A new land dividend

The opportunity of alternative proteins in Europe

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Authors
Lydia Collas and Dustin Benton

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Summary

"There is simply not enough land to continue current patterns of food consumption and meet our new goals for land."

Europe faces a land crunch. It has almost no productive land unused by people and it substantially relies on land outside Europe. But more land is needed to achieve Europe's carbon neutrality and nature goals, to expand the area of nature-friendly agriculture and generate energy.

There is simply not enough land to continue current patterns of food consumption and meet our new goals for land. But talking about what we eat in Europe remains taboo: for politicians, diet change is a bitter pill to swallow.

Alternative proteins can help to avoid this stalemate. They could taste the same as meat and dairy with radically lower costs to consumers and the environment. Today's plant-based alternative proteins are already beginning to displace processed meat and dairy products as they reach cost parity. Our analysis suggests that, even with very limited support, they could displace a sixth of European meat and dairy consumption by 2050.

With the right policy support, products created by precision fermentation or cultivated meat could replicate some cuts of meat and more complex cheeses. This could enable alternative proteins to displace two thirds of the animal products currently consumed across Europe. If this were the case, alternative proteins could displace Europe's land crunch with an enormous land dividend. Reducing

demand for meat and dairy by two thirds would mean 44 per cent of the farmland in the ten European countries we studied would no longer be needed for growing feed and grazing animals. Overseas land use would fall even further, by 57 per cent, releasing an area equivalent to Spain from producing the food that Europe imports.

The question is what could be done with this land dividend. Governments could use it to grow more food at home, increasing self-sufficiency; expand natural habitats that store carbon and support wild species; or increase the area of agroecological or high nature value farmland in Europe. Here, we show the implications of a 'shared dividend' policy, which does all three. (We explore other scenarios in our accompanying technical report).

In our 'high innovation' scenario, where alternative proteins come to represent two thirds of the meat and dairy market by 2050, sharing the land dividend would have four benefits:

1. The ten European countries studied would become self-sufficient in food, in terms of net land use.

2. Farmers would benefit from the carbon removal market by having the space to expand nature-rich, natural carbon sinks. These would avoid the need for engineered carbon removals, saving €21 billion a year by 2050 on the cost of

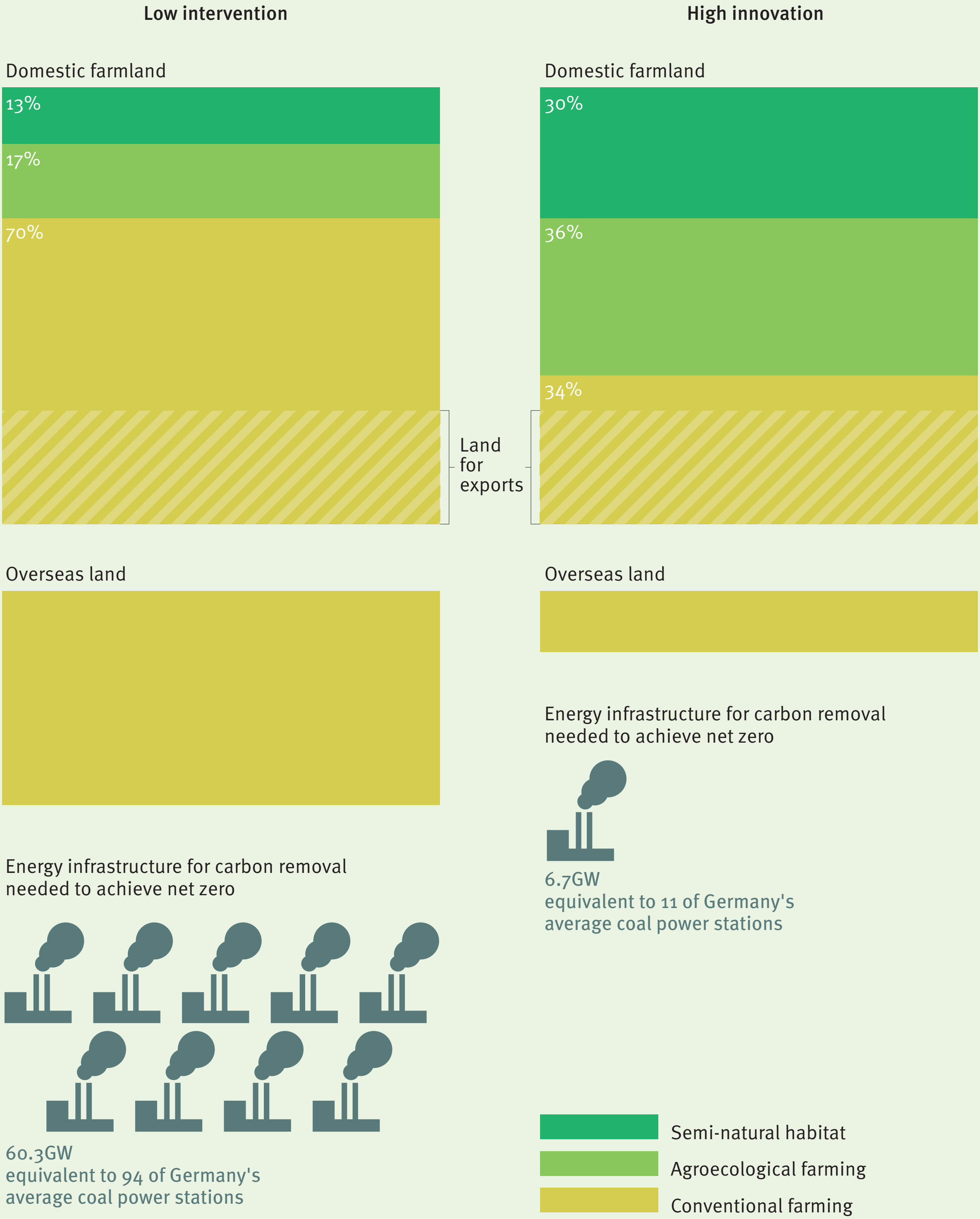
> "The CAP must be reimagined as a new rural deal."

meeting Europe's carbon neutrality goals, equivalent to nearly half the EU's Common Agricultural Policy (CAP) budget.

3. The area of agroecological farmland would quadruple by 2050, which is more than is necessary to meet the EU Farm to Fork strategy's goal of 25 per cent of land being certified organic.
4. Enough wildlife habitat would be created to restore so-called Annex I habitats (those identified as most in need of conservation) required by the EU's Nature Restoration Law.

To ensure the social benefits of this change are realised, the CAP must be reimagined as a new rural deal, one which pays farmers and land managers for nature restoration and carbon removal, alongside food. Alternative proteins would be central to this new rural deal, as they create the space to avoid the difficult trade-offs that Europe will otherwise face in reconciling its food, climate, nature and rural economic goals.

The potential for land use change under our two alternative protein scenarios



What are alternative proteins?

> **“Precision fermentation seeks to make products indistinguishable from animal-based meat and dairy.”**

Alternative proteins are foods produced to provide the sensory and nutritional equivalent of animal meat, dairy and eggs. There are three main types, produced from plants, fermentation and animal cells:

Plant-based meat, **dairy and egg** products are available today and typically displace products like sausages, burgers or milk. They range from more familiar products like bean burgers or almond milk to newer foods like vegan camembert or pea protein based Beyond Burgers. Innovation is likely to make these products taste similar to the conventional animal products they displace, at lower cost.

Fermentation is an innovative approach to producing foods that deliver the distinctive flavours and textures of animal products, without farming animals. Products such as Quorn or Fy are made with similar processes to those used to make beer and yoghurt. A new process of precision fermentation is aiming to make products indistinguishable from animal-based meat and dairy. The heme protein used in the Impossible Burger and animal-free whey protein in Perfect Day ice cream are among the products already on the market.

Cultivated meat is the same as the beef, pork, chicken and lamb that people enjoy eating today, and is sometimes called cellular agriculture. Like beer, cultivated meat is made in fermenters instead of by farming animals. The world’s first cultivated meat burger, produced in 2013, was rumoured to cost $330,000, but prices have dropped dramatically since. Products have recently been approved for sale in Singapore and the United States, and they are being considered by regulators for approval in the UK and Switzerland.

Up to two thirds of meat and dairy could be displaced by 2050

> **"Alternative proteins will only reach their full potential with supportive policy."**

Alternative proteins are likely to displace some conventional meat and dairy products for two reasons. First, a large share of meat and dairy products are either processed or pre-prepared, like supermarket lasagne or frozen pizza. In processed food markets, businesses, rather than end consumers, choose ingredients to maximise profit margins, meaning the switch to alternative proteins could be made as soon as they undercut conventional meat and dairy on price.[1]

Second, price and convenience drive consumer choices, meaning that alternative proteins offering a like for like replacement are more likely to displace conventional meat and dairy products than unprocessed plant foods which are less convenient. The extent of the displacement will depend on three factors:

1. **Price.** Innovation and scale up must bring down the costs of alternative proteins to attract consumers and food manufacturers. Price parity will be reached sooner if food price inflation continues to disproportionately affect meat and dairy products, driving food manufacturers towards alternatives with the right flavour and price.[2]
2. **Policy.** Governments influence how easily these products come to market by funding startups, infrastructure and the regulators that approve new products. Alternative proteins will only reach their full potential with supportive policy.
3. **Taste.** Plant-based products are unlikely to replicate the taste of less processed forms of meat and dairy. Precision fermentation and cultivated meat must be scientifically and commercially successful to be able to displace cuts of meat and cheeses.

Alternative protein development scenarios

> **"For more complex cuts of meat, additional innovation is needed for cultivated meat to reach a competitive price."**

Our analysis looked at two scenarios:[3]

Low intervention

Without supportive policy, we estimate alternative proteins could displace about a sixth of meat and dairy consumption by 2050. In this scenario, both precision fermentation and cultivated meat fail to become profitable, so only the plant-based alternative proteins sector grows. These plant-based products cannot displace whole cuts of meat or most types of cheese which have tastes and textures they cannot replicate, so substitution is limited to some processed meat and dairy products.

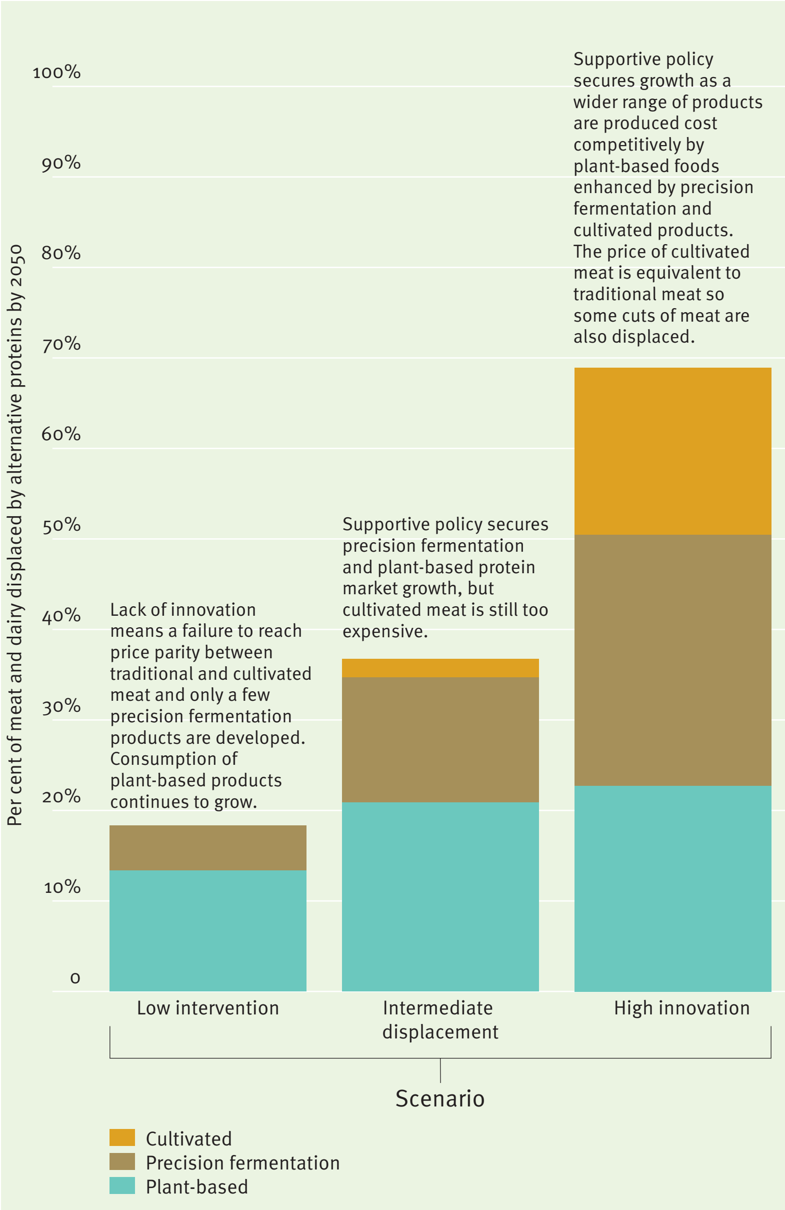
High innovation

With significant supportive policy the picture changes. Precision fermentation products can readily replace milk and eggs. In addition, precision fermentation and cellular agriculture can produce animal fats, enzymes and natural flavours that will make plant-based products taste much more like animal products. For more complex cuts of meat, additional innovation is needed for cultivated meat to reach a competitive price. If it can, some cuts of meat could be displaced, in addition to the meat and dairy eaten in processed forms, which is approximately half of what is consumed.[4]

In this scenario, alternative proteins account for over two thirds of meat and dairy sales by 2050. Most processed meat and dairy could be displaced, along with some complex cuts of meat. With supportive policy, traditional meat and dairy production could continue, but only serving higher value, lower volume, premium markets.

Our accompanying technical report also studies an ‘intermediate displacement’ scenario and a scenario where alternative proteins fail to expand their present market share.

Policy will influence how much alternative proteins can displace meat and dairy



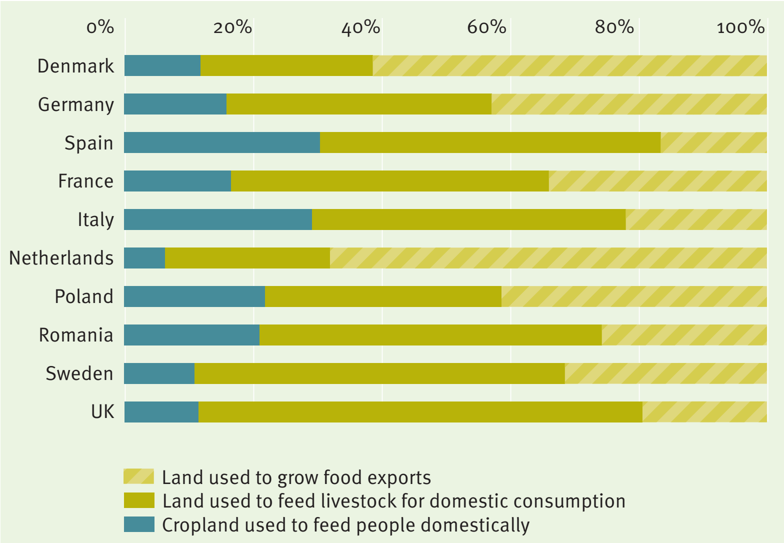
Alternative proteins create a land dividend

> **"Over half of the farmland in the countries studied is used to produce meat and dairy."**

We studied what these scenarios would mean for ten countries which account for 80 per cent of total EU plus UK GDP and 70 per cent of total EU and UK land area: Denmark, France, Germany, Italy, the Netherlands, Poland, Romania, Spain, Sweden and the UK. These include a wide range of geographies, agricultural systems and land uses.

Today, over half of the farmland in the countries studied is used to produce meat and dairy products. Just 20 per cent of their agricultural area is used to grow plants eaten by their populations. In addition, all ten countries import food grown elsewhere, much of which is fed to domestic livestock. Though Europe is a net exporter of agricultural produce by value, it is a large importer of land use: these countries use over twice the land area overseas to grow the food they import, compared to the area used domestically to produce food they export.

Current land use is dominated by livestock in almost every country

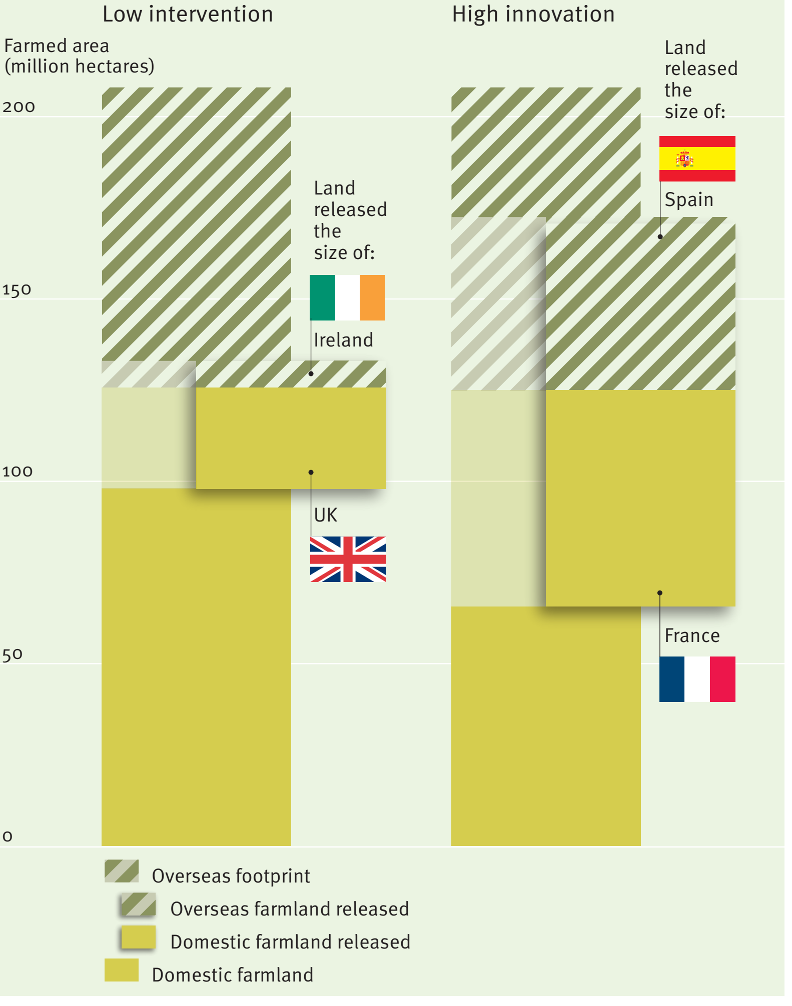


> “Our ‘high innovation’ scenario would free up 44 per cent of domestic land, an area the size of France.”

Compared to meat and dairy, alternative proteins require far less land. In our ‘low intervention’ scenario, where approximately a sixth of meat and dairy is displaced by alternative proteins, 21 per cent of the domestic farmed area and nine per cent of the land overseas used for imports would be released for alternative uses.

Our ‘high innovation’ scenario, in which two thirds of meat and dairy is displaced, would free up 44 per cent of domestic land, an area nearly the size of France. An even greater area would be released from land used abroad for imports: 57 per cent less would be required, an area the size of Spain.

Increasing alternative protein consumption releases land for other uses at home and overseas



France, Spain and the UK have the greatest land dividend, given their large areas of farmed land and extensively grazed outdoor beef and lamb sectors. Countries which produce more pork and chicken use relatively less land for livestock production and so less land would be released by increasing consumption of alternative proteins. The least land is released in Denmark and the Netherlands which have small agricultural areas dominated by export production which we assumed would remain unchanged.

Overall, though, shifting from meat and dairy to alternative proteins creates a large land dividend. European governments and their electorates have the opportunity to decide on how this could be used. We outline the options and trade-offs.

Using the land dividend

> **"More land is needed to achieve Europe's carbon neutrality and nature goals."**

Across Europe, there is almost no productive land that is not used by people, and there is substantial reliance on land outside Europe for food supply.[5] But more land is needed to achieve Europe's carbon neutrality and nature goals, to expand the area of organic or nature-friendly agriculture and generate energy.

These goals are not always mutually exclusive: for example, land used for solar or wind power can also be used for agriculture, and some types of farming provide habitats for farm-adapted species.[6] However, there are also trade-offs to be addressed.

The main drivers of changing land use and the trade-offs, are:

1. **Food security.** Countries want to onshore production, which may help reduce climate related food disruptions. Onshoring also relieves land pressures in other countries which is necessary to end deforestation, nature decline and reach climate targets. However, using more land for food domestically reduces space for other uses.
2. **Biomass for carbon removal.** Bioenergy, including that used in bioenergy with carbon capture and storage (BECCS), could become a very large land use as countries aim to offset their emissions. If demand for bioenergy cannot be met from waste feedstocks, biomass production will compete for space with natural habitats and food production.
3. **Habitat expansion for nature and carbon removal.** Investing in farmers and land managers in Europe to expand forests, wetlands and other semi-natural habitats is a cheaper way to remove carbon from the atmosphere than BECCS and is essential to restoring

nature across Europe. There are trade-offs here too: these habitats produce little food, but they offer diversified farm incomes, rural employment, leisure facilities and natural beauty.

4. **Agroecology.** Nature-friendly or agroecological approaches to farming can support traditional livelihoods and farm-adapted wildlife. But, by avoiding synthetic inputs, they tend to use more land per unit of food grown compared to conventional agriculture.[7]

> **“Semi-natural habitats offer rural employment, leisure facilities and natural beauty.”**

The land dividend created by alternative proteins can offer space for all these priorities whilst reducing the trade-offs between them.

The scale of the opportunity

> **How the land dividend is spent is a political decision.”**

We assessed the scale of the opportunity from increasing alternative proteins to:

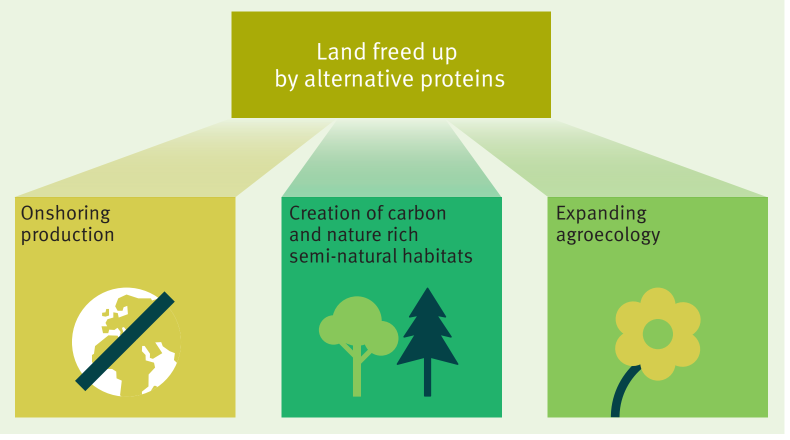
1. Increase self-sufficiency.
2. Expand semi-natural habitat to reduce demand for engineered carbon removal.
3. Expand agroecology.

We present a ‘shared dividend’ approach which equally divides land freed up by increasing the consumption of alternative proteins between these three priorities. This treats each priority as equally important and is not optimised for specific outcomes.

Ultimately, how the land dividend is spent is a political decision; but it is for European policy makers to decide how to make the most of the opportunity.

Our supporting technical report explores in detail the outcomes of different approaches to using land freed up to deliver against these three priorities.

The land dividend is split evenly across three priorities



Shared dividends: four major findings

> **The ten countries studied could meet their land demand within their own borders.”**

1. Alternative proteins could make countries self-sufficient in land use[8]

In our ‘high innovation’ scenario for alternative proteins, the ten countries we studied could meet their land demand within their own borders, while continuing to export food. Under our ‘shared dividend’ approach, the area used to produce exports would be greater than the area of overseas land used to produce imports. The current situation is very different: these countries use more than twice as much land overseas to grow imported food as they use domestically to grow food for export, making them dependent on land overseas.

At the level of individual countries, under this scenario there would be two exceptions: the Netherlands and the UK would continue to use substantially more land overseas for imports than they use to produce exports. However, both countries’ land demand could be met by the land freed up in the other eight countries we studied.

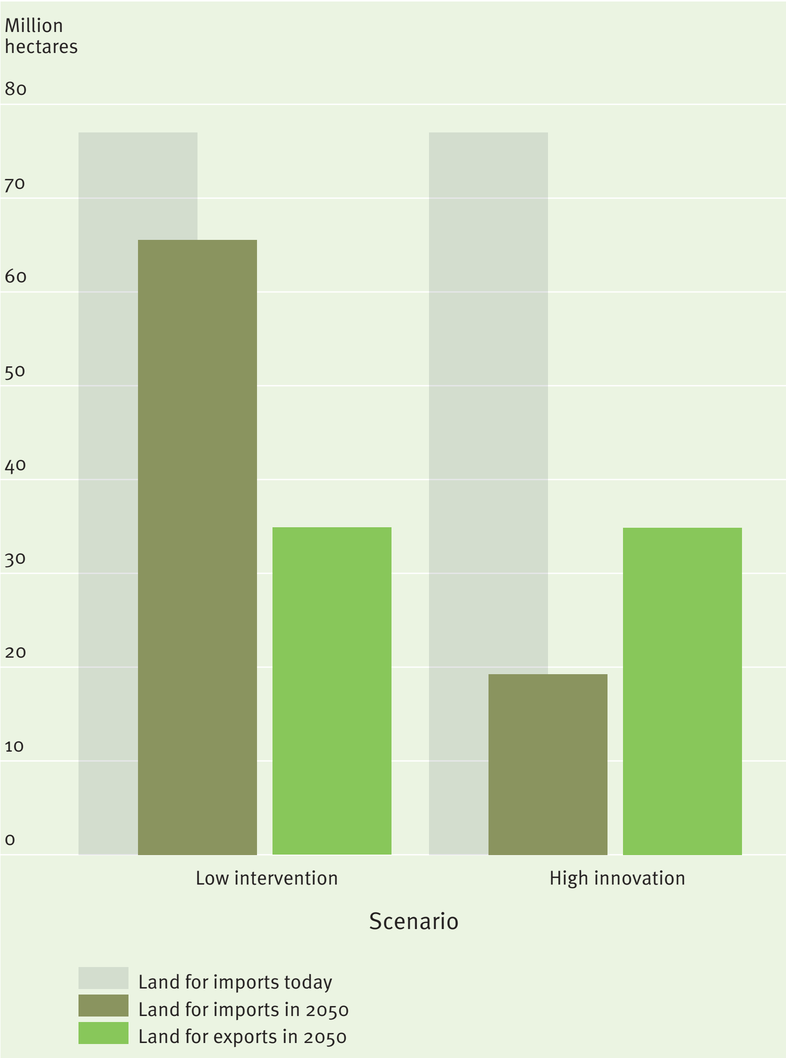
In our ‘low intervention’ scenario, the ten countries we studied would, together, still depend on an area the size of Denmark overseas for their food imports. However, a ‘shared dividend’ approach would see overseas land use decline by a fifth compared to today.

In both scenarios, this increase in self-sufficiency arises partly because we assume that alternative proteins would be produced domestically. This would require policy support to attract producers and capitalise on the opportunity for European farmers to supply the inputs for the industry.

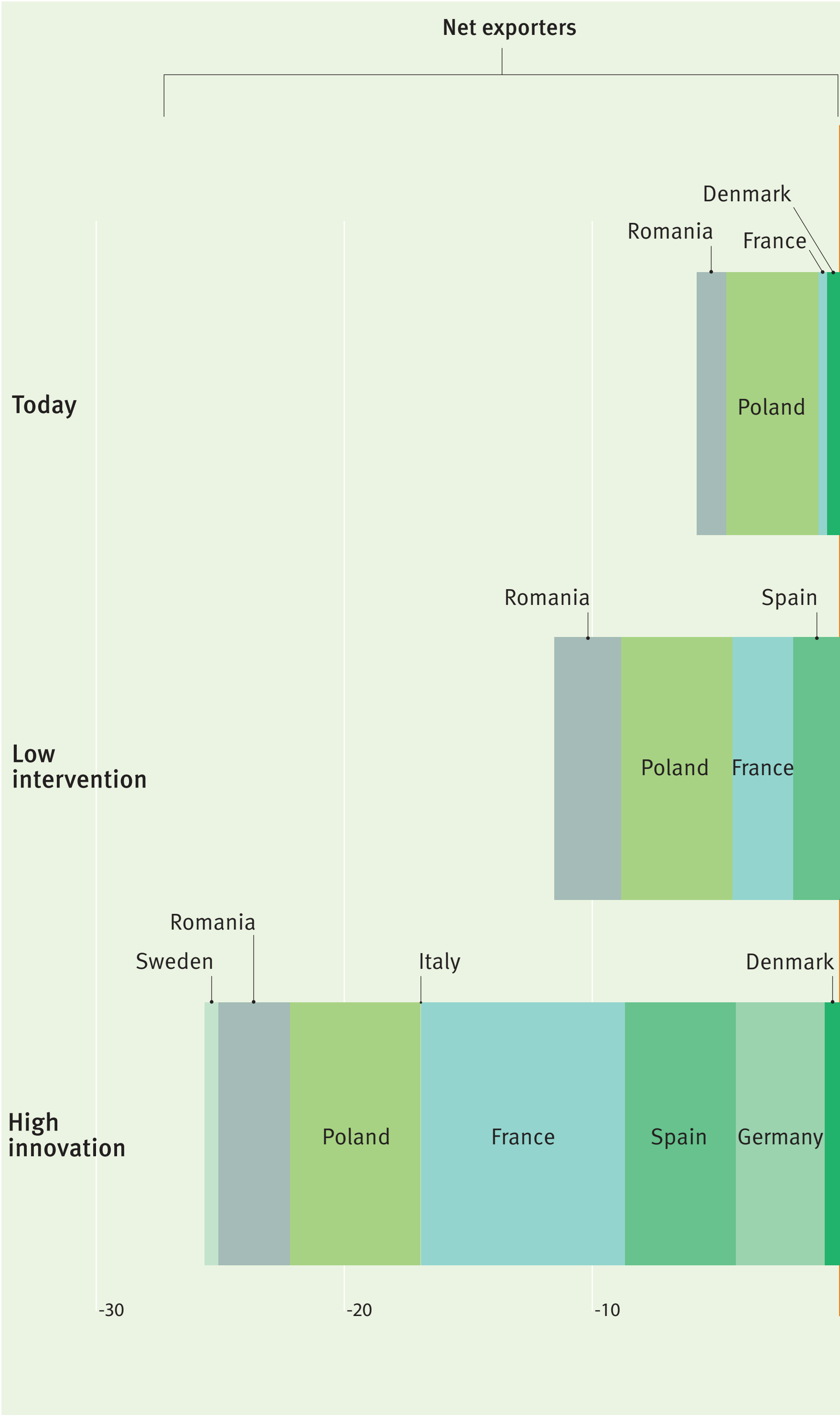
Although food security is not synonymous with self-sufficiency, high innovation and uptake of alternative proteins would return these countries to levels of food self-sufficiency last experienced at least 30 years ago.[9]

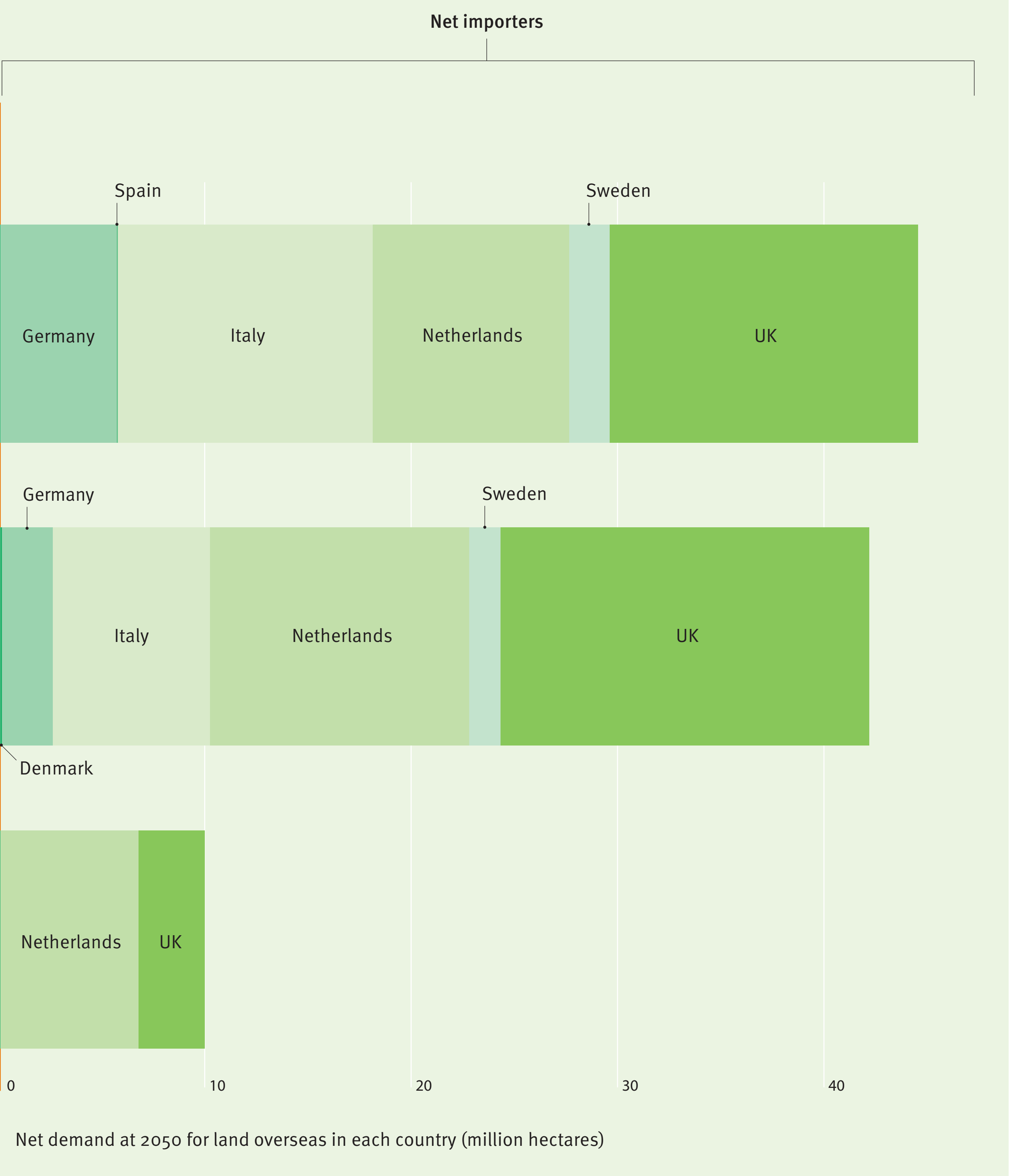
> **"High innovation in alternative proteins would return these countries to levels of food self-sufficiency last experienced at least 30 years ago."**

Alternative proteins improve self-sufficiency



Only the UK and the Netherlands would still be reliant on land overseas with high innovation of alternative proteins





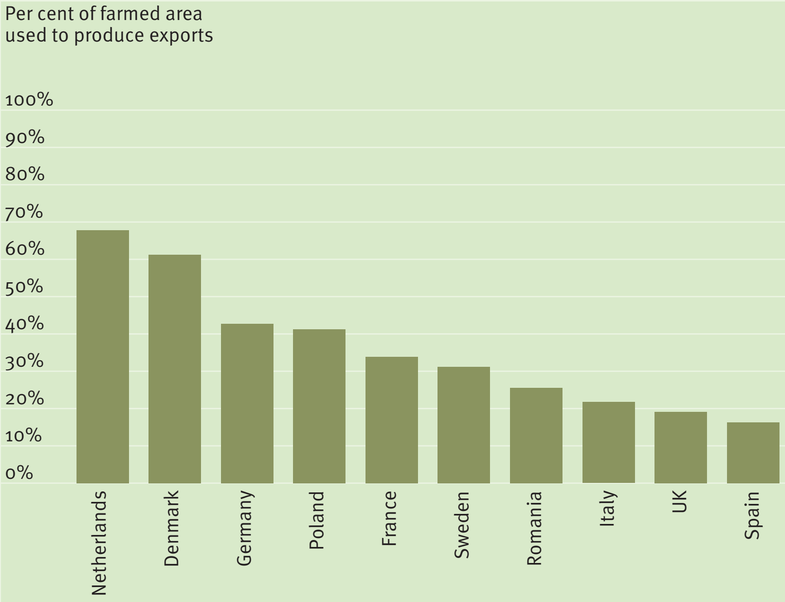
Net importers
Spain
Sweden
Germany
Italy
Netherlands
UK
Germany
Sweden
Italy
Netherlands
UK
Denmark
Netherlands
UK
0
10
20
30
40
Net demand at 2050 for land overseas in each country (million hectares)

Could countries rethink producing food for export?

One factor we did not adjust for in our analysis was the amount of land used for exports. We assumed countries would export the same amount of food products in 2050 that they do today. But countries may reconsider this as the costs of environmental damage rise. This is particularly pertinent in the Netherlands, which uses over 60 per cent of its farmland to grow exported produce. Similarly, over half of Denmark's farmed area grows livestock products for export, and nitrogen pollution from farming is suspected to be causing 'dead zones' in the seas surrounding the country.[10] If alternative proteins are successful in these countries, it may make sense to shift their export industries towards these less polluting products.

This issue is not exclusive to large exporters. The British government recently suffered a defeat in parliament over its intention to remove requirements for the building industry to offset nutrient pollution caused by new housing. But livestock manure is far more polluting than housebuilding. Degrading a nation's environment to produce food for other countries may become more contentious as other sectors come under increasing pressure to clean up the environment.

Denmark and the Netherlands use over half of their farmland to produce food exports



2. Alternative proteins could avoid expensive carbon removal infrastructure

> **"Increased consumption of alternative proteins reduces demand for expensive engineered removals."**

Carbon neutrality, or net zero, requires unavoidable residual greenhouse gas emissions to be balanced out by removing emissions, typically carbon dioxide, from the atmosphere. Natural ecosystems, such as forests, are the only form of carbon removal operating at scale and have the significant benefit of also being species-rich wildlife habitats. Where natural ecosystems are too limited in size to remove enough residual emissions, technological solutions referred to as 'engineered carbon removal' can be used to increase sequestration. The main method is to capture the carbon released when plants are burnt, a process known as bioenergy with carbon capture and storage (BECCS).

Therefore, land is likely to provide the 'net' in net zero: the question for policy makers is what balance they should seek between natural habitat creation and BECCS. Evidence from the UK suggests BECCS has three significant drawbacks: it has few benefits for nature, may not deliver genuine removals and is four to 12 times more expensive than supporting farmers and land managers to create carbon sequestering semi-natural habitats, per tonne of CO_2.[11,12,13]

Increased consumption of alternative proteins reduces demand for expensive engineered removals in two important ways. First, their carbon footprint is much lower than meat and dairy products.[14] This reduces the emissions that need to be offset. Second, in freeing up land, alternative proteins create space to expand natural carbon sinks, reducing the need for engineered carbon removals, whilst benefitting nature.

> **It is much cheaper to support European farmers to manage land for carbon and nature than to pay for BECCS.”**

Our analysis considers emissions across the whole economy. We assumed other sectors' emissions will fall as planned and estimated the likely emissions from the farming and land use sector resulting from each of our modelled scenarios.[15] We assumed any emissions not offset by natural carbon sinks must be offset through BECCS.

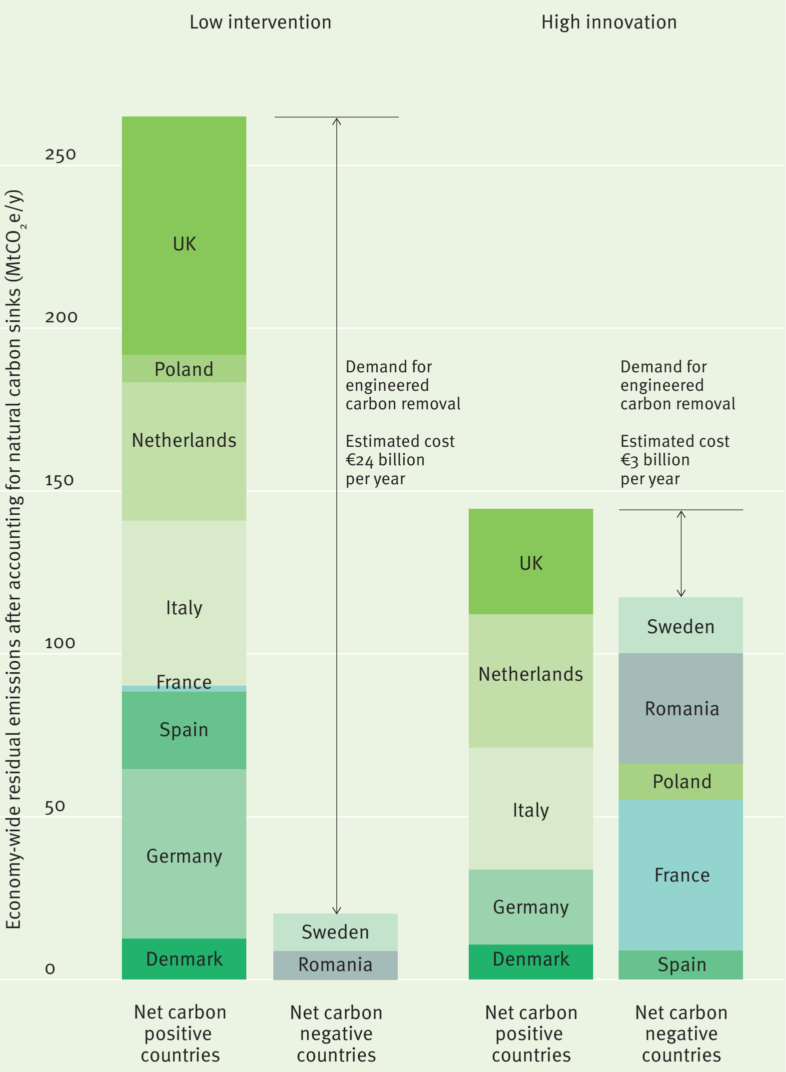
Our 'high innovation' scenario reduces the required engineered carbon removal for net zero across all ten countries' economies from 243MtCO_2e per year to just 27MtCO_2e per year by 2050, assuming excess negative emissions are traded between countries.

This has four major benefits. First, taxpayer costs fall because it is much cheaper to support European farmers and land managers to manage land for carbon and nature than to pay for BECCS: the savings are worth around €21 billion in 2050 alone.[16] Second, investment in carbon removal goes to the rural areas where natural habitats are expanded. This improves marginal rural livelihoods, provided governments support farmers with a fair price for carbon removal.

Third, it avoids the need to build large amounts of infrastructure: removing 243MtCO_2e a year from the atmosphere with BECCS plants would involve building electricity generation infrastructure larger than Germany and Poland's combined coal power plants.[17] Finally, it avoids challenging supply chain issues: 243MtCO_2e per year of BECCS would need five times more wood pellets than are currently produced globally.[18]

If the alternative proteins industry cannot increase its market share, demand for engineered carbon removal will exceed 300MtCO_2e per year. Demand would remain high due to emissions from the livestock sector and because the land necessary would not be available to expand natural carbon sinks, meaning engineered solutions would be needed. This could happen, for instance, if alternative protein products are banned, as Italy recently did with cultivated meat.[19]

Alternative proteins allow the expansion of natural carbon sinks, reducing demand for engineered carbon removal



Net carbon positive countries
Countries that need negative emissions, in addition to their natural sinks, to achieve net zero

Net carbon negative countries
Countries that have more negative emissions from their natural sinks than they need to achieve net zero

Hidden within this European story are groups of countries with their own stories. Regardless of how they might take advantage of their potential land dividend, Sweden and Romania are likely to be net carbon negative, ie absorbing more carbon emissions than they produce, due to their natural carbon sink capacity, without having to resort to engineered removals, even with low intervention in alternative proteins.

These nations could choose to use their negative carbon emissions balance to sell to, or share with, five of the countries we studied (the Netherlands, UK, Italy, Germany and Denmark) that would have excess emissions. As nature-based removals, these would be likely to undercut the cost of engineered removals.

The other countries included in our study, France, Spain and Poland, have the potential to reach negative emissions without recourse to engineered removals, but only in our ‘high innovation’ alternative proteins scenario.

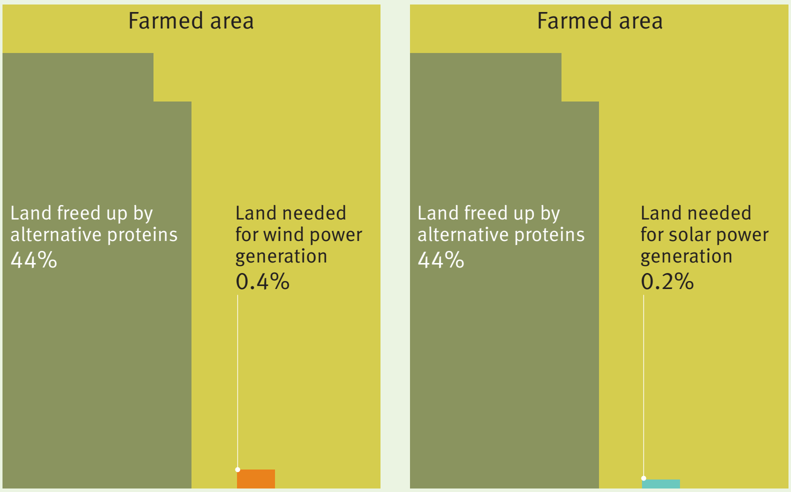
The renewable energy demand of alternative proteins

Producing alternative proteins requires energy. Renewables are the cheapest energy source but they need land. To account for this, we estimate that, based on the anticipated efficiency that could be achieved by scaling up alternative proteins, our 'high innovation' scenario would require 300-700TWh more electricity per year in 2050 to produce the alternative proteins for all ten countries. Using solar power to generate this would use 0.1-0.2 per cent of the land area of the countries studied. Using onshore wind, it would rise to 0.3-0.4 per cent.

Wind can be integrated alongside farmland with no impact on food production as turbines occupy a small fraction of land area: the rest is typically fields. For solar farms, grazing can still take place underneath solar panels, while agrivoltaics can combine solar with some types of crop production.

However, the land area needed for renewables is dwarfed by the 44 per cent of domestic farmland that alternative proteins could free up. In addition, because meat and dairy production also requires energy, it would cut energy demand in the countries that meat and dairy are currently imported from, as we assume the alternative proteins that displace these products would be produced domestically .

The land demand for the renewable energy infrastructure needed to produce alternative proteins is a fraction of the land they free up



3. Alternative proteins enable agroecological farmland to quadruple

> “36 per cent of currently farmed land in the countries we studied could become certified organic.”

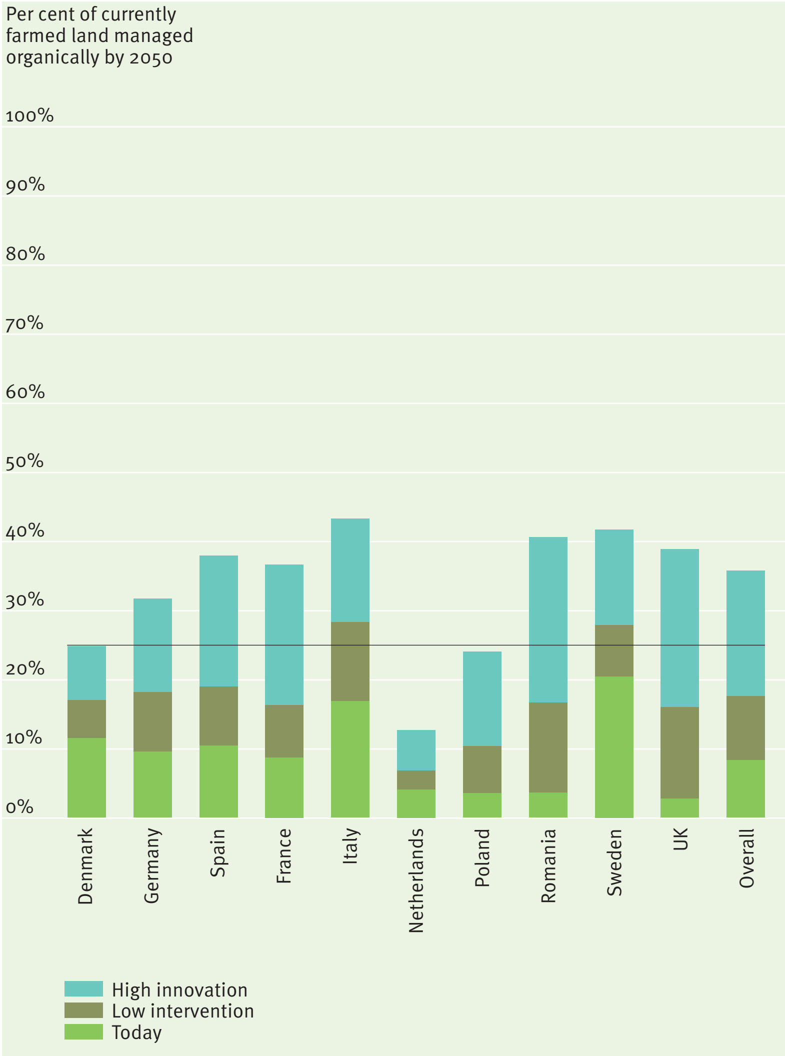
Unless consumption of conventional meat and dairy declines substantially, expanding agroecological, high nature value, or nature-friendly farming has unintended consequences. The definitions of these farming types are loose, but their common feature is lower food yields requiring greater land area, so simply changing to these methods would drive some production overseas. Increasing the use of alternative proteins changes the equation by creating space for these farming methods to grow domestically.

With high innovation in alternative proteins, our shared dividend approach would allow the agroecological or nature-friendly farm area to quadruple, whilst overseas land use and demand for engineered carbon removal falls. Because no estimates of the area of agroecological or nature-friendly farming exist, we have used organic farmland as a proxy. Our ‘high innovation’ scenario could mean 36 per cent of currently farmed land in the countries we studied could become certified organic, exceeding the EU Farm to Fork target to farm 25 per cent of land organically. Individually, only the Netherlands and Poland would struggle to hit this target without needing to increase its food imports.

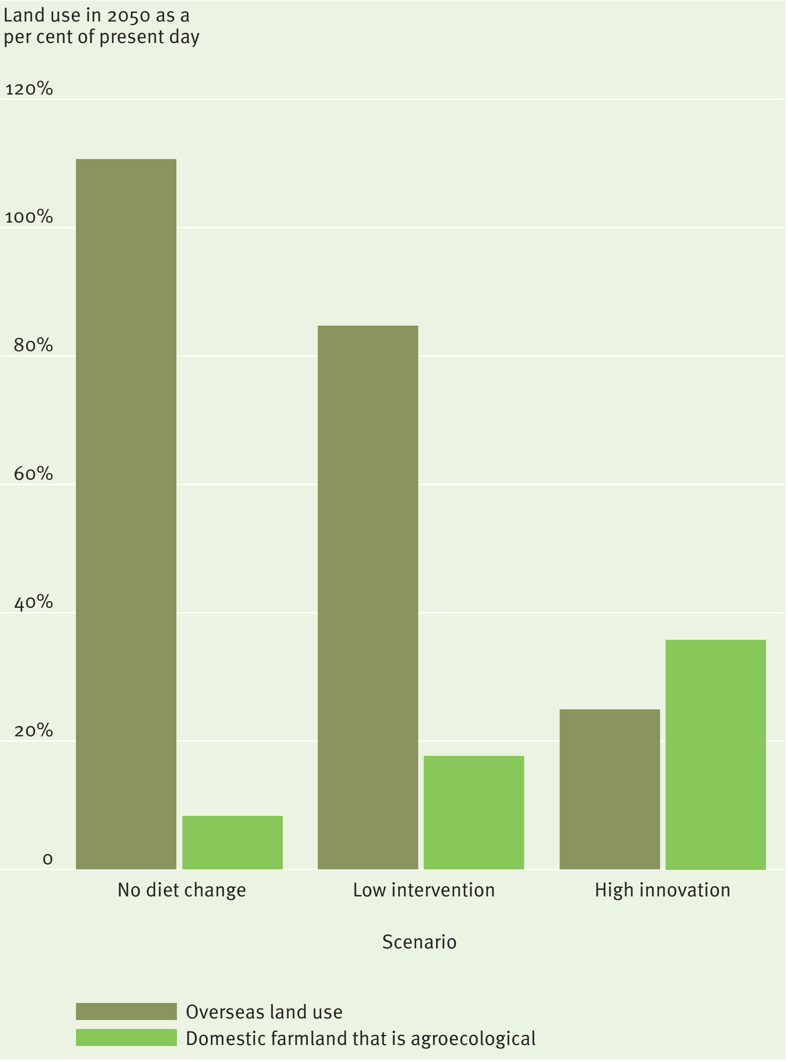
Even in our ‘low intervention’ scenario, there would be enough land freed up to double the organically farmed area. In Italy and Sweden this would be sufficient to meet the Farm to Fork target. The other countries we studied would need additional displacement of meat and dairy by alternative proteins to meet the target under our shared dividend approach.

The EU’s 25 per cent Farm to Fork target has been set for 2030. Many countries are not on track to meet it.[20]
Our analysis shows that the speed at which meat and dairy are displaced by alternative proteins would determine the timeframe within which this target could be met without offshoring food production. Reaching the target by 2030 would require extremely rapid alternative protein uptake.

Only the Netherlands and Poland struggle to achieve 25% organic production in our 'high innovation' scenario



Expanding alternative proteins frees up more land for domestic organic farming without forcing more production overseas



Limits to expanding agroecological farming

Agroecological farming can support traditional livelihoods and support wild species that do well on farmland. Some of these are under threat from practices associated with high yielding, more conventional systems, such as ground nesting skylarks that reproduce with little success in the winter sown crops developed by modern breeding techniques.

> **“Species will continue to decline if land spared by switching to alternative proteins is only used to expand agroecological farming.”**

Evidence from both Poland and the UK suggests wildlife overall would benefit from a ‘three compartment’ approach to land use where high yield farming in some places frees up land elsewhere for semi-natural habitat and to make other farming more nature-friendly, such as creating fallow plots within a crop where skylarks could nest, which typically reduces yields.[21]

But many species will continue to decline if land spared by switching to alternative proteins is only used to expand agroecological farming. These species have suffered from the loss of non-farmed land, such as forests, wetlands, scrublands and other habitats cleared to make way for agriculture. To restore nature, it is important that agroecological farming is not expanded at the expense of protecting and expanding unfarmed habitats.

In addition, though agroecological farmland may produce lower greenhouse gas emissions per unit area, it is not a net carbon sink.[22] If agroecological farming takes space away from natural habitats that can sequester carbon, it will increase demand for engineered carbon removal, increasing the cost to taxpayers of net zero.

Diet change is therefore essential for agroecological farming to expand and maintain sufficient food production; without it, expanding agroecology would reduce food self-sufficiency, as lower yields mean more food has to be sourced from overseas.

4. Alternative proteins could make space for more wildlife habitats and reduce impacts overseas

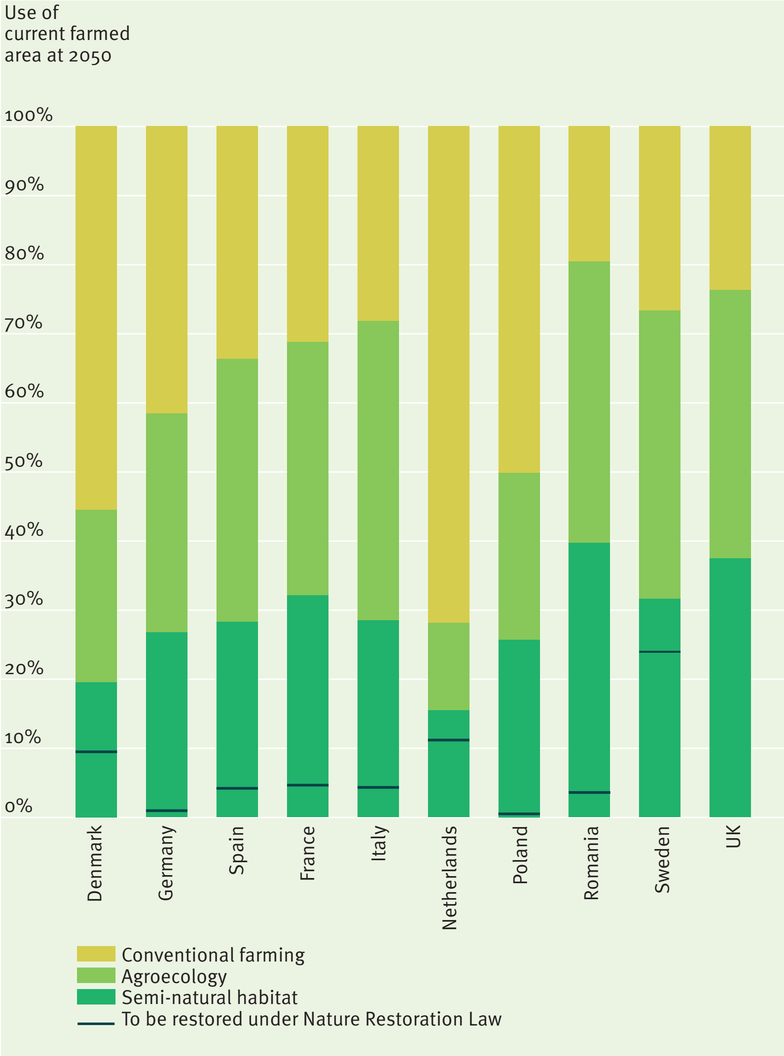
> **Lower demand for land use overseas could reduce deforestation pressures.”**

Even a low level of alternative protein uptake could allow farmers to expand agroecological farming and semi-natural habitats on a third of currently farmed land, with significant advantages for wildlife across Europe.

Our ‘high innovation’ scenario would double this opportunity to two thirds of currently farmed land. Farmers on a third of currently farmed land could be supported to restore semi-natural habitats, such as forests, bogs, fens and scrubland. In addition, a further third of currently farmed land could be agroecologically managed by 2050, benefitting the farm-adapted species that the EU’s recent Nature Restoration Law has pledged to restore. Evidence from the UK suggests using some land for habitat creation would offer a more profitable and stable future to farms in Less Favoured Areas (now called areas with natural or other area-specific constraints, or ANCs), as long as governments offer a fair price for the environmental benefits.[23]

While we have not quantified the associated nature benefits, the combination of semi-natural habitat and high nature value farming would allow the ten countries we studied to create and restore the Annex I habitats at the level required under the EU’s Nature Restoration Law.[24] In addition, lower demand for land use overseas could reduce deforestation pressures, depending on domestic policies in the countries the EU trades with, helping to support recent EU and UK commitments to deforestation-free products and ending deforestation.[25,26]

Our 'high innovation' scenario could allow all countries to create and restore the habitats required by the Nature Restoration Law[27]



Species benefitting from semi-natural habitats	Species benefitting from agroecological farming
Iberian lynx **Habitat: forest** Threatened by hunting and habitat loss primarily driven by agriculture 	**Eurasian skylark** **Habitat: open farmland** Threatened by changes to farming practices including autumn sowing and stubble loss 
Northern lapwing **Habitat: wet grassland** Threatened by habitat loss driven by agriculture 	**Grey partridge** **Habitat: farmland** Threatened by pesticides, increasing farm tidiness 
European bison **Habitat: forest** Threatened by habitat loss primarily driven by agriculture 	**Grey long-eared bat** **Habitat: meadow, grassland** Threatened by changed farm practices driving habitat loss 
Large heath butterfly **Habitat: bog** Threatened by habitat loss due to drainage of land for agriculture 	**Large blue butterfly** **Habitat: meadow, grassland** Threatened by changed farm practices driving habitat loss 

Drought and desertification in Spain

> **The changes expected in Spain also reinforces the case for the greater economic and climate resilience that alternative proteins could offer."**

Global heating is limiting both the suitability of land in Europe for agriculture and the types of habitats that can be established on land that might be freed up by alternative proteins.

Of the countries we studied, Spain is expected to have the largest area that will become unsuitable for agriculture and trees: 74 per cent of the country's land is threatened with desertification and current temperature rises have already cut the value of Spanish agriculture by six per cent.[28,29]

Farmers play a stewardship role in managing habitats in a way that reduces risks, particularly of forest fire. Policy should support farmers to take the lead in expanding suitable habitats where appropriate. Our modelling sees a variety of habitat types created in each country: woodlands, wetlands, scrub and other species-rich grassland habitats. In the face of increasing forest fires and desertification, the potential to expand woodland or high nature value farmland may be especially limited in southern Spain.[30]

However, the changes expected in Spain also reinforces the case for the greater economic and climate resilience that alternative proteins could offer. The subsequent land dividend would reduce the economic disruption caused by rapid warming and enable the country to focus on increasing its nature-based resilience.

> “We found no significant difference between the land use footprints of alternative proteins and unprocessed plant-based foods.”

Why not just eat more plants, rather than alternative proteins?

We studied the expansion of plant-based proteins, precision fermentation and cultivated meat and dairy products. However, many stakeholders we interviewed for this research suggested it would be better to eat more unprocessed fruit, vegetables, pulses and grains instead. While this is a good option, we believe alternative proteins are more likely to drive down the consumption of meat and dairy for two reasons. First, alternative proteins can closely replicate the tastes and textures of meat and dairy which many people still want. Second, it is easier to switch a beef burger to a similarly presented plant-based burger than to ask people to alter their eating habits and cook more from scratch, which is less convenient.

We conducted a sensitivity analysis in which meat and dairy consumption was only displaced by unprocessed plants rather than alternative proteins, to assess the impact on our conclusions. We found no significant difference between the land use footprints of alternative proteins and unprocessed plant-based foods, even when the energy infrastructure needed for alternative proteins is included.

On environmental grounds, policy makers should support people to choose either alternative proteins or unprocessed plant foods, or a mix of both.

Conclusions

> "Alternative proteins could open up a new vision for farming and managing Europe's rural areas, with huge potential benefits."

A shift to eating alternative proteins would create an unprecedented land dividend for Europe, avoiding difficult trade-offs between food self-sufficiency, carbon neutrality, biodiversity protection and the preservation of rural livelihoods. For geopolitical, environmental and social reasons, these are going to be major issues over the next 25 years.

Alternative proteins are much more land efficient than conventional meat and dairy products. Even accounting for the land needed to power their production, the ten countries we studied have the potential to become food self-sufficient under our 'high innovation' scenario. This could happen at the same time as expanding agroecological or high nature value farming fourfold and supporting farmers on more than a quarter of currently farmed land to create carbon sequestering, wildlife-rich natural habitats. This would result in up to nine times less demand for expensive, engineered carbon removals.

To realise this opportunity, governments will need to increase their support for alternative proteins with innovation funding and ensure rapid, well regulated approval of new products. At the same time, rural policy should anticipate the land dividend this will lead to. Policy must support farmers to change how they use their land to meet other priorities, and provide fair, long term funding for land stewardship that delivers public goods, such as carbon storage, flood and fire prevention, and biodiversity restoration.

Overall, our analysis shows that much higher consumption of alternative proteins could open up a new vision for farming and managing Europe's rural areas, with huge potential benefits. It will be crucial to engage people democratically in the opportunities that this presents.

Recommendations

1. Policy should support the development of alternative proteins in Europe with investment to drive healthier product composition and taste and cost parity, while ensuring European farmers supply the inputs.

2 To gain the land dividend we have outlined, the Common Agricultural Policy (CAP) should avoid direct payments that support conventional meat and dairy production. Combining today's CAP with reduced domestic demand for conventional animal products would see European taxpayers paying once for production, which is often exported, and then paying again to mitigate the subsequent carbon emissions and environmental damage caused by high levels of livestock production.

3. Farmers should be paid to convert land previously dedicated to conventional meat and dairy production into habitats that store carbon and restore nature. Doing so would be a cost effective way to meet climate and nature targets, and would guarantee rural livelihoods.

4. In the EU, member states should openly discuss landscape and rural economic change with their citizens, with a view to shifting CAP payments to a wider set of rural land uses.

Endnotes

1 National Food Strategy, 2021, *The evidence*; see p 140, for the rise of processed and pre-prepared meat in the UK's diet; and see p 129-133 for evidence on existing dietary transitions. The rapidly rising trend in the consumption of ready-made meals can be seen in: Systemiq, 2023, 'Ready-made meals study key insights'.

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3 Further detail and additional displacement scenarios can be found in our accompanying technical report.

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Green Alliance
18th Floor
Millbank Tower
21-24 Millbank
London SW1P 4QP

+44 (0)20 7233 7433
ga@green-alliance.org.uk

www.green-alliance.org.uk
@GreenAllianceUK
blog: www.greenallianceblog.org.uk