date, land use has received surprisingly little attention, despite it offering substantial opportunities to reduce and further sequester emissions. In the UK, emissions from the agricultural and land use sector amounted to 53 $MtCO_2e$ in 2016, over 11 per cent of the UK's total emissions. Moreover, while most other sectors of the UK economy have progressively decarbonised, emissions from agriculture have not fallen since 2008.[2]

The current approach is not sustainable: business as usual or delaying action will limit the UK's ability to cut emissions and undermine important natural functions that land provides, including food production and resilience to a warming climate. These functions have been gradually depleted. Low carbon, sustainable practices need to become mainstream to reverse widespread environmental damage and secure a productive and resilient UK farming system for the future.

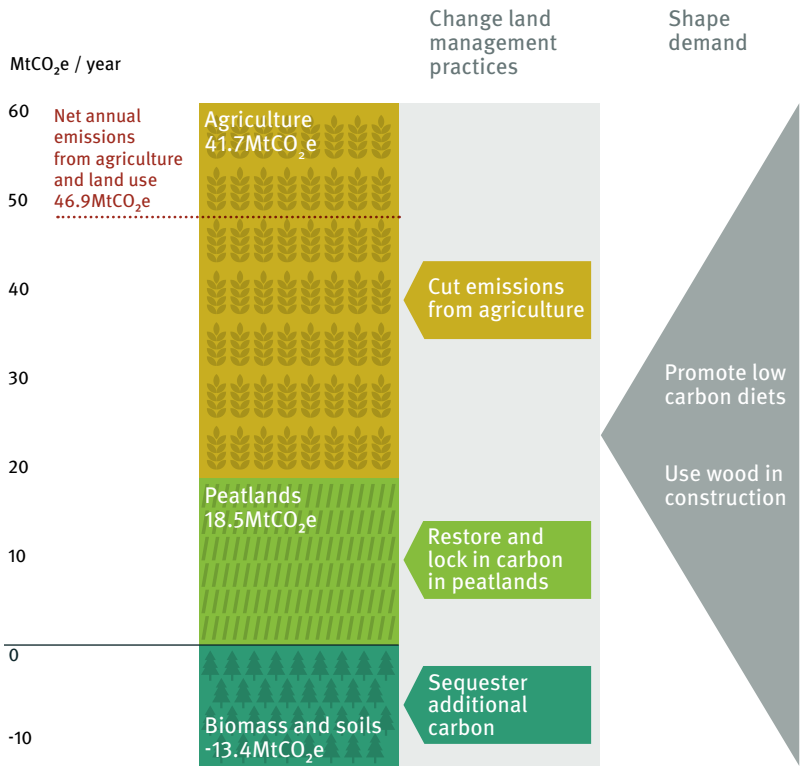
Brexit has triggered a debate on the future of land use policy and is an opportunity to address it as part of wider decarbonisation efforts.

What role can land use play in climate change mitigation?

In 2016, the Committee on Climate Change (CCC) estimated annual emissions from agriculture and the land use sector to be 53MtCO_2e.[3] This included emissions from land used for settlements (including buildings, infrastructure and urban green spaces) which were estimated to be 5.8MtCO_2e. This report focuses only on emissions from UK farming and related land use. Of these, emissions from agriculture were 41.7CO_2e, biomass (ie plants and trees) and soils provided a net sink of 13.4MtCO_2e and peatlands were estimated to be net emitters of 18.5MtCO_2e.[4,5] Excluding settlements, therefore, emissions in 2016 were 46.9MtCO_2e, nearly equal to the total annual emissions of Denmark in the same year'.[6]

To support the UK's decarbonisation efforts, there are a range of measures that can directly target agricultural practices, peatland management and increasing carbon sequestration. Action on the demand side includes dietary change and using wood in construction.

UK emissions from agriculture and land use in 2016[7]



"Livestock farming is responsible for 70 per cent of the emissions from agriculture."

How to change land management

Cutting emissions from agriculture

Emissions from agriculture arise from a number of sources. Livestock farming is largely responsible for methane emissions from the digestion of ruminants, also known as enteric fermentation, while storage and processing of manure releases methane and nitrous oxide. Overall, livestock farming is responsible for 70 per cent of the emissions from agriculture. The bulk of emissions from arable farming come from using nitrogen fertilisers and the management of waste, which releases nitrous oxide.[8,9]

According to the Committee on Climate Change (CCC), cost effective measures to support low carbon farming could include:[10]

- **Lowering livestock emissions:** preventing and treating livestock diseases can enhance productivity and limit the emissions associated with dairy and meat production; other options include novel feeds to increase performance and reduce methane production, and selective breeding of lower emitting cattle.[11]
- **Improved crop and soil management:** measures include the controlled use of nitrogen fertilisers to match inputs to field conditions more closely; increased use of organic residues, such as livestock manures and digestate from the processing of food wastes and crops; and more cultivation of legumes, which fix nitrogen in the soil and reduce the need for fertilisers.
- **Improved manure management:** options include manure storage and treatment by anaerobic digestion; and the use of better livestock housing and slurry application equipment.

In its analysis for the fifth carbon budget, the CCC estimates that on farm measures could cut agricultural emissions by 7MtCO_2e per year in 2030.[12] Actions to cut emissions from agriculture would also reduce farm costs, for example, of fertiliser input and livestock.[13] It would also promote climate change resilience through improved soil health and water quality.

Despite these potential positive impacts, action so far has been limited and a voluntary approach to change has been ineffective, so the sector is unlikely to meet its target to cut emissions by 4.5 MtCO_2e per year (3MtCO_2e in England) by 2022 compared to 2007 levels.[14]

It is notable that some measures can also improve carbon sequestration, for example through agroforestry and better soil management, discussed on page 14. Emissions sequestered in soils and trees on farmland are accounted under 'Biomass and soils' (see graphic on page nine), in line with international emission accounting methods.

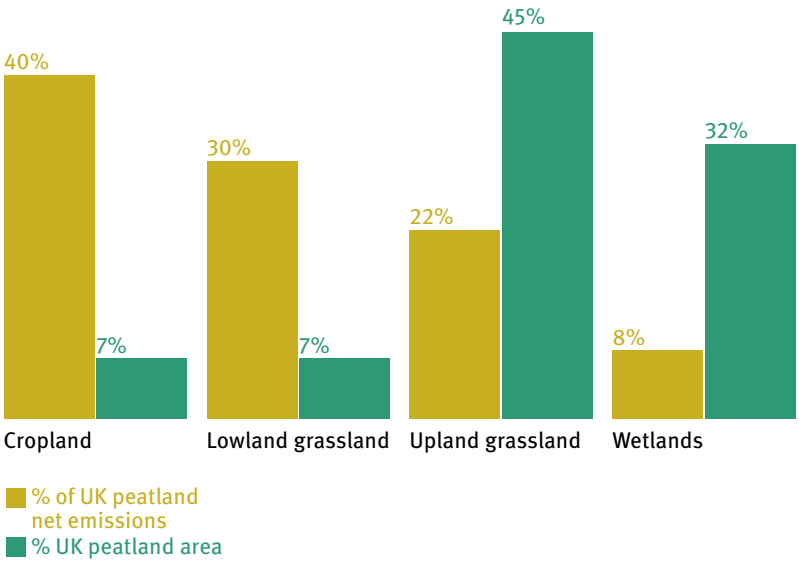
"Action so far has been limited and a voluntary approach to change has been ineffective."

Using peatland to lock in carbon

Healthy peatland is a natural carbon store. It is estimated to store around 40 per cent of the UK's soil carbon.[15] However, the majority of the UK's 2.7 million hectares of peatland have been degraded by unsustainable practices, including agriculture, forestry, peat extraction and burning for recreational purposes (such as for grouse shoots).[16] This has led to the release of stored carbon through erosion and dissolved carbon lost to watercourses, making them a net emitter of greenhouse gases.[17,18] Not all peatlands emit at the same rate, as shown below. Lowland cropland is responsible for about 40 per cent of emissions, despite accounting for only seven per cent of the UK's peatland area.

Lowland cropland is responsible for higher emissions than other peatland, despite its small area[19]

UK peatland net emissions vs area covered, 2016



Peatland forms in conditions of a high and stable water table, enabling bog species to resist competition from other plant species.[20] Without these conditions, bog species are lost and peatland is unable to store carbon as effectively. Sea level rise and poor management practices, including drainage for agriculture and infrastructure development, can threaten storage capacity and cause the release of CO_2.[21,22,23,24,25,26]

Peatland restoration involves ending degrading practices and maintaining or raising the water table. The CCC has also outlined options for the more sustainable management of intensively farmed lowland peat. These options include partial rewetting, through seasonal raising of the water table, and the adoption of alternative farming practices such as paludiculture, an

agricultural system to grow crops on wet or rewetted peatland, which can provide an economically viable alternative to conventional farming.[27,28] According to the CCC's assessment, the restoration and rewetting of peatlands, including partial rewetting of some of the unrestored intensively managed lowland peats, could reduce their annual emissions from 18.5MtCO_2e in 2016 to 13.7MtCO_2e in 2030, a 26 per cent reduction.[29]

Restoration not only reduces net emissions, but peatlands in good condition can also provide additional carbon sequestration. Furthermore, sustainably managed peatlands reduce flood risk, improve water quality (70 per cent of Britain's drinking water is sourced from peatland dominated catchments) and support greater biodiversity.[30]

There is no question that protection and restoration of peatlands should start immediately. Delay is likely to make restoration more expensive, as a result of more extensive degradation, and could make it impossible if the extent of degradation becomes irreversible. These efforts should also consider climate change, determining what the conditions best suited for adaptation would be, rather than solely focusing on restoring peatland to historical conditions.

Factors hindering restoration include weak regulation and enforcement, limited financial resources, lack of skills, problems with data monitoring, difficulty co-ordinating with multiple land owners and the invisible nature of carbon sequestration.[31,32,33,34,35]

Sequestering more carbon

"The amount of carbon sequestered from the atmosphere can be increased through better land management."

The amount of carbon sequestered from the atmosphere can be increased through better land management. Below we look at the options, including afforestation, agroforestry, improving salt marshes, increasing sequestration from soils and the use of biochar.

Woodlands

Trees sequester carbon from the atmosphere through photosynthesis, storing it in biomass above and below ground, and passing it into the soil. Currently, UK forests, which account for 13 per cent of UK land area, are a net carbon sink (-13.7MtCO_2e per year in 2016).[36] However, the rate of carbon sequestration is expected to decline in future, largely as a result of the dramatic reduction in tree planting in recent years, to an average of 9,000 hectares per year since 2010.[37]

To meet its decarbonisation ambitions, the UK will have to increase this rate substantially. Overall, England, Wales, Scotland and Northern Ireland aim to achieve planting rates of 20,000 hectares a year by 2020 and 27,000 a year by 2024, while the CCC estimates that rapid decarbonisation will only take place at 50,000 hectare a year. This is not far off the peak afforestation rates the UK achieved in the 1970s.[38] These high planting rates, assumed in the CCC's 'high biomass/natural peatland' (HBP)

"An immediate step change in tree planting rates is needed."

scenario, as well as a greater share of forest brought into active management, would result in forestry providing a net sink of 15.2MtCO_2e a year by 2030, of which 5.3MtCO_2e a year would be from forests planted after 2016.[39] As trees require about ten years to achieve a substantial sequestration rate, an immediate step change in tree planting rates is needed.[40]

Planting should be in appropriate locations to avoid damage to existing habitats, such as peatlands, and to maximise the emissions mitigation potential, as rates of carbon sequestration vary with soil type and the nature of previous land use.[41] Different locations will also have different levels of susceptibility to climate change impacts.

The preferred tree mix should also be considered, taking into account sequestration rates, biodiversity and landscape impact, potential commercial goals, plot area and resilience to climate change impacts. For example, conifers grow faster than broadleaf trees, so can sequester carbon sooner, yet broadleaf trees sequester a greater amount of carbon in the long term.[42,43] Diversity of age and species improves resilience and there is evidence that, with increased species richness and the accumulation of larger, older trees, more carbon can be stored above and below ground. This is especially apparent in smaller plots of land.[44,45,46] Carbon uptake was also found to be greater in the regrowth of formally disturbed forests in the mid to high latitudes.[47]

Policies must ensure that new forestry delivers multiple benefits and that the damage that resulted from previous, narrowly focused forestry policy in the 1980s is not repeated. Sustainably managed woodland is associated with greater soil protection, better water and soil quality, biodiversity and recreational benefits. It can also help to support a low carbon construction industry, providing timber as an alternative to more carbon intensive building materials.[48]

Salt marshes and new wetlands

Further sequestration can be achieved through the restoration and creation of ecosystems other than woodlands.

The UK has about 45,000 hectares of salt marsh. Based on analysis by the Royal Society, we estimate that restoring coastal salt marsh could sequester an additional 0.3MtCO_2e per year by 2050.[49] This would also provide natural protection against waves and storm surges. Salt marshes are a biodiverse ecosystem that can play a significant role in pollution control and maintaining water quality.[50]

As consumption and diets change, former pasture could also be returned to wetlands as part of a carbon sequestration and adaptation strategy.

"Agroforestry also increases biodiversity on farmland and improves soil quality and water retention."

Agroforestry

Agroforestry is the integration of trees and shrubs on cropland and grassland. Similar to woodland, agroforestry contributes to carbon sequestration by storing it in biomass above and below ground, and in the soil. In their HBP scenario, the CCC estimates that more hedgerows and agroforestry could sequester 2.4MtCO_2e per year by 2030.[51]

In addition to sequestering carbon, agroforestry also increases biodiversity on farmland and improves soil quality and water retention.[52,53] Planting fruit or nut trees can provide another source of profit for farmers.[54]

Despite these benefits, agroforestry in the UK has received limited support because it falls in the policy gap between forestry and agriculture, and as a result there is a lack of clear funding options.[55] Linked to this, limited knowledge and a lack of practical guidance to farmers has prevented it from expanding.

Bioenergy crops

Another measure is the use of bioenergy crops, in combination with carbon capture and storage technologies. Bioenergy crops are a contentious but nonetheless important area to consider and, in this report, we take the same line as the CCC.

In its land use and biomass reports, the CCC suggests that, as well as reducing emissions for other sectors, growing biomass for energy could also sequester carbon (though this effect can be offset by the carbon lost due to soil disturbance initially). This is as long as wider sustainability considerations are carefully managed.

The CCC outlines three main types of bioenergy crops that could be considered: Miscanthus and short rotation coppice willow, which are fast growing crops, and short rotation forestry, which is currently non-existent in the UK and is not expected to be deployed before 2030.

The CCC recommends moving away from use of biomass solely as a substitute for fossil fuels. Instead, it advocates combining it with carbon capture and storage (CCS) technologies, so that, in addition to providing energy, the combined measures can be used for the net removal of CO_2 from the atmosphere. To employ this method, the government would need to invest in new enabling technologies, including CCS, and align policy to support their development.

Importantly, bioenergy crops could pose significant challenges to natural ecosystems, freshwater resources and food production, particularly if planted on a large scale.[56] The CCC recommends a stronger governance framework to ensure the co-benefits are maximised and potentially significant trade-offs are minimised.

Other measures

Changing agricultural practices to enhance soil carbon sequestration is another option.[57] The Royal Society estimates that soil carbon sequestration could save 10MtCO_2e per year by 2050.[58,59] Practices include better crop and nutrient management (ie improving varieties, using crop rotations and optimising fertiliser use), reducing tillage intensity, varying grass types, improving animal stocking density and new methods, such as growing crops with deeper roots or roots more resistant to decomposition. Principal barriers are a lack of knowledge among farmers and land managers and an absence of supportive policy or financial incentives.

Another measure is to use biochar. This is a durable product, similar to charcoal, formed by thermal decomposition in a limited oxygen environment. Incorporated into the soil, it can store carbon for extended periods, while improving soil fertility and quality. The Royal Society suggests that biochar could sequester 5MtCO_2e a year by 2050.[60] However, as this method has yet to be demonstrated at scale, there are still uncertainties over its effectiveness and implications. Further research would be needed to assess these and inform decisions about its wider use.

The role of demand

"Demand for products from the land inevitably shapes how it is managed."

While the measures discussed above directly apply to land use, demand for products from the land inevitably shapes how it is managed and should, therefore, be considered in the approach to better stewardship of the natural environment.

Promoting healthier diets

As emphasised by the IPCC report, and more recently by the CCC and the Eat-Lancet Commission, changes to diet will be essential to cut emissions from the livestock sector, reducing emissions from animals as well as pressure on land use from red meat and dairy production.[61] These dietary changes would also support better health outcomes, which could be the primary driver of change. A shift towards healthier diets, cutting red meat and dairy consumption by 50 per cent by 2050, would halve the agricultural use of grassland whilst lowering emissions. If less red meat was eaten, in line with the advice from the government's *Eatwell Guide*, some grassland could be released for other uses.[62, 63]

However, the impact on land use of dietary change is not straightforward. As the UK relies on imports for a little under half of its food consumption, a shift away from eating red meat may not directly affect domestic livestock production.[64] If the focus is on dietary change alone, UK farmers may simply increase their exports and continue production as before. Similarly, if the focus is only on reducing domestic livestock production, without addressing the UK's consumption of red meat and dairy, diets may not change and the emissions associated with the production of these foods will be exported to other countries. This would shift the burden to territories that may be less able to decarbonise their livestock sector.

"The use of wood in construction provides long term storage for carbon."

Therefore, there should be co-ordinated policies that support both healthier diets and changes in domestic land use.

Measures to cut food waste would also help to cut emissions by reducing the need for some agricultural production. Food waste in the UK is estimated to be ten million tonnes a year beyond the farm gate, most of which is wasted vegetables and fruit. However, if policy continues to encourage excess production, lower demand will not necessarily lead to a fall in production. To avoid this, incentives should apply to both the supply and demand sides.

Using more wood in construction

The use of wood in construction provides long term storage for carbon sequestered in trees. It is also one of the main ways to reduce embodied emissions in construction, replacing more carbon intensive materials like steel and cement. It could cut UK emissions from construction by a total of 28MtCO_2e during the course of the fifth carbon budget (between 2027 and 2032).[65]

At the moment, timber is not widely used for construction in England and Wales, but it is much more widespread in Scotland and Northern Ireland.[66] Promoting low carbon construction would encourage land managers to invest in commercial forestry operations to supply the sector and could stimulate the development of UK supply chains. Currently, the UK imports most of its wood products.[67] [68]

Getting on track for net zero by 2040

As we have outlined, there are a number of ways in which land use can contribute to climate change mitigation. But what measures should be used and how fast should they be deployed?

The National Farmers' Union (NFU) has recently announced its ambition to achieve net zero by 2040 across the land use sector. Focusing only on long term targets can make net zero carbon land use seem more difficult to achieve than it will likely prove to be, given the potential for innovation in low carbon technologies and strategies deployed at scale, as the development of renewable energy has shown.

Here we consider what steps the UK could take to make rapid progress towards the NFU's target over the next ten years. We have used the CCC's 'high biomass/natural peatland' (HBP) scenario as the starting point, given that it is their most ambitious scenario to cut emissions from land use in the UK, and have examined what additional measures would be needed by 2030 to reduce emissions in line with the NFU's ambitions.

Our analysis shows that the rapid roll out of low carbon measures in land management, combined with a shift to healthier diets, could cut net emissions from land use by nearly 60 per cent, to 19.6MtCO_2e a year by 2030, and put the sector on track to meet the NFU's 2040 target. This could be achieved by:

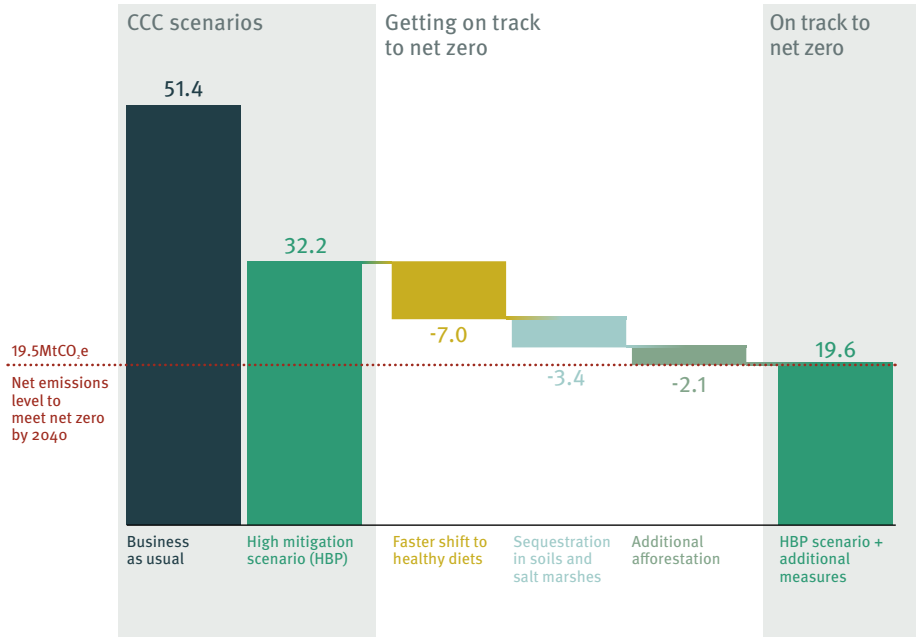
"The rapid roll out of measures in land management, combined with a shift to healthier diets, could cut net emissions from land use by nearly 60 per cent."

- **Deploying measures proposed by the CCC in its HBP scenario:** the CCC estimates that action to cut emissions from agriculture, greater uptake of afforestation and agroforestry, some deployment of energy crops and peatland restoration, could cut emissions from 46.9MtCO_2e per year in 2016 to 32.2MtCO_2e per year by 2030 (compared with 51.4MtCO_2e per year under business as usual).[69]
- **Accelerating the shift to healthier diets:** the HBP scenario assumes that red meat and dairy consumption will drop by 20 per cent by 2050, and just over eight per cent by 2030. A faster transition to healthier, more sustainable diets, cutting red meat and dairy consumption by 30 per cent by 2030 and replacing it with alternatives including poultry, plant-based proteins and novel protein products, could cut an additional 7MtCO_2e per year in 2030.
- **Implementing other carbon sequestration measures:** soil carbon sequestration and the restoration of salt marshes could sequester an additional 3.4MtCO_2e per year; biochar has not yet been demonstrated at scale, so further research would be needed to judge its emissions reduction potential over the next decade.
- **Additional afforestation:** Grassland released from livestock farming through a faster shift to healthier diets (estimated to be about 2.8 million hectares in 2030, if red meat and dairy consumption drops by 30 per cent) could be used for further measures, such as afforestation; this could sequester between 2.1 and 5.3MtCO_2e per year in 2030, depending on the rate of planting.[70] If the tree planting rates already

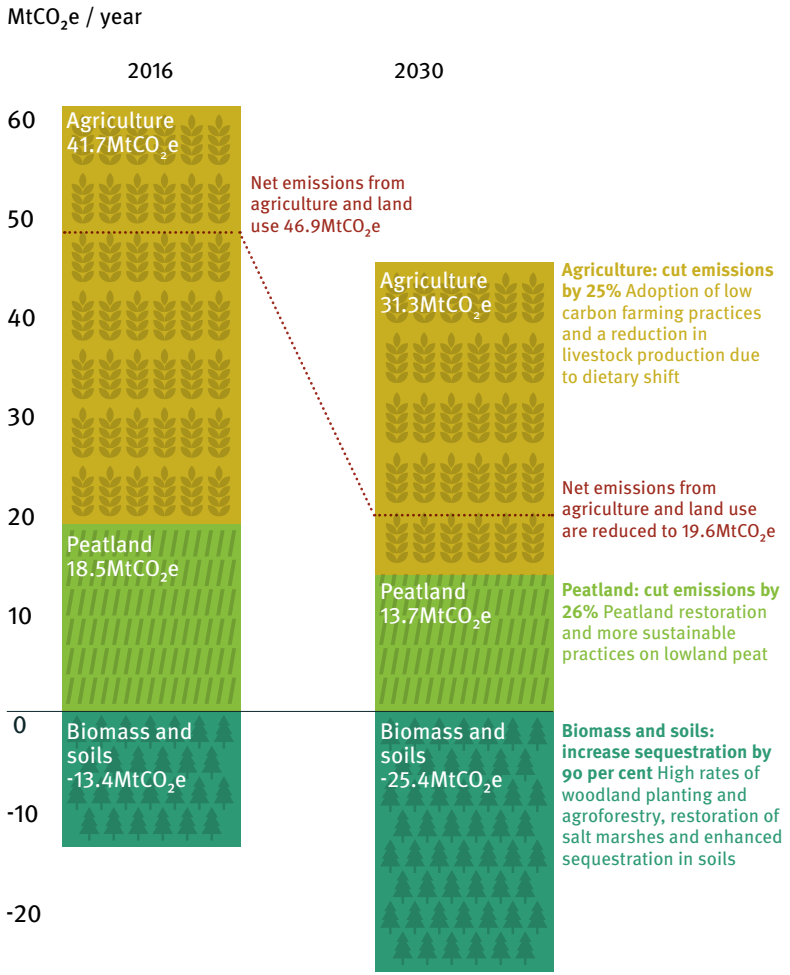
included in the HBP scenario increased by 40 per cent (to 70,000 hectares in total per year across the UK), our analysis suggests it would be enough to set the UK on the right track.

A summary of the impact of all these options is shown below and on the next page. Overall, emissions could be reduced from 46.9MtCO_2e net emissions a year in 2016 to 19.6MtCO_2e in 2030, while also delivering wider environmental benefits and improving health outcomes.[71]

Cutting net emissions by 2030 (MtCO_2e per year)



Opportunities to reduce emissions by 2030 from climate change mitigation action in land use



The Committee on Climate Change's 'high biomass/natural peatland' (HBP) scenario

The CCC's scenario, used in this analysis, includes the following climate change mitigation measures:

Cut emissions from agriculture: Improvements in farming practices and technologies cut agricultural emissions to 38.3MtCO2e per year in 2030.

Lock carbon in peatland: Restoration and rewetting of peatland, including partial rewetting of part of the unrestored, intensively managed lowland peat reduces emissions from peatland from 18.5MtCO2e in 2016 to 13.7MtCO2e per year (with partial rewetting) in 2030 (26 per cent reduction).[72]

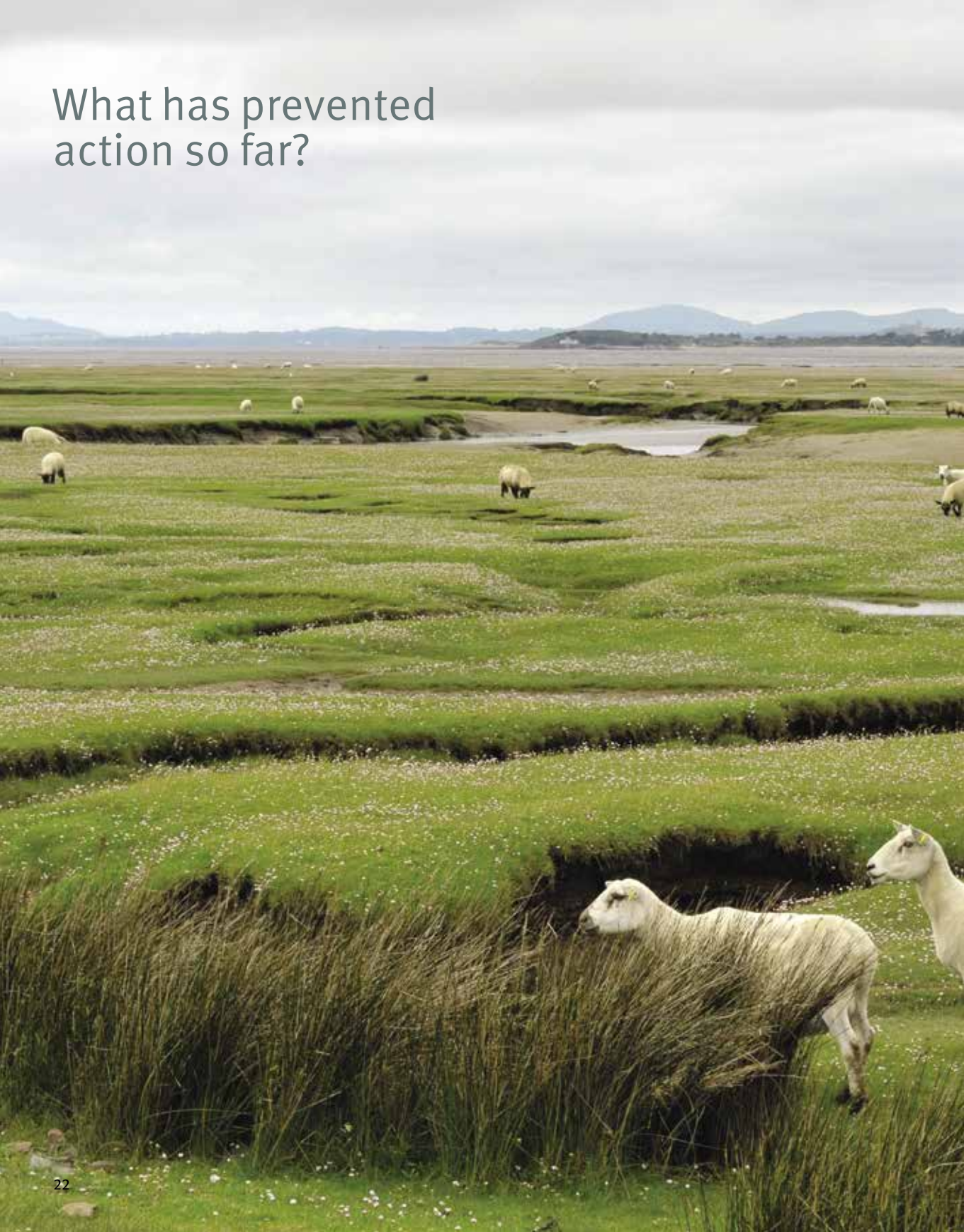
Sequester additional carbon:

This includes:

- Tree planting rates of 25,000 hectares per year to 2023, and 50,000 hectares per year after that, as well as a greater share of forest brought into active management, providing a net sink of 15.2MtCO2e per year by 2030, of which 5.3MtCO2e per year comes from forest planted after 2016.[73]
- Increase in hedgerows and greater uptake of agroforestry systems sequesters 2.4MtCO2e per year by 2030.[74]
- Planting of 27,000 hectares short rotation coppice and Miscanthus a year.[75]

Promote healthier diets: A shift to lower consumption of red meat and dairy, achieving a reduction of just over eight per cent by 2030 and 20 per cent in 2050.

What has prevented action so far?



"Decarbonising land use has not been a clear objective of EU or UK agricultural policy."

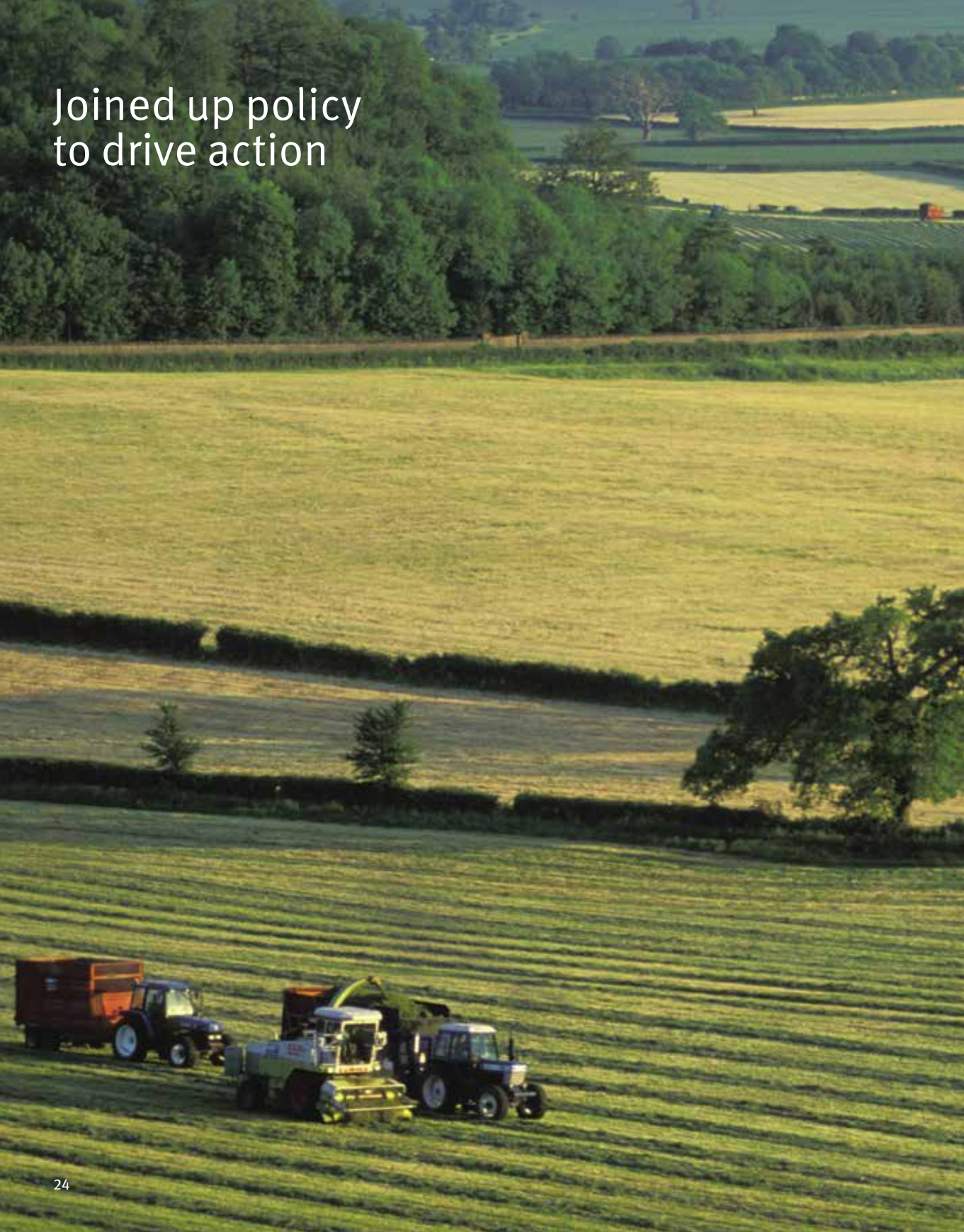
Fragmented and incomplete policies, partly due to a lack of co-ordinated action across government departments, as well as national and EU policies, have meant that maximising short term food production has been prioritised over sustainable, low carbon farming and land management. This pressure and the need to drive down costs have pushed UK farmers towards intensification and limited investment in more sustainable options. This has risked a permanent loss of UK agricultural capacity.

The current payment system, the Common Agriculture Policy (CAP), has been largely ineffective at encouraging environmental best practice. Requirements for 'greening payments' and 'cross compliance', the two main tools to encourage the adoption of sustainable practices, have been criticised for setting standards too low, being overly bureaucratic and lacking an effective enforcement regime to deliver the intended benefits.[76]

Similarly, decarbonising land use has not been a clear objective of EU or UK agricultural policy. Many of the measures the CCC has identified as cost effective have so far been encouraged only through voluntary initiatives, which have failed to drive uptake (44 per cent of farmers took no action to reduce their greenhouse gas emissions in 2016).[77]

This has been further exacerbated by the lack of a strategic approach to land use. Efforts to encourage tree planting and the restoration of natural ecosystems have been limited and piecemeal. And opportunities provided by green infrastructure and how it is affected by other infrastructure have not been properly addressed at the national level.[78] Achieving a vision for low carbon, sustainable land use will require a fundamental change in approach, to one that is much more integrated and strategic.

Joined up policy to drive action



"Efforts to change the way we use land should fit into a vision that considers the wider operating context."

The changes required to achieve net zero emissions from land by 2040 will not be achieved through incremental improvements. Transformational change is needed to address the potential shifts in production resulting from changes in diet, the extensive degree of peatland restoration and afforestation needed and move to a system that operates within natural limits. UK farmers and land managers will be important agents of this change and beneficiaries of the transition, but the policy environment must support them by providing the right incentives to innovate and adopt new measures and by encouraging and rewarding low carbon best practice.

Co-ordinated and consistent action across government departments must, therefore, ensure a step change, both in the way land managers use their assets, as well as in how supply chains and consumers drive demand for low carbon, sustainable products.

While our analysis of the options to 2030 looks at the whole of the UK, in line with the CCC's approach, our recommendations for interventions are tailored to England. But, as the principles that have informed our analysis can apply to land use anywhere, we hope that some of these proposals may also provide useful insights for policy makers in Scotland, Wales, Northern Ireland and other countries.

Farmers and land managers should be encouraged to adopt sustainable farming measures that will also enhance their business productivity and resilience. Action will be enabled by innovation in low carbon practices and technologies, including tools to support effective monitoring and assessment of interventions, and by a strong and effective regulatory and enforcement regime.

Importantly, efforts to change the way we use land should fit into a vision that considers the wider operating context. Markets are important drivers of land management decisions. Similarly, successful domestic policy to cut land use emissions is contingent on the UK's future trade relations. Policy that fails to consider demand and supply chains risks undermining those farmers and land managers who invest in low carbon practices in the UK, while potentially causing environmental damage abroad. Policy should, therefore, align demand with low carbon aspirations for food production and land management and help farmers to go beyond minimum requirements.

A set of policy enablers should underpin delivery, supporting a more strategic approach to land use and evidence based decision making.

See overleaf for a summary of the measures we propose.[79]

Drive uptake of best practice

- Stimulate investment in low carbon farming through the new ELM system and transitional support
- Substantially increase tree planting and peatland restoration, supported by new funding
- Ban damaging practices on peat and establish a strong regulatory and enforcement regime

Shape demand

- Promote healthier diets through public procurement and retailer influence
- Make supply chains accountable for their impact on land use
- Commit to the highest environmental standards in trade policy

Spatial mapping | Harmonised metrics | Robust emissions accounting

Invest in policy enablers

A roadmap for 2030

"Land use policy still lacks coherence and a sense of urgency to achieve emissions reductions."

Stimulate low carbon best practice

The UK government has committed to establishing a post-CAP framework that delivers public goods, climate change mitigation being one of them, but land use policy still lacks coherence and a sense of urgency to achieve emissions reductions and provide farmers with consistent objectives to drive low carbon investment.

Transitional support for farmers could be tied largely to increasing productivity, with the risk of causing negative environmental outcomes that the post-CAP framework is designed to prevent. There is no clarity around what mechanism will encourage a shift to low carbon livestock farming, despite it accounting for 70 per cent of agricultural emissions; rates of afforestation are lower than ever; and practices that contribute to peatland degradation are ongoing. This highlights a substantial gap in the government's current plan to reduce emissions, especially as the new Environmental Land Management (ELM) system will only be fully up and running in 2025 and not all land managers will necessarily want to take part.

Addressing this gap and enabling farmers and land managers to play their role in the transition requires a commitment to ambitious climate change mitigation across all policies that have a bearing on land use.

Our recommendations to stimulate low carbon practices are:

Climate action should be a central objective of transitional support to farmers and the new ELM system. Ahead of full implementation of the ELM system, currently set for 2025, transitional support should promote low carbon measures and other public goods that the government intends to reward under the new system. This will demonstrate to farmers the direction in which their businesses need to move and motivate immediate investment in low carbon practices, rather than delaying action until the new system is fully in place in 2025. The ELM system should be designed to provide a nationally consistent approach to climate change mitigation based on the CCC's recommendations and spatial data on mitigation potential across different areas.

Regulation should drive the uptake of low carbon measures in agriculture. Voluntary schemes have failed and will not deliver the rate of decarbonisation required to cut agricultural emissions in line with the CCC's recommendations. The government should raise the regulatory baseline to ensure these measures are implemented across the board and tackle all the main sources of agricultural emissions. In particular, it should set requirements to improve soil management, currently only addressed in cross compliance, and mandate nutrient management plans for arable farmers to ensure optimal fertiliser use and better use of organic residues.[80] The government should progressively raise legal standards over time, setting the trajectory for meeting the UK's decarbonisation commitments and the outcomes outlined in the government's 25 year environment plan.

"Meeting the tree planting rates and ecosystem restoration needed by 2030 requires the government to fast forward action."

Concrete policies should be set immediately for much higher rates of afforestation, to ban damaging practices and promote peatland restoration. Meeting the tree planting rates and ecosystem restoration needed by 2030 requires the government to fast forward action. We welcome Defra's commitment to publish an English Tree Strategy and an England Peat Strategy, but there is a risk these will set long term ambitions without immediate urgency. Both financial and non-financial barriers should be addressed as soon as possible to increase tree planting, as outlined in the CCC's 2018 report to parliament.[81] No regret options for peatlands include setting a roadmap to ban peatland burning for recreational purposes, as well as bringing forward the ban on peat extraction and setting interim phased targets to end the sale of peat.[82] By the early 2020s, the government should establish priority areas for afforestation and ecosystem restoration, based on robust spatial mapping to maximise climate change mitigation (as well as other environmental benefits) and avoid negative impacts on existing ecosystems. These areas could form part of the Nature Recovery Network, or of an expanded set of Forestry Investment Zones, and should be linked to clear incentives for climate action and be consistent with biodiversity objectives.

Defra should identify opportunities for strengthening the domestic market for carbon credits from land based projects. As outlined in our recent report, *New routes to decarbonise land use with Natural Infrastructure Schemes*, private funding could support the decarbonisation of farming and land use with new revenue streams alongside government funding. This would allow farmers to go further in their efforts to cut carbon emissions, beyond what the ELM system can support. To enable this, Defra should set guidelines on how public and private funding can work together. It should also create a strategic framework for farmers and land managers to generate carbon credits in the forthcoming emissions reduction plan for agriculture.

The government should boost innovation funding and support the uptake of low carbon solutions. Innovation will be necessary to achieve the full emissions reduction potential of many of the options we have outlined across farming, forestry, carbon sequestration and ecosystem restoration, as well as to develop the monitoring and decision making tools needed, such as the new ELM system. Early adoption of new low carbon solutions should be supported via match funding from government or through co-investment by land managers and food supply chain companies.

"In Copenhagen, public procurement policies have driven a reduction in the consumption of red meat."

Shape demand for low carbon food and biomass production

There has to be a strong business case for land managers to prioritise low carbon methods and changes to land use at the scale needed for rapid decarbonisation. Currently, there are limited incentives for this, which risks frustrating those investing in low carbon options. The food and construction supply chains, together with a shift to low carbon diets and buildings, will be important drivers.

Our recommendations to shape demand are:

The government should establish a cross departmental strategy to encourage more plant-based eating and the consumption of less and better meat.[83] A first step would be to introduce mandatory procurement standards for caterers in public institutions, as part of Defra's new Food Strategy, with support for farmers to shift their production to meet this new demand. In Copenhagen, public procurement policies have driven a reduction in meat consumption and an increase in purchasing of seasonal and organic products, at no extra cost to the city, rewarding farmers that have invested in sustainable food production.[84] The government should also work with the hospitality and retail sectors to use their influence to increase the uptake of low carbon diets. Such a dietary shift will also result in better health overall, reducing public health costs.

The supply chain should drive the production of low carbon, sustainable food. Low carbon solutions must underpin all aspects of food production to cut agricultural emissions across the board. Businesses in the food supply chain have an interest in supporting best practice: managing the environmental impacts of their operations will be vital to ensure business resilience and long term productivity of the UK food sector. The government should work with the food sector to establish a corporate accounting system which monitors its environmental footprint, to encourage low carbon farming and the sustainable use of natural assets.[85] This would benefit UK farmers as well as the wider food sector.

Defra and BEIS should work together to reduce food waste. WRAP has estimated that food waste amounts to 1.85 million tonnes in the manufacturing sector and 1.3 million tonnes in the retail and hospitality sectors, costing businesses over £4 billion each year.[86,87] A more efficient use of resources, encouraged via the industrial strategy, would reduce these costs to businesses, while taking pressure off land resources. Furthermore, adding to the bottom line and raising the performance would benefit less affluent parts of the country where employment in food manufacturing is concentrated.[88]

The government should also introduce measures to encourage households to cut food waste, estimated at 7.3 million tonnes in 2015. Some is unavoidable, but most can be prevented. In the UK we waste on average of 53.4 kilogrammes per person, compared to 11 kilogrammes in the Czech Republic and 13 kilogrammes in Slovenia.[89] Mandating separate food waste collections across England would be a first step in helping households to cut avoidable waste.

"Effective tools are needed to support a strategic and integrated approach to land use."

Low carbon construction should be the norm. Wood could be substituted for high carbon construction materials in many buildings, providing long term storage for carbon sequestered in trees, as well as cutting emissions from construction.[90] Examples of low carbon buildings in the UK have between 25 and 50 per cent of the embodied carbon of conventional buildings and were built at no extra cost.[91] Setting requirements for low carbon construction would provide a long term market for commercial forestry in the UK, attracting private investment to support the rates of tree planting needed for higher carbon sequestration.

UK trade policy should support the highest environmental standards. Food imports currently account for half the food consumed in the UK. It is vital that future trade policy does not undermine good practice at home or drive environmental degradation abroad through trade in cheap and unsustainable products from countries with lower environmental standards. The government should commit to trade policy, anchored in primary legislation, which safeguards the environment, provides transparency and gives parliament and civil society a voice in the negotiations.[92]

Invest in enablers to guide action

Effective tools are needed to guide policy development and the uptake of low carbon solutions to support a strategic and integrated approach to land use. They are essential for a number of reasons. First, land is a limited asset and important choices have to be made to ensure it both helps to cut emissions and supports the goods and services essential for the economy and society. Second, the uptake and impact of different practices should be monitored, regulatory compliance enforced and best practice rewarded. And, finally, an effective emissions accounting system should inform future policy development. As these cross cutting measures are vital for policy development and implementation, the government should take action immediately to put them in place.

Our recommendations for policy enablers are:

Spatial mapping should direct climate change mitigation to optimal locations. The effectiveness of some measures, such as afforestation, will depend on where they are implemented. Others, such as restoration and the sustainable management of peatlands, require catchment scale interventions to restore optimal hydrological conditions and fulfil carbon sequestration potential. Land is a limited resource, so understanding its location specific potential allows better planning for the greatest impact. More strategic use of public and private funding will provide better value for money. Cost efficiency of schemes is also increased through economies of scale and collaboration between land managers. A national, spatially defined, assessment of opportunities and targets, combined with local, bottom up consideration of possible interventions, would provide a tool for democratic engagement and decision making. The government should initiate spatial mapping of opportunities, to underpin the development of the ELM system, as well as to identify the priority areas for peatland restoration and afforestation.

“Aligned practices in land use and supply chains will help farmers and food manufacturers to adopt low carbon measures.”

Harmonised metrics should promote low carbon food production in the field and along supply chains. Low carbon land management should be informed by a robust monitoring, reporting and verification framework. This would allow a baseline and metrics to measure performance against targets and a range of other environmental outcomes. It will lead to better management decisions and more effective participation in the ELM system. And it should inform the corporate accounting system that supply chains need to monitor their environmental footprints. Aligned practices in land use and supply chains will help farmers and food manufacturers to adopt low carbon measures and provide a more transparent system to reward best practice.

A robust emissions accounting system should monitor the impact of UK policy at home and abroad. Land use will play a critical role in decarbonisation, yet emissions accounting for this sector still does not reflect the true impact of the sector, potentially frustrating international efforts to cut emissions. The UK has already taken important steps to improve this by committing to including emissions from wetlands by 2021-22. But there are other areas where improvement is needed.

The CCC suggests that biomass could be significant in meeting long term climate targets. However, it warns that, without stronger monitoring, reporting and verification, the current international accounting system does not properly encourage importers and exporters of biomass to protect the land use based carbon stocks of the exporting country.

Furthermore, the UK inventory only includes emissions from the livestock sector generated within national boundaries. Emissions from the production of feed abroad, which the UK imports to support its livestock sector, are not considered, potentially distorting the assessment of implications linked to different forms of farming.

Finally, accounting for emissions from UK food consumption should inform policies targeting demand, such as a shift to eating less meat and dairy. This would ensure that efforts to promote a low carbon farming sector in the UK do not simply result in exporting the emissions associated with high carbon foods.

Conclusion

“By developing new solutions and a robust policy framework the UK would set an example to the world.”

The UK is at a pivotal moment. The urgency to tackle climate change now means that all sectors of the economy must play their part. Brexit is providing an opportunity to improve the way we produce food and manage land, and for transformational change to cut emissions from land use rapidly.

The chance now is for the government to set out new policies to support farmers and land managers to take action, enhancing their productivity and resilience, and putting the country on the right track to meet the NFU’s stated target of net zero emissions from land use by 2040.

This will require an integrated and strategic approach to land, with decarbonisation as its central aim. Joined up policy across government should allow farmers and land managers to make the best use of their assets, while promoting demand for low carbon, sustainable products among consumers and throughout supply chains. To have a chance of meeting the goal, the development of this policy must start now. We should make the most of the moment Brexit is offering to create a clear business case for farmers and land managers to reduce their emissions and increase carbon storage.

Cutting emissions from land use is not a challenge the UK faces alone. Keeping temperature rise to 1.5°C requires global effort. By developing new solutions and a robust policy framework for low carbon farming and land management, the UK would set an example to the world.

Endnotes

Full methodology for the numerical analysis is available at www.green-alliance.org.uk/resources/cutting_carbon_from_land_ use_methodology

A more detailed discussion of our policy recommendations is available at www.green-alliance.org.uk/resources/cutting_carbon_from_land_use_annex

[1] Intergovernmental Panel on Climate Change's (IPCC), 2018, *Special report: global warming of 1.5°C.*

[2] Committee on Climate Change (CCC), 2018a, *Progress report to parliament*

[3] CCC, 2018b, *Land use: reducing emissions and preparing for climate change*

[4] Note that emissions from agriculture, as reported in the CCC's land use report, do not include CO_2 emissions from machinery and off-road farm vehicles. Total emissions from agriculture including machinery amount to 46.5MtCO_2e per year in 2016.

[5] Modelled by the CCC, 2018b, op cit. Total emissions (53MtCO_2e per year in 2016) includes additional emissions associated with settlements (5.8MtCO_2e). The category 'forestry and soils' includes: forestry, bioenergy, agro-forestry, hedges and agriculture land use change.

[6] Settlements refer to land use for urban development. Denmark's annual greenhouse gas emissions in 2016 were 50MtCO_2e, see European Environment Agency, 'Country profiles - greenhouse gases and energy 2018', figure 3: 'Total historic and projected greenhouse gas emissions in European Member States in million tons CO_2 equivalent - 2016', www.eea.europa.eu/themes/climate/trends-and-projections-in-europe/climate-and-energy-country-profiles/country-profiles-greenhouse-gases-and.

[7] CCC, 2018b, op cit.

[8] M Nesbit et al, 2018, *Sectoral assessment for agriculture, forestry and other land use, IEEP.*

[9] CCC, 2018b, op cit; the CCC's analysis only considers methane and nitrous oxides emissions, and carbon dioxide emissions from liming and urea applied on land (which amount to 1.3MtCO_2e per year). Stationary and mobile machinery also create carbon dioxide emissions, but these were excluded from their analysis and are therefore not considered in this report.

[10] CCC, 2018b, op cit; further information on these measures is provided in the CCC's report on land use and technical annex.

[11] M Nesbit et al, 2018, op cit

[12] Of the 7MtCO_2e potential annual emission savings in 2030, the CCC estimates that 6.1MtCO_2e result from methane and nitrous oxide emissions reductions, while 0.9MtCO_2e are from measures to reduce emissions from on farm machinery.

[13] CCC, 2018b, op cit. This estimates that 80 per cent of emissions abatement measures in agriculture could be achieved whilst reducing overall costs to farmers; see also: CCC, 2017, letter to Rt Hon Michael Gove MP on agriculture, land use and the natural environment

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[16] Scottish Government, 2007, *Module 5 estimates of carbon loss from scenarios of accelerated erosion of peats*, www.webarchive.org.uk/wayback/archive/20180520162259/http://www.gov.scot/Publications/2007/03/16170508/7

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[21] A Whittle and A V Gallego-Sala, 2016, 'Vulnerability of the peatland carbon sink to sea-level rise', *Scientific Reports, 6, 28758*

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[27] CCC, 2018b, op cit

[28] European Commission, November 2015, *Paludiculture: sustainable productive utilisation of rewetted peatlands*

[29] A Thomson, et al, 2018, *Quantifying the impact of future land use scenarios to 2050 and beyond – Final report for the Committee on Climate Change*, p43

[30] RSPB, *England's upland peatlands: turning around a crisis*.

[31] K Glenk and J Martin-Ortega, September 2017, *The economics of peatland restoration*

[32] ClimateXChange, 2017, *Peatland Action Programme – lessons learned*

[33] International Union for Conservation of Nature - UK, *Peatland Code*

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[36] CCC, 2018b, op cit, p39

[37] Ibid

[38] Ibid

[39] A Thomson et al, 2018, op cit, p34

[40] The Royal Society, 2018, *Greenhouse gas removal*

[41] D J Read, et al, 2009, *Combating climate change – a role for UK forests. An assessment of the potential of the UK's trees and woodlands to mitigate and adapt to climate change*

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[60] Ibid. This would require application of biochar to a quarter of the six million hectares of UK arable land.

[61] The CCC estimates that low carbon farming practices would only cut emissions by 9MtCO2e by 2050, while a shift to healthier diets could deliver much deeper decarbonisation (assuming direct impact on UK land use).

[62] CCC, 2018b, op cit

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[65] Green Alliance, 2018a, *Less in, more out*

[66] CCC, 2018a, op cit; Forestry Statistics, 2018, 'Chapter 2: UK-grown timber, Forestry Commission'

[67] A Thomson, et al, 2018, op cit, p51. Note that the amount of timber from newly planted forests will be small until later in the century.

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[70] These estimates assume a rate of afforestation on released grasslands between 10,000 to 25,000 hectares per year to 2023, and of 20,000 to 50,000 hectares per year after that. These would have to be considered in addition to the rate of afforestation that the CCC has already modelled in its HBF scenario, which assumes a yearly afforestation rate of 50,000 hectares.

[71] For the full methodology for the numerical analysis, including an overview of the reduction potential of different combinations of measures and different deployment rates, see www.green-alliance.org.uk/resources/cutting_carbon_from_land_ use_ methodology.

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[73] Ibid, p34

[74] Ibid, p46

[75] Ibid, p 40-41

[76] Green Alliance, 2018b, *Setting the standard*

[77] CCC, 2018a, op cit

[78] Natural Capital Committee, 2019, *State of natural capital annual report 2019: sixth report to the Economic Affairs Committee of the cabinet;*

[79] Our policy recommendations are discussed in more depth at www.green-alliance.org.uk/ resources/ cutting_carbon_from_land_use_annex

[80] On soil management, the government should include in regulation the requirements currently set out in cross-compliance GAECs 4-6, which set requirements to protect soils by maintaining minimum soil cover, limit soil erosion through suitable practical measures and maintain the level of organic matter in soil; for more information, see Defra, 2019, *The guide to cross compliance in England 2019*.

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[85] Natural Capital Committee, 2019, op cit. The Natural Capital Committee has already developed a corporate accounting template, including a set of standards.

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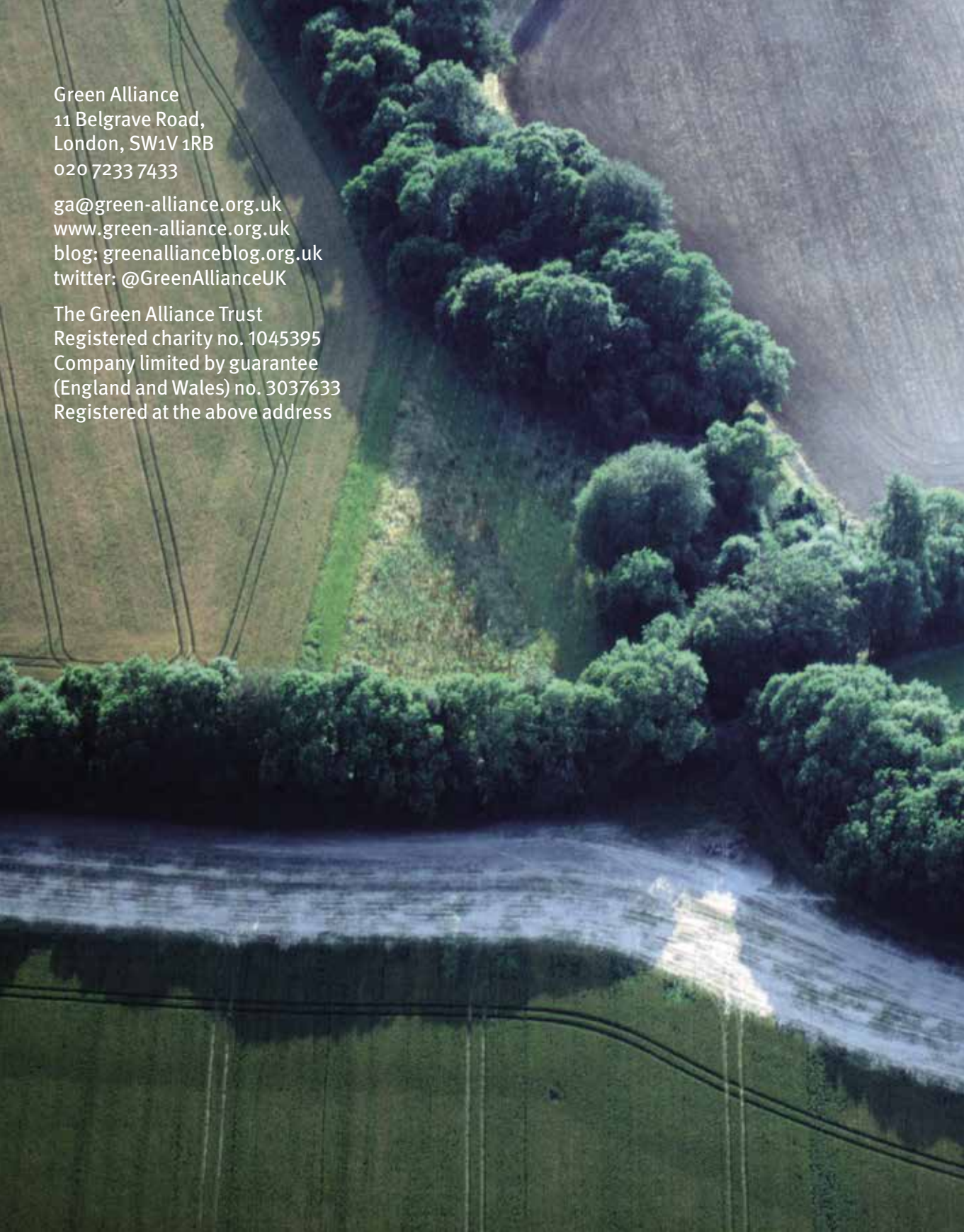

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