

FOOD NOT FEED – HOW TO STOP THE WORLD'S BIGGEST FORM OF FOOD WASTE

October 2025



**“ If the use of grain as animal feed was ended,
an extra 2 billion people could be fed each year ”**

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EXECUTIVE SUMMARY

Industrial animal production – in which large numbers of animals are crammed together in overcrowded sheds – is praised as being resource-efficient. ‘Look at how many pigs and chickens we can produce on this small parcel of land.’

But this is a deception, the clever trick of the card cheat. It hides the reality that a much larger amount of land is needed to produce the grain and soy used to feed industrially farmed animals. In fact, literally 99 times more land is needed to produce the feed for industrially farmed pigs and chickens than is used to house them on the farm.¹

But a second tranche of resource-inefficiency must be factored in. Animals convert grain – wheat, maize/corn, barley – very inefficiently into meat and milk. Studies show that for every 100 calories of human-edible grain fed to animals, just 3-25 calories enter the human food chain as meat.^{2,3} And for every 100 grams of protein in human-edible grain fed to animals, just 5-40 grams of protein enter the human food chain as meat.^{4,5}

This is inefficiency on a grand scale. It’s as if for every 100 new homes that are built, some 70 are immediately bulldozed. Medieval alchemy sought to turn base metals into gold. This is reverse-alchemy – turning nutritious grain into waste.

In light of these poor conversion rates, we need to extend the concept of food waste beyond the conventional definition (e.g. being discarded by households, retailers, restaurants, and food service operators) to include the waste entailed in feeding human-edible crops to farmed animals.



This report shows that in many countries much more food is wasted by using grain as animal feed, than is wasted in the conventional sense. The figures of waste in this report do not refer to the total grain fed to animals; they are the amount that is wasted due to several plant-derived calories or grams of protein being needed to produce one calorie or one gram of protein in meat, milk, and eggs. In the EU, for example, 124 million tonnes of grain are lost each year due to the conversion inefficiencies of producing meat, milk, and eggs compared to 59 million tonnes of conventional food waste. In the US the gap is even wider: 160 million tonnes lost via animal feed inefficiency, versus 66 million tonnes through traditional waste.

Globally 766 million tonnes of grain are wasted annually by being fed to pigs, broiler chickens, laying hens, beef cattle, and dairy cows. This is much larger than any other form of food waste. The UN Environment Programme (UNEP)'s 2024 Food Waste Index^[i] report shows other forms of global food waste in 2022 as being as follows:

- Households – 631 million tonnes
- Food service – 290 million tonnes
- Retail – 131 million tonnes

Feeding grain to animals is a waste not just of these crops but of the scarce land, water, and energy used to produce them

Soy.

The fact that a large proportion of global soy production is used as feed for farmed animals – and that this is a key driver of deforestation – is widely known. There is, however, much less recognition of the fact that huge amounts of grain are also fed to animals; indeed the use of grain far outweighs the use of soy in the feed of industrially reared animals.⁶



[i] United Nations Environment Programme, 2024. Food Waste Index Report, 2024. Nairobi.

Feeding grain to animals ...

... undermines food security

Some argue that an expansion of industrial animal production is needed in the Global South to improve food security. However, the poor conversion by animals of human-edible grain into meat and milk means that industrial animal production does not build food security, rather it undermines it.

It is also contended that in order to feed the world population as anticipated in 2050, food production must be massively increased – even by as much as 60% – and accordingly that further industrialisation of livestock production is essential.⁷ However, our calculations show that if the use of grain as animal feed were ended, an extra two billion people could be fed each year.⁸

Moreover, stopping the use of grain as feed would release huge tracts of arable land. If the use of grain and soy as feed was ended, globally around 175 million hectares of arable land could be freed up – almost the size of Indonesia. This land could instead be used to grow fruit, vegetables, root crops, nuts, seeds, and legumes such as peas and beans; all these contribute to a nutritious, varied diet. Worryingly, however, predictions by industry leader Alltech Agri-Food Outlook 2025, and a report by the UN Food and Agriculture Organization (FAO) and the Organisation for Economic Co-operation and Development (OECD), show that the global use of grain as feed is rising. If the expansion in the production of grain for feed that took place in 2024 continues in subsequent years, we will need an additional four million hectares of arable land, an area the size of the Netherlands.

Creating this extra arable land could involve encroaching into key ecosystems and displacing, even destroying, wildlife. Our own calculations indicate that the global increase in the use of grain as feed could be even greater, swallowing up huge amounts of scarce cropland which would be much more efficiently used to provide food for direct human consumption.

... pushes prices up

Furthermore, industrial livestock's huge demand for grain exerts upward pressure on its market price as both feed and food,^{9 10} potentially placing this food out of reach of poor populations in the Global South,¹¹ and exposing animal farmers to price volatility that only big industrial farms can shoulder.

... harms the environment

Industrial production's huge demand for grain as animal feed has been a key factor fuelling the intensification of crop production. This, with its use of monocultures, chemical pesticides, and synthetic nitrogen fertilisers has led to soil degradation,^{12 13} biodiversity loss,¹⁴ overuse and pollution of water,¹⁵ and air pollution.¹⁶

“ Industrial animal production does not build food security, rather it undermines it ”



The feed provided for pigs and poultry lies at the heart of this resource inefficiency and environmental degradation

Globally over two thirds – 69% – of compound feed (which mainly consists of grain and soy) is used for pigs and poultry which tend to be the most industrial of the livestock sectors. Often around 90% of pig and broiler chicken diets consists of grain and soy (broilers are the chickens reared for meat).¹⁷

99% of the land used in industrial pig and chicken farming is the land needed to grow the feed – the tiny amount of space given to the animals on the farm accounts for just 1% of land use.

And it is feed production that in most cases is the main driver of the greenhouse gas (GHG) emissions stemming from chicken and pig farming. 67-91% of the GHG emissions from industrial chicken production – and 41-68% of the emissions from industrial pig farming – arise from feed production and the associated land use change.¹⁸





How should farmed animals be fed?

Farmed animals only make an efficient contribution to food security when they are converting materials we cannot consume into food that we can eat.^{19 20}

So, farmed animals should mainly be fed on:

- pasture or other grassland
- by-products, e.g. brewers grains, citrus pulp, sunflower meal
- unavoidable food waste, e.g. unwanted bakery products, fruit and vegetables; where necessary food waste must be properly treated to make it safe for consumption
- crop residues.^{21 22}

Will mainly feeding animals on materials we can't consume result in producing less meat and milk?

Yes, it will. Moving away from industrial livestock production with its dependence on feeding grain and soy to animals, would lead to a reduction of about 50% in global production and consumption of animal-sourced food.²³ Reduced consumption of animal products must mainly take place in high- and middle-income countries.

While such a reduction may appear alarming to some, a global decrease in consumption of animal-sourced food is essential if we are to meet the Paris climate targets and the UN's Sustainable Development Goals (SDGs) while feeding ourselves within planetary boundaries.



Policy proposals for a phased transition away from the high use of grain and soy as animal feed

- 1 Reduce the use of grain and soy as feed.**
Governments must establish clear policies for reducing the use of human-edible grain and soy as feed. Pasture-based production systems must be (financially) incentivised.
- 2 Adopt a food first land policy.**
In the interests of food security, productive arable land must be used to produce food for direct human consumption.
- 3 End subsidy support for the production of grain and soy as feed.**
Subsidies should not be available for grain and soy produced for animal feed.
- 4 Increase public awareness of the resource inefficiency and environmental degradation inherent in feeding grain and soy to animals.**
Programmes are needed to increase public awareness of the implications of different animal farming methods and consumption levels for the environment, food security, human health, and animal welfare.
- 5 Require public procurement to take the lead.**
Public bodies providing food in schools, hospitals and care homes, should use meat, milk, and eggs coming from animals that have not been fed – or have only minimally been fed – on human-edible grain and soy.
- 6 Encourage the adoption of plant-rich, flexitarian diets.**
Governments should set clear targets to reduce animal-sourced food consumption in high-consuming populations and shift towards plant-rich diets, aligned with the Paris Agreement, the Global Biodiversity Framework, and the SDGs.
- 7 Require banks and other financial institutions to stop funding industrial livestock production.**
Require commercial banks, multilateral development banks and asset managers to stop funding and investing in livestock producers and ancillary businesses (such as feed mills) that use grain and soy as feed.

CHAPTER

1. INTRODUCTION



The fact that a large proportion of global soy production is used as feed for farmed animals – and that this is a key driver of deforestation – is widely known.²⁴ There is, however, much less recognition of the fact that huge amounts of grain are also fed to animals.

Globally each year around 1,000 million tonnes of grain – wheat, corn/maize, barley and oats – are fed to farmed animals.²⁵

Why does this matter? Because animals convert this grain very inefficiently into meat and milk. Studies show that for every 100 calories of human-edible grain fed to animals, just 3-25 calories enter the human food chain as meat.^{26 27} And for every 100 grams of protein in human-edible grain fed to animals, just 5-40 grams of protein enter the human food chain as meat.^{28 29} Indeed, the inefficiency is so substantial that a Compassion in World Farming study calculates that worldwide an additional two billion people could be fed each year if, instead of being fed to animals, these crops were used for direct human consumption.³⁰

Data from the International Grains Council show that 45% of the world's grain is used as animal feed.³¹ Much of this grain is incorporated into compound feed. Compound feed is a pre-mixed blend of grains, soy, vitamins and minerals; often around 75% of compound feed comprises grains and soy.³²

Figure 1

Amount of compound feed consumed globally by farmed species in 2024 in million metric tonnes

Source: Alltech Agri-Food Outlook, 2025

Poultry	595.80
Pigs	369.29
Dairy cows	165.50
Beef cattle	134.05
Other species	122.17

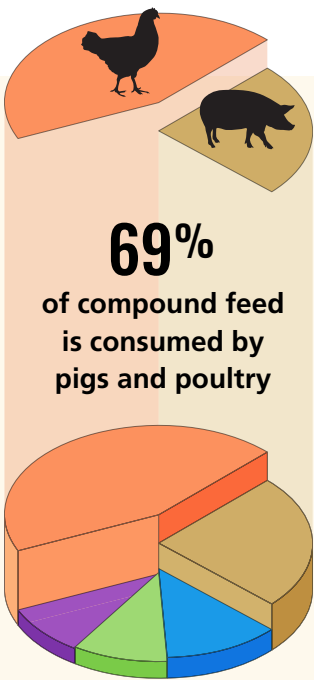


Figure 1 shows the amount of compound feed that is consumed globally by farmed species. Over two thirds – 69% – is used for pigs and poultry who tend to be the most industrial of the livestock sectors.

Figure 2

Amount of compound feed produced by region in 2024 in million metric tonnes

Source: Alltech Agri-Food Outlook, 2025

Asia-Pacific	533.14
North America	290.72
Europe	276.76
Latin America	198.38
Africa	57.79
Middle East	37.68
Oceania	10.97

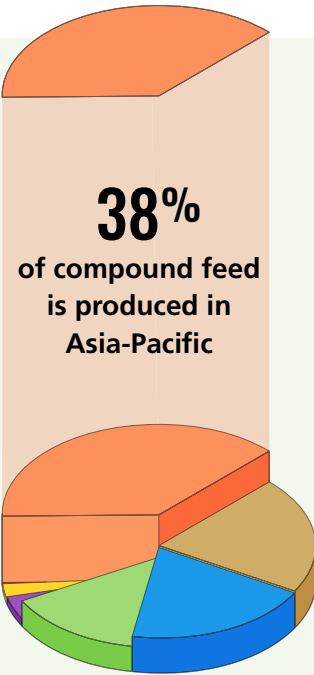


Figure 2 sets out the amount of compound feed that was produced in each region in 2024. The Asia-Pacific region is by far the largest producer of compound feed.

However, not all of the grain used as animal feed is incorporated into compound feed. Rather than buying ready-mixed feed from compound feed manufacturers, some animal producers grow the grain they need for feed themselves, or they buy grain and mix it into feed on the farm.

Composition of broiler and pig diets

A study carried out by Blonk Consultants for World Animal Protection shows the composition of pig and broiler diets in the Netherlands (which it takes as a proxy for the EU), the US, China and Brazil.³³ The proportion of the diets in each of these countries provided by grain and soy is set out in Tables 1 and 2. These show that grain comprises around two thirds of pig and broiler diets.

Table 1

The proportion of grain and soy in broiler feed in four countries

Ingredient	Netherlands	Brazil	US	China
Maize/corn %	20.0	67.5	64.6	39.0
Wheat %	48.0	-	-	18.0
Barley %	-	-	-	5.0
Sorghum %	-	-	-	9.0
Soybean %	25.0	24.4	24.6	23.0
Total of grain & soy %	93.0	91.9	89.2	94.0
Others %	7.0	8.1	10.8	6.0

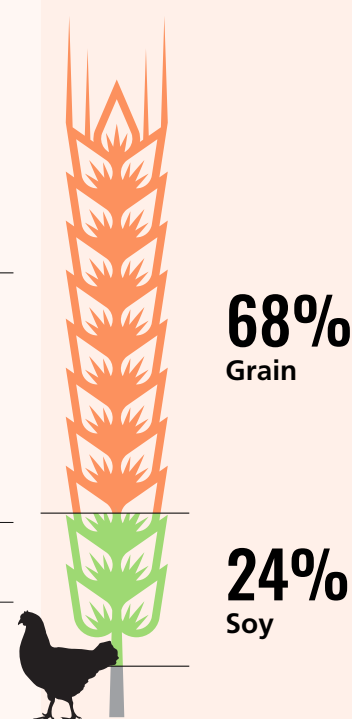
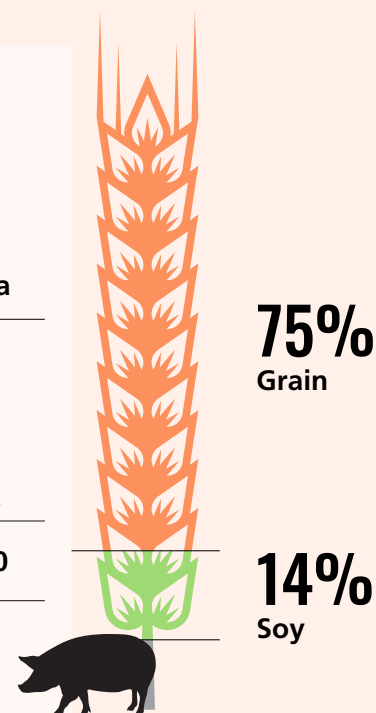


Table 2

The proportion of grain and soy in pig feed in four countries

Ingredient	Netherlands	Brazil	US	China
Maize/corn %	12.8	76.4	65.0	65.3
Wheat %	37.9	-	-	13.3
Barley %	31.1	-	-	-
Soybean %	6.8	16.9	9.3	21.4
Total of grain & soy %	88.6	93.3	74.3	100.0
Others %	11.4	6.7	25.7	-



CHAPTER

2. FEEDING GRAIN TO ANIMALS – A FORM OF FOOD LOSS



This report shows the amount of grain used as feed in several countries and calculates that in many, including the EU, China, and the US, we waste much more by using grain as animal feed than is wasted in the conventional sense, e.g. by being discarded by households, retailers, restaurants, and food service operators. The figures of waste in this report do not refer to the total grain fed to animals; they are the amount that is wasted due to several plant-derived calories or grams of protein being needed to produce one calorie or one gram of protein in meat, milk, and eggs.

“ Colossally inefficient ”

The poor conversion by animals of grain into protein and energy

Previously ‘feed conversion ratios’ tended to be based on weight, e.g. how many kilos of feed were needed to produce one kilo of meat. This is a rather crude analysis as it takes no account of the amount of nutrition fed to animals, compared with the amount contained in the ensuing meat, milk, or eggs. Accordingly, more recent studies have calculated how much protein and energy (calories) is contained in the feed provided to animals compared with the protein and calories in the resulting meat, milk, and eggs.

Cassidy *et al.* (2013) have calculated calorie and protein conversion rates for different types of animal products when human-edible grain is fed to animals.³⁴ They conclude that for every 100 calories of grain fed to animals, we get only about 40 new calories of milk, 22 calories of eggs, 12 of chicken, 10 of pork, or 3 of beef.

Regarding the conversion of grain protein into meat, milk, and egg protein, Cassidy *et al.* report that for every 100 grams of grain protein fed to animals, we get only about 43 new grams of protein in milk, 35 in eggs, 40 in chicken, 10 in pork, or 5 in beef.



For every 100% of human-edible grain fed to animals, we only get back ...

Table 3
Livestock conversion efficiencies of grain in calories and protein
Calculated by Cassidy *et al.*, 2013 ³⁵

					
Efficiency	Dairy	Eggs	Chicken	Pork	Beef
 Calorie conversion %	40	22	12	10	3
 Protein conversion %	43	35	40	10	5

More recently Fry *et al.* (2018) have calculated the protein and calorie conversion rates when grain is fed to animals. Their conversion figures are set out in Table 4.

Table 4

Livestock conversion efficiencies
of grain in calories and protein

Calculated by Fry *et al.*, 2018 ³⁶

			
Efficiency	Chicken	Pork	Beef
 Calorie conversion %	25	11	5
 Protein conversion %	34	15	10

Similarly, Rasul *et al.* (2024) calculated that in the period 2015-2019 on average 9.5 exajoules (EJ) per year contained in human-edible crops were fed to farmed animals who converted this into just 3.3 EJ contained in animal-source foods.³⁷ This means that just 34.7% of the energy contained in human-edible crops fed to animals was converted into human-edible calories, while 65.3% of the energy was lost in the sense that it provided no energy for human consumption.

In light of these poor conversion rates, we need to extend the concept of food waste beyond the conventional definition (e.g. food discarded by consumers, retailers, and other food businesses) to include the food waste entailed in feeding human-edible crops to farmed animals.

The very inefficient conversion by animals of grain into meat, milk, and eggs clearly undermines food security. It is vital that we use grain as efficiently as possible. This need is reinforced by the anticipated reduction in crop yields due to climate change.³⁸

For several countries we have calculated the amount of grain that is wasted by feeding it to animals, and then compared this to food waste in the conventional sense. The way we approached these calculations is set out in the Methodology section. The countries we selected are those where we have offices, together with Spain which is one of the EU’s foremost livestock producers, and Brazil which is included as a major producer of soy and farmed animals.



Methodology of the report's calculations for Table 5

The amount of food waste entailed in feeding human-edible grain to farmed animals was calculated as follows. First, the amount of grain used as feed in the country concerned was found in government or industry publications in the case of the EU, France, the UK and the US. For the other countries it was found from data produced by the UN Food and Agriculture Organization (FAO). Next, the amount of grain used as animal feed in the country concerned was allocated to each of the main farmed species.

Then the rate at which each species converts the calories and protein in grain into meat, milk, or eggs was taken from Cassidy *et al.* and Fry *et al.* In each case the more efficient conversion rate provided by Cassidy or Fry was used to avoid overstating the loss of calories and protein in feeding grain to animals. The counterpart of the conversion ratio is the waste ratio which shows the proportion of grain fed to animals that is wasted, in the sense that it does not produce any protein or energy for human consumption. Next, the waste ratio was used to calculate the amount of grain wasted annually as a result of it being fed to animals. This figure does not refer to the total grain fed to animals; it is the amount that is wasted due to several plant-derived calories or grams of protein being needed to produce one calorie or one gram of protein in meat, milk, and eggs.

Finally, the total amount of grain lost looked at through both poor protein and calorie conversion lenses was combined, and then divided by two to produce one overall figure of the annual loss due to the poor conversion of the protein and energy in grain into meat, milk and eggs.

This figure was compared with the amount of food loss and waste per year in the conventional sense, e.g. by consumers, retailers, and other food businesses discarding unwanted food.

Details of all the calculations can be found in our
Supplementary materials: www.ciwf.org/supplementary

Note re years used in our calculations: The figures in Tables 5 & 6 relate to recent years, mainly to 2020-2024. Details of the years involved for the EU, US, UK, and France are in the [*Supplementary materials*](#). For the other countries, data from 2020-2022 was used. The headings in Tables 5 & 6 refer to various data 'per year'. In fact they are data for a recent year/s; however, we believe it is acceptable to regard them as typical annual figures during the mid-2020s.

Table 5

Key food waste data for several countries
per year in million tonnes

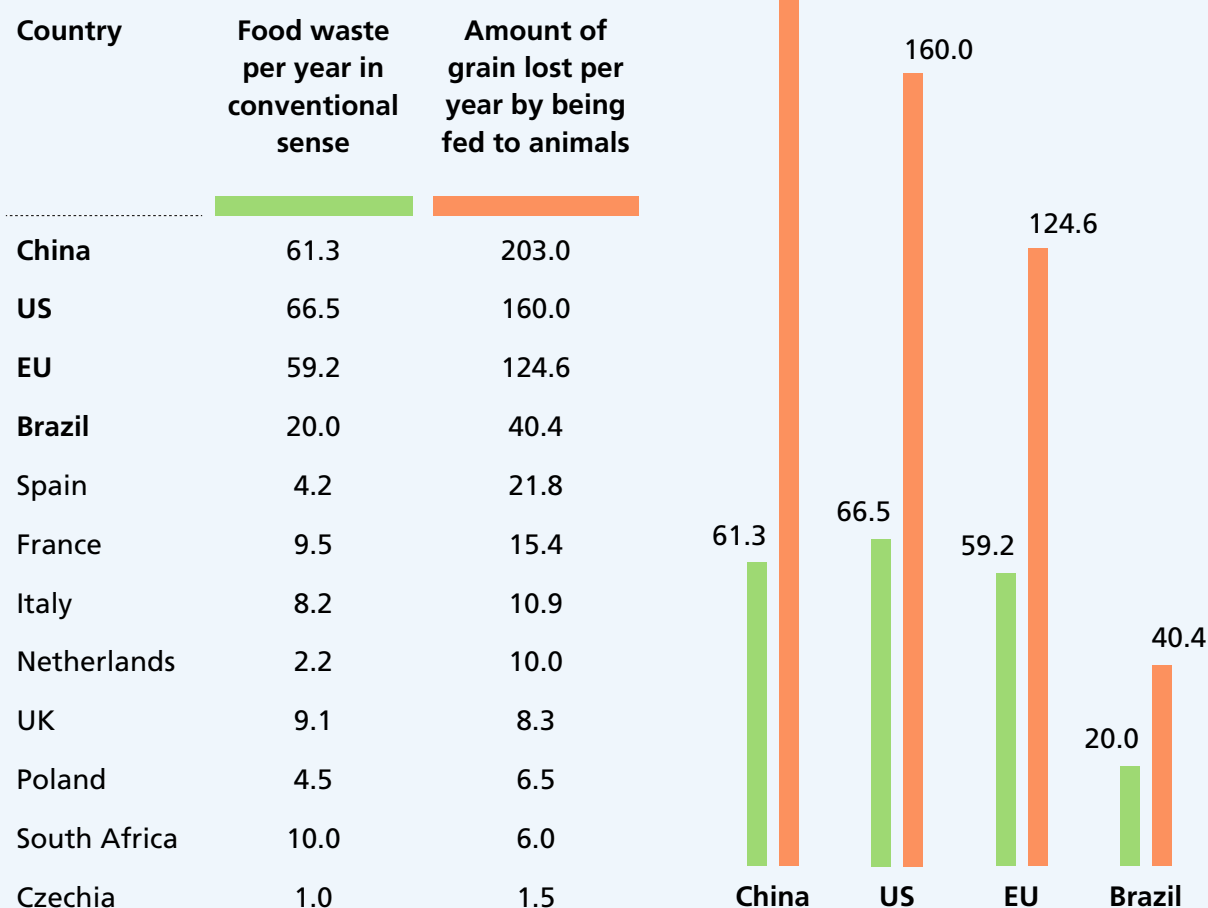
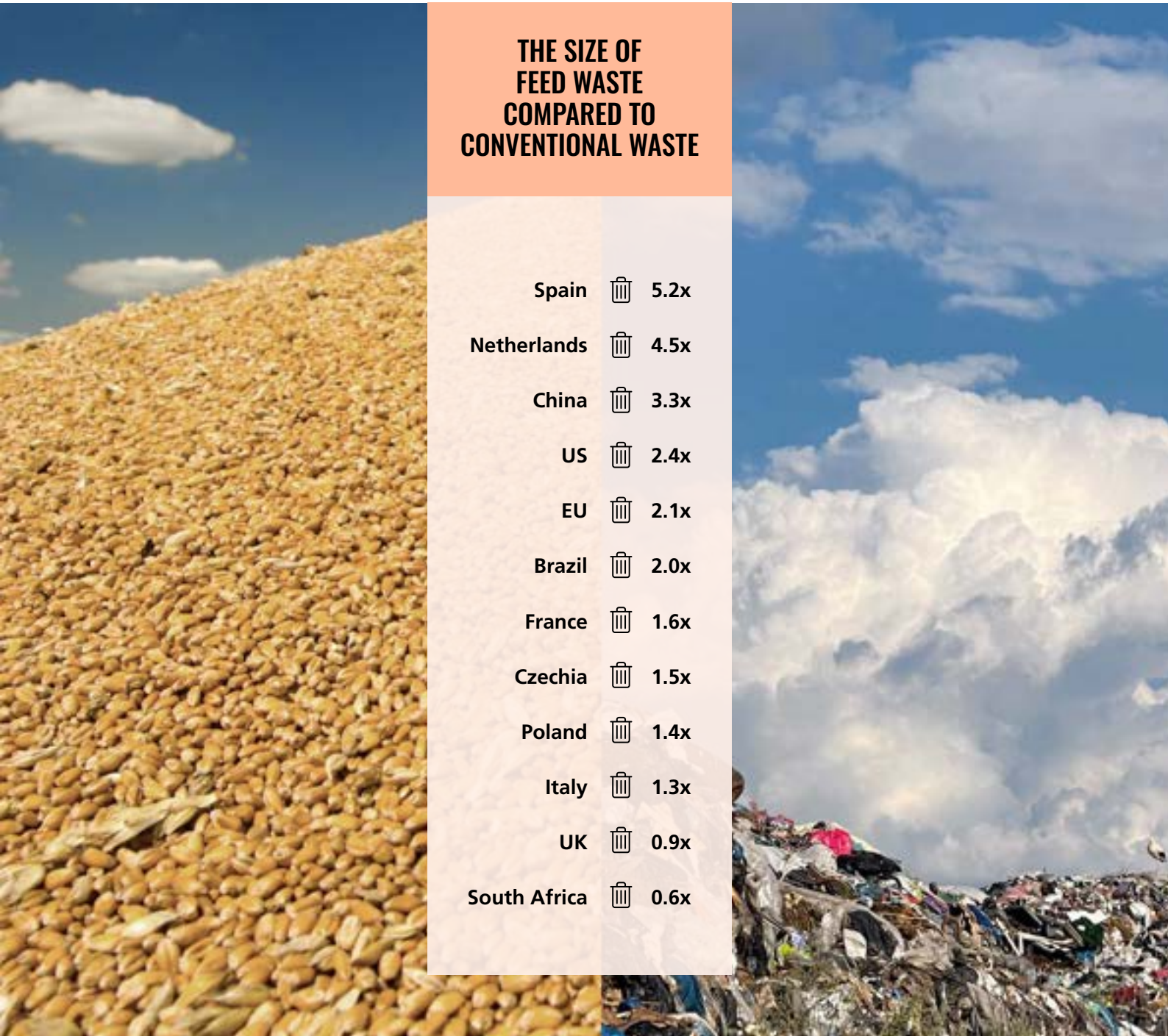


Table 5 shows that in most of the countries that we studied, the food wasted by feeding grain to animals is greater than food waste in the conventional sense.

Additional details for Table 5 can be found in the Annex on page [56](#)





Globally 766 million tonnes of grain are wasted annually by being fed to pigs, broiler chickens, laying hens, beef cattle, and dairy cows; see the Supplementary materials: www.ciwf.org/supplementary

This is much larger than any other form of food waste. The UN Environment Programme (UNEP)'s 2024 Food Waste Index³⁹ report shows other forms of food waste in 2022 as being as follows:

- Households – 631 million tonnes
- Food service – 290 million tonnes
- Retail – 131 million tonnes

In Table 6 we set out the number of additional people who could be fed annually in various countries if the use of grain as animal feed was brought to an end. We recognise that not all the grain used as feed is suitable for human consumption, but we are not proposing that all of this grain should be directly eaten by people. What is released if grain is no longer used as feed is not so much the grain, but the arable land on which it is grown. Accordingly, Table 6 also shows the amount of arable land that would be released if the use of grain as feed was ended. This land should instead be used to produce a wide variety of crops for direct human consumption such as fruit, vegetables, root crops, nuts, seeds, and legumes such as peas and beans; all these contribute to a nutritious, varied, and healthy diet.

Methodology of the report’s calculations for Table 6

To determine the additional number of people who could be fed we have taken the figure in Table 5 for the tonnage of grain lost each year by its use as feed and calculated the amount of calories contained in that grain, using UN Food and Agriculture Organization (FAO) figures on the calorie content of grain. The average dietary energy requirement per person is 2,353 kcal/person/day⁴⁰ which amounts to 858,845 calories per year. Dividing the calories in the grain lost by its use as feed by the average annual calorie requirement per person, shows how many additional people could be fed by ending the use of grain as feed.

Using the number of calories saved by no longer feeding grain to farmed animals is a broad proxy for the amount of food that could be grown on the arable land no longer used to grow grain for feed. In reality some of that food will contain more calories than grain and other foods will contain fewer calories, but may well provide other vital components of a healthy diet. For example, fruit and vegetables generally provide fewer calories than grain but include vitamins, minerals, and fibre that are essential for a nutritious diet.

To determine the amount of arable land that could be released, we have taken the amount of arable land used in a particular country to produce grain, and calculated the amount of that land used to grow feed on the basis of the proportion of that country’s grain used as feed.

Our calculations take account of the fact that when grain is no longer used to feed animals, around 50% of these crops (or other crops) and land are still needed to replace the reduction in production of animal-sourced food due to ending the feeding of grain to animals, while around 50% are ‘saved’ and can be used to feed additional people.

Details of all the calculations can be found in our
Supplementary materials: www.ciwf.org/supplementary

Table 6

Number of people who could be fed each year and amount of arable land that would be released if the arable land currently used to grow grain for feed was instead used to produce food for direct human consumption.



Country	Amount of grain lost per year by being fed to animals	Number of people who could be fed per year	Amount of arable land that would be released
China	203 million tonnes	403.0 million	19.6 million hectares
US	160.0 million tons	287.8 million	18.0 million acres (= 7.2 million hectares)
EU	124.6 million tonnes	247.1 million	14.8 million hectares
Brazil	40.4 million tonnes	80.2 million	7.6 million hectares
Spain	21.8 million tonnes	43.2 million	2.3 million hectares
France	15.4 million tonnes	30.5 million	1.4 million hectares
Italy	10.9 million tonnes	21.7 million	0.8 million hectares
Netherlands	10.0 million tonnes	19.8 million	0.07 million hectares
UK	8.3 million tonnes	16.5 million	0.8 million hectares
Poland	6.5 million tonnes	12.8 million	2.0 million hectares
South Africa	6.0 million tonnes	12 million	0.8 million hectares
Czechia	1.5 million tonnes	3.0 million	0.3 million hectares

STAGGERINGLY INEFFICIENT

Experts describe the use of grain to feed animals as ‘staggeringly inefficient’,⁴¹ ‘colossally inefficient’⁴² and ‘a very inefficient use of land to produce food’.⁴³ The European Commission’s Joint Research Centre has said that: ‘the use of highly productive croplands to produce animal feedstuffs ... represents a net drain on the world’s potential food supply’.⁴⁴

The UN Food and Agriculture Organization (FAO) has said: ‘When livestock are raised in intensive systems, they convert carbohydrates and protein that might otherwise be eaten directly by humans and use them to produce a smaller quantity of energy and protein. In these situations, livestock can be said to reduce the food balance’.⁴⁵ The FAO warns that further use of grain as animal feed could threaten food security by reducing the grain available for human consumption.⁴⁶

The United Nations Environment Programme’s (UNEP) 2022 Emissions GAP Report states that: ‘more efficient use of resource is essential to fight food insecurity and malnutrition ... Reducing the use of much of the world’s grain production to feed animals and producing more food for direct human consumption can significantly contribute to this objective’.⁴⁷

The very poor conversion of human-edible grain into meat and milk totally undermines the myth that industrial farming of animals is efficient; in fact it is profoundly inefficient and is a massive drain on the world’s food supply.



European Union: food wasted by feeding grain to animals

Over 59 million tonnes of food waste were generated in the EU in 2022.⁴⁸ Most of this was produced by households, retailers, restaurants, food service, and food manufacturers.

However, much more is wasted – **124 million tonnes** per year – by using grains such as wheat, barley, oats, and maize as animal feed.

On an individual level, Eurostat states that on average food waste per EU inhabitant amounts to 132 kg of food per year (this includes not just the food wasted by households but the food wasted by food businesses and in primary production).⁴⁹ In contrast to this, the 124 million tonnes of grain wasted each year in the EU by feeding these crops to animals, translates into an average of 275 kg of grain being wasted annually per EU inhabitant. Clearly twice as much food is wasted by feeding grain to farmed animals as is wasted in the conventional sense.

The European Commission states that nearly two thirds of EU grain is used as animal feed.⁵⁰ This figure is borne out by FEFAC – Fédération Européenne des Fabricants d'Aliments Composés – which represents the European compound feed industry. FEFAC states that: 'livestock represents the primary market for EU-produced cereals, accounting for 61% of internal usage'.⁵¹

FEFAC breaks this down as follows: up to 32% of grain consumed in the EU is directly used by farmers to feed their animals, while 29% of grain is used by the compound feed industry.

FEFAC adds that another 15% is used for seeds, biofuels, and other industrial uses, leaving just 23% of EU grain being used for direct human consumption.

As with the global position, two thirds – 65% – of EU compound feed production is used for pigs and poultry.⁵²

There is something profoundly questionable about so much of EU grain production being used to feed animals while so little is used for direct human consumption. The EU has created a situation where two destructive forms of agriculture – industrial animal agriculture and agrochemical-based, monoculture crop production – are mutually dependent on each other. The grain sector is dependent on the industrial livestock sector to mop up its huge surplus of crop production, while the industrial farming of animals would not be viable without massive amounts of subsidised cheap grain.

Research shows that the EU's Common Agricultural Policy (CAP) subsidies for meat and dairy production are much higher than first appears to be the case, once the subsidies for feed production are taken into account.⁵³ Kortleve *et al.* (2024) calculate that subsidies for poultry more than double once subsidies for feed production are included; they rise from €0.06 per kg to €0.15 per kg. Subsidies for pigs quadruple once subsidies for feed production are taken into account; they increase from €0.07 per kg to €0.28 per kg.⁵⁴



US: food wasted by feeding grain to animals

The US Department of Agriculture (USDA) states: 'In the United States, food waste is estimated at between 30-40 per cent of the food supply. This is based on USDA estimates of 31 per cent food loss at the retail and consumer levels. This added up to approximately 133 billion pounds [66.5 million tons] and US\$161 billion worth of food in 2010.'⁵⁵

However, the US wastes much more – **160 million tons** per year – by using grain as animal feed.

Our World in Data calculates that 50.25% of US grain is used as animal feed.⁵⁶ A 2025 report prepared for the Institute for Feed Education and Research estimates that in 2023 the amount of grain used as animal feed in the US was 202,764,885 tons.⁵⁷ Corn comprises the vast majority of grain used as feed in the US.⁵⁸

Shepon *et al* (2018) examined the food losses in the US 'associated with consuming resource-intensive animal-based items instead of plant-based alternatives which are nutritionally comparable, e.g. in terms of protein content'.⁵⁹ The study refers to such losses as 'opportunity food losses'.

The researchers found that the 'opportunity food losses of beef, pork, dairy, poultry, and eggs are 96%, 90%, 75%, 50%, and 40%, respectively'. This means that, for example, 90% of the crops fed to pigs are lost, i.e. they provide no nutrition for human consumption. The study points out that these losses arise 'because plant-based replacement diets can produce 20-fold and two-fold more nutritionally similar food per cropland than beef and eggs, the most and least resource-intensive animal categories respectively'. The study adds: 'Concurrently replacing all animal-based items in the US diet with plant-based alternatives will add enough food to feed, in full, 350 million additional people', which is more than can be achieved by completely eliminating all conventional food losses in the US.

UK: food wasted by feeding grain to animals

A UK Parliament research briefing states that the Waste and Resources Action Programme 'estimated that in 2021, total food waste in the UK amounted to 9.1 million tonnes (Mt); this does not include waste on farms. By weight, most food waste comes from households (6.4Mt), followed by manufacturing (1.4Mt) hospitality and food service (1.1Mt) and retail (0.2Mt).'⁶⁰

However, almost as much – **8.3 million tonnes** per year – is wasted by using grain as animal feed. Calculations based on the Defra report *Agriculture in the UK 2024* show that 52.8% of UK grain – wheat, barley, and oats – are used as animal feed.⁶¹

France: food wasted by feeding grain to animals

The European Commission states that food waste amounted to 9.5 million tonnes in France in 2022 and amounted to 133 kg per person in 2020.⁶² This includes food loss and waste from primary production, processing and manufacturing, retail and other distribution of food, restaurants and other food services, and households. However, more is wasted – **15.4 million tonnes** per year – by using grain such as wheat, maize, and barley as animal feed. The largest user of grain in France is the animal feed sector.⁶³

The French livestock sector is highly dependent on imports. It imports over three million tonnes of soybeans a year, mainly from Latin America.⁶⁴ Likewise, intensive animal production requires a significant use of synthetic fertilisers for the production of grain as animal feed. 80% of these fertilisers are imported.⁶⁵

MICRONUTRIENTS

Micronutrients are essential vitamins and minerals the body needs in small amounts for various bodily functions.

Iron

Berners-Lee *et al.* (2018) calculate that the human-edible crops grown worldwide contain an average of 74 milligrams of iron per person per day (mg/p/d).⁶⁶ Of this, harvest losses, post-harvest losses, uses of crops for seeds, losses during trade and non-food uses account for 12 mg/p/d, leaving 62 mg/p/d available for consumption. Two thirds of this (41 mg/p/d) is fed to animals, which deliver only 3 mg/p/d to the human food chain as iron in meat, dairy, and fish. A return of just 7%.

Zinc

Berners-Lee *et al.* (2018) calculate that the human-edible crops grown worldwide contain an average of 42 milligrammes of zinc per person per day (mg/p/d). Of this, harvest and post-harvest losses, use of crops for seeds, losses during trade and non-food uses account for 9 mg/p/day, leaving 33 mg/p/d available for consumption. Over half of this (19 mg/p/d) is fed to animals, which deliver only 4 mg/p/d to the human food chain as zinc in meat, dairy, and fish. A return of just 21%.

Vitamin A

Berners-Lee *et al.* (2018) report that – in contrast with the position on energy, protein, iron and zinc – animals provide more vitamin A for human consumption than they are fed in human-edible crops, with a 214% return.



CHAPTER

3. FUTURE PROJECTIONS



While ending the use of grain as feed would release huge tracts of arable land (see Table 6), large amounts of additional arable land would be needed if the use of grain to feed animals was to increase. The *Alltech Agri-Food Outlook 2025* states that feed production expanded by 16.7 million tonnes in 2024, an increase of 1.2%. If such an increase were to again take place in 2026 or any other year this decade, huge amounts of additional land and water would be needed to produce this extra feed.

The World Bank Group states that an average of 4.182 tonnes of cereals are produced per hectare.⁶⁷ To produce an additional 16.7 million tonnes would require an extra 4 million hectares of arable land (3.99 million hectares to be exact). This is almost equivalent to the size of the Netherlands.

This is unlikely to be a unique event in one exceptional year. The *OECD-FAO Agricultural Outlook 2025-2034* estimates that the global production of cereals for feed will increase by 134 million tonnes by 2034 compared with a base period of 2022-24.⁶⁸ The OECD-FAO argues that much of this additional production can be met by increased yields per hectare, but this may well not be the case as climate change is projected to negatively impact cereal yields.⁶⁹

Similarly, large volumes of extra water will be needed to produce these additional cereals required for feed production. Research on water use refers to blue and grey water footprints. The blue water footprint denotes the volume of surface and groundwater consumed as a result of the production of a crop. The grey water footprint refers to the water needed to assimilate the pollution generated by a crop's production.

Hoekstra (2020) calculates that 412,000 litres of blue and grey water are needed on average to produce one tonne of cereals. To produce an additional 16.7 million tonnes of cereals as feed would require an extra 6,880 billion litres of blue and grey water each year; this is equivalent to 2.7 million Olympic size swimming pools.

The additional arable land needed to produce the anticipated increased demand for cereals as feed can presumably be used each year, i.e. a new 4 million hectares of arable land will not need to be brought into production each year. This said, if these feed cereals are produced in monocultures with substantial use of agro-chemicals, the land used will degrade over time and produce lower yields so requiring additional arable land to be brought into production.

However, new blue and grey water will to some extent be needed each year to support the increased demand for feed cereals as rainwater is often insufficient to fully replenish rivers, lakes, and groundwater, and to provide sufficient new water to assimilate pollutants.

Compassion in World Farming has also calculated its own projections of future trends and these indicate a potentially much greater growth in the use of grain as feed.

Methodology

To project future trends based on business as usual (BAU) in the use of barley, corn, and wheat for animal feed, a log-linear regression approach was employed in six world regions (Africa, the Americas, Asia, Europe, Oceania). Feed use data for the selected regions from 2010 to 2022 were obtained from the FAO Food Balances dataset (<https://www.fao.org/faostat/en/#data/FBS>). To account for potential non-linear growth patterns and stabilise variance, the natural logarithm of the outcome variables was calculated. A linear regression model was then fitted to the log-transformed data using year as the independent variable. The resulting models were used to forecast values for the years 2023 through 2040. Predictions were generated on the log scale and subsequently back-transformed to the original scale, allowing for interpretation in actual units. 95% confidence intervals were calculated to reflect uncertainty in the forecasts.

The 50% reduction scenario was modelled by applying a smooth reduction factor to BAU projections from 2023 to 2040, reaching 75% of BAU by 2030 and 50% by 2040, using monotonic spline interpolation. This factor was applied to both the fitted values and their confidence intervals. We considered a first 25% reduction by 2030 as a feasible short-term target, allowing gradual adaptation of agricultural systems. All analyses were conducted using RStudio (version 2025.05.0).

Figure 3

Historical and projected grain use for animal feed in several regions (Africa, Americas, Asia, Europe, Oceania, and the entire world), projections from 2023 to 2040 under two scenarios: business as usual (BAU) using log-linear regression models, and a 50% reduction by 2040 compared with BAU. Dashed red lines represent BAU projections, while blue dashed lines represent the 50% reduction scenario. Shaded areas indicate 95% confidence intervals, and the grey shading highlights the 2023-2040 projection period.

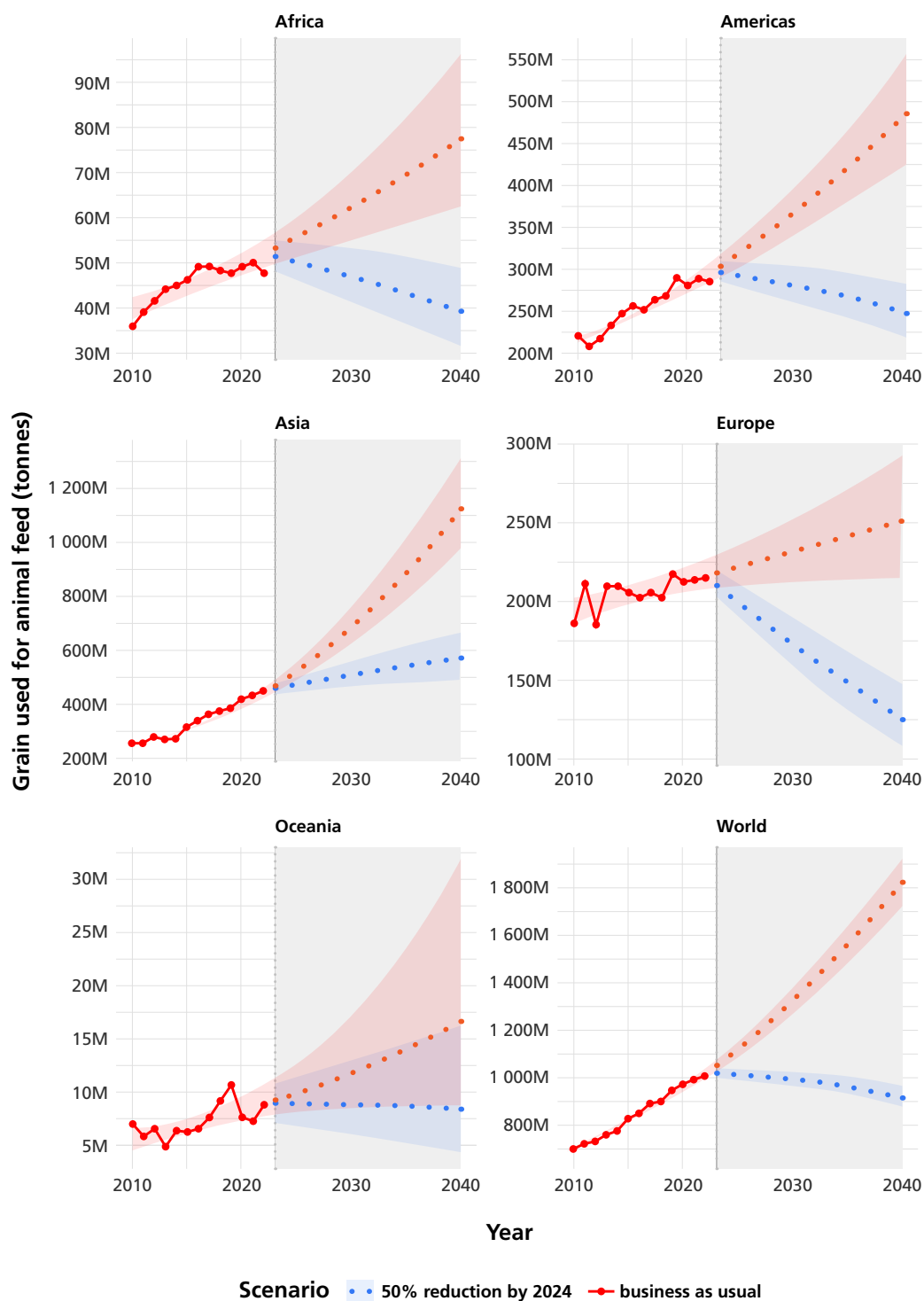


Table 7

Summary statistics of amount of grain fed to animals per year for each world region, including the 2022 values, projected BAU values for 2030 and 2040, the absolute increase relative to 2022, percentage change, fold increase, the model's coefficient of determination (R^2), which indicates the goodness of fit, and the amount of grain released from its use to feed animals if predicted BAU increases are reduced by 25% in 2030 and by 50% in 2040.

Area	Africa	Americas	Asia	Europe	Oceania	World
Amount of grain fed to animals per year in 2022 in million tonnes	48	283	451	214	9	1010
Amount of grain lost per year by being fed to animals in 2022 in million tonnes	38	224	356	169	7	793
Predicted amount of grain fed to animals per year in 2030 in million tonnes	62	371	683	230	12	1320
Amount of grain lost per year by being fed to animals by 2030 in million tonnes	49	293	539	182	9	1050
Predicted amount of grain fed to animals per year in 2040 in million tonnes	77	490	1130	250	17	1820
Amount of grain lost per year by being fed to animals by 2040 in million tonnes	61	387	896	197	13	1440
Absolute predicted increased amount of grain used to feed animals from 2022 to 2040 in million tonnes	30	207	684	35	8	820
Predicted percentage of increase (%)	62,33	72,99	151,79	16,61	89,26	81,54
Predicted times increase from 2022 to 2040	1,62	1,73	2,52	1,17	1,89	1,82
R^2 values	0,73	0,92	0,97	0,43	0,44	0,99
Amount of grain released from its use to feed animals in 2030 if 25% reduction is applied in million tonnes	15	93	171	57	3	331
Amount of grain released from its use to feed animals in 2040 if 50% reduction is applied in million tonnes	38	245	567	125	8,4	912



Future grain use by region

Among the regions analysed, Asia, the Americas, and Oceania exhibit the most pronounced increases in projected grain use to feed farmed animals between 2022 and 2040 (**Figure 3**). Asia leads with a dramatic increase from 451 million tonnes in 2022 to 1,130 million tonnes in 2040 (**Table 7**), representing a 151.79% rise (**Table 7**). The Americas follow with an increase from 283 million tonnes in 2022 to 490 million tonnes in 2040, making a 72.99% rise (**Table 7**). Oceania, while smaller in absolute numbers, is projected to increase from 9 million to 17 million tonnes by 2040 – an 89.26% rise (**Table 7**).

Africa shows a more moderate increase but still significant, from 48 million tonnes in 2022 to 77 million tonnes in 2040 – a 62.33% increase (**Table 7**). In contrast, Europe’s projected increase is the smallest, with a rise of just 16.61% from 2022 to 2040, representing an additional 35 million tonnes (**Table 7**).

Globally, the total amount of grain fed to animals is projected to rise from 1,010 million tonnes in 2022 to 1,820 million tonnes by 2040, representing a total increase of 820 million tonnes, an 81.54% increase (**Table 7**).

Africa, Americas, and Asia have high R^2 values (0.73, 0.92 and 0.97, respectively), suggesting strong confidence in the projected increases in grain use for animal feed (**Table 7**). In contrast, Europe and Oceania show lower R^2 values (0.43 and 0.44, respectively), indicating more uncertainty in the accuracy of the projections for these regions.

Asia’s massive projected feed demand will lead to predicted annual grain losses due to the inefficiency with which animals convert grain to meat, milk, and eggs exceeding 896 million tonnes of grain by 2040, underscoring the immense resource drain inherent in intensive livestock production. The Americas follow closely, with substantial projected annual losses of 387 million tonnes by 2040. Europe and Africa also experience significant losses, with annual grain losses expected to reach 197 million tonnes in Europe and 61 million tonnes in Africa by 2040. Oceania, while smaller in absolute numbers, will experience a projected loss of 13 million tonnes by 2040 (**Table 7**).

The projected increases in grain use for animal feed in Asia and Americas may reflect ongoing industrialisation and the rising demand for cheap animal protein, such as poultry, driven by expanding middle classes and urbanisation. Asia’s rapid growth, particularly in countries like China, underscores the shift towards more intensive livestock systems.⁷⁰ The increase in feed demand in these regions highlights the inefficiency of current systems, with vast quantities of food resources being diverted away from addressing food security challenges.⁷¹ Meanwhile, regions such as Europe are seeing more gradual changes in feed demand, partly due to shifts toward sustainable and plant-based diets.⁷²



In light of the projected increases in grain use for animal feed, we explored the potential impact of reducing the amount of grain used as animal feed compared with BAU predicted increases. To achieve a 50% reduction by 2040, we also explored a more gradual, feasible approach, analysing a 25% reduction by 2030, which represents an achievable short-term target that allows for the adaptation of agricultural systems. These reductions could significantly free up grain for alternative uses, such as direct human consumption, contributing to improved food security and environmental sustainability.

By 2030, applying a 25% reduction globally would release approximately 331 million tonnes of grain compared with BAU predicted increases. Of this, 171 million tonnes would come from Asia and 93 million tonnes from the Americas (Table 7). By 2040, a more ambitious 50% reduction could free up 912 million tonnes globally, with 567 million tonnes coming from Asia and 245 million tonnes from the Americas (Table 7). These reductions would create significant opportunities to redistribute grain towards human consumption and more sustainable agricultural practices such as crop diversification, integrated crop-livestock systems, and organic farming.



The impact of such reductions extends beyond food security. By reducing the amount of grain used for animal feed, we could also reduce the land, water, and energy required for growing grain⁷³ while contributing to environmental sustainability, climate mitigation, and opportunities for higher animal welfare. This would lead to environmental benefits, including lower carbon footprints, and potentially improved biodiversity, as less land would be needed for monoculture crops destined for animal feed. Therefore, by freeing up grain that would otherwise go to animal feed, we have the chance to optimise resource use globally, reduce waste, and help mitigate environmental impacts, all while supporting more sustainable practices in the agricultural sector.

“ If, as projected, demand for grain as animal feed could soar, large amounts of extra arable land and water will be needed to produce these crops, making it even harder to feed the growing world population ”

CHAPTER

4. THE GREATER PART OF FACTORY FARMING’S ENVIRONMENTAL HARMS ARISE FROM FEED PRODUCTION

Industrial production’s huge demand for grain as animal feed has been a key factor fuelling the intensification of crop production. This, with its use of monocultures, chemical pesticides and synthetic nitrogen fertilisers has led to soil degradation,⁷⁴⁷⁵ biodiversity loss,⁷⁶ overuse and pollution of water,⁷⁷ and air pollution.⁷⁸ In short, industrial animal agriculture undermines the key resources on which long-term productive farming depends.



Detrimental impact of synthetic nitrogen fertilisers

A significant proportion of synthetic nitrogen fertilisers are used to grow feed crops for animals.⁷⁹

The World Bank's report *Detox Development* and other research shows that while synthetic nitrogen fertilisers can boost productivity in the short term, in the longer term they can lead to soil acidification, reduced soil fertility and quality, and hence to diminishing crop productivity.^{80 81 82}

Moreover, long-term use of nitrogen fertilisers can lead to a decline in soil carbon and soil organic matter⁸³; this undermines soils' ability to contribute to the mitigation of climate change.

Most of the nitrogen in synthetic fertilisers is not absorbed by the crops

The *Detox Development* report highlights the low efficiency of nitrogen fertilisers with less than half of the nitrogen applied to crops reaching the harvested crop. It points out the nitrogen that is not absorbed by crops 'gets lost to the surrounding environment in its multiple chemical forms – as nitrites and nitrates, polluting the waterways; as anhydrous ammonia or nitrogen oxide, worsening air quality; and as nitrous oxide, exacerbating climate change and stratospheric ozone depletion'.

The planetary boundary for nitrogen has already been exceeded⁸⁴, and the World Bank *Detox Development* report says that: 'some believe that nitrogen is the world's largest externality, exceeding even carbon'. A 2022 paper published in the journal *Nature* stresses that: 'the use of synthetic nitrogen fertiliser is unsustainable'.⁸⁵

Ailing waters

In a section headed 'Ailing waters' the World Bank report states: 'The massive increase in nitrogen fertilisers has left a scar across many of the world's water bodies. ... Runoff of excess nitrogen can lead to cyanobacteria-related algal blooms ... Large algal blooms can devastate ecosystems, often resulting in hypoxia or dead zones, a condition that arises when water bodies lack sufficient oxygen'.

Air pollution

The World Bank report states: 'Fertiliser is a key culprit in nitrogen pollution, which fouls the air and water worldwide'. The report points out that some of the nitrogen applied as fertiliser ends up in the atmosphere where it is a key cause of air pollution, as it contributes to the formation of fine particulate matter that adversely affects human health.

Climate change

Menegat *et al.* (2022) state that GHG emissions arise from both the manufacture and the application of nitrogen fertilisers.⁸⁶ They stress that: 'reducing overall production and use of synthetic nitrogen fertilisers offers large mitigation potential'.⁸⁷ Much of the nitrogen fertiliser applied in agriculture gets broken down by microbes in the soil, releasing nitrous oxide into the atmosphere.



Detrimental impact of chemical pesticides

A substantial proportion of pesticides are used to grow animal feed crops.⁸⁸ It has been estimated that around 44% of the highly hazardous pesticides sold in 2018 were sprayed on just two crops: soya beans and maize,⁸⁹ and 77% of global soy production⁹⁰ and 56% of the world’s maize production⁹¹ are used as animal feed ingredients.

The FAO points out that: ‘extensive use of pesticides tends to reduce soil biodiversity, unbalance the ecosystem with an oversimplification of the species present and pave the way for pathogenic organisms to prevail’.⁹² In effect pesticides contribute to the very problem they are intended to address.

The FAO adds that monocultures, which are at the heart of intensive crop production, ‘result in proliferation of above-ground and below-ground pests and pathogens, which require introduction of pesticides in intensively managed fields’. So, intensive farming contributes to a problem – proliferation of pathogens and pests – and then tries to tackle the problem with a solution – chemical pesticides – that in turn creates further problems.

The European Commission states: ‘The use of chemical pesticides in agriculture contributes to soil, water and air pollution, biodiversity loss and can harm non-target plants, insects, birds, mammals, and amphibians’.⁹³



The inefficiency of feeding grain to animals is compounded by its high, polluting use of water and land, and its large GHG emissions

Water – use and pollution

The majority of water use and pollution in the intensive livestock sector arises from the production of grain and soy as animal feed. Hoekstra (2020) states: 'The water footprint of feed contributes 98 per cent to the water footprint of meat and dairy.'⁹⁴ He calculates that animals fed on cereals and soy (industrially farmed animals) use 43 times as much surface- and groundwater and are 61 times as polluting of water as animals fed on grass and other roughages.

The FAO states: 'Often, over 90 per cent of the water consumption in livestock and poultry production is associated with feed production'.⁹⁵ It also states: 'identifying the origin, type and quantity of feedstuff used for livestock feeding and determining the water use associated with feed production is of paramount importance in livestock water use assessments'.⁹⁶

Land use – broilers

A Wageningen study states that the production of regular broilers requires 3.58 m² of land/kg live weight per bird.⁹⁷ Taking an average slaughter weight of 2.2 kg, this means that the production of regular broilers requires 7.8 m² of land per bird. If broilers are stocked at 39 kg/m², they each have around 564 cm² of floor space – meaning that over 7.74 m² of the 7.8 m² of land needed to rear each broiler is the land required to grow the feed. In short, feed production contributes 99% to the land use of broiler production.

Land use – pigs

A study by Zu Ermgassen *et al.* (2016) calculates that the production of pigmeat requires 3.6 – 4.3 m² of land/kg live weight.⁹⁸ If we take the lower figure – 3.6 m²/kg live weight – and assume a slaughter weight of 110kg, the production of pigs requires 396 m² of land per pig. The EU Pigs Directive (2008/120/EC) requires each pig to be given 1 m² of land – meaning that 395 m² of the 396 m² of land needed to rear each pig is the land required to grow the feed. In short, as with broilers, feed production contributes 99% to the land use of pig production.

Greenhouse gas emissions

The Blonk study contains detailed information of the GHG emissions from broiler and pig production. Tables 8 and 9 show the amount of GHGs emitted by broiler and pig production respectively in each of the Netherlands (which is taken by Blonk as a proxy for the EU), Brazil, the US, and China.

The tables on the next page show the overall emissions and also the amount of emissions due to feed production and land use change; most land use change will be due to feed production.

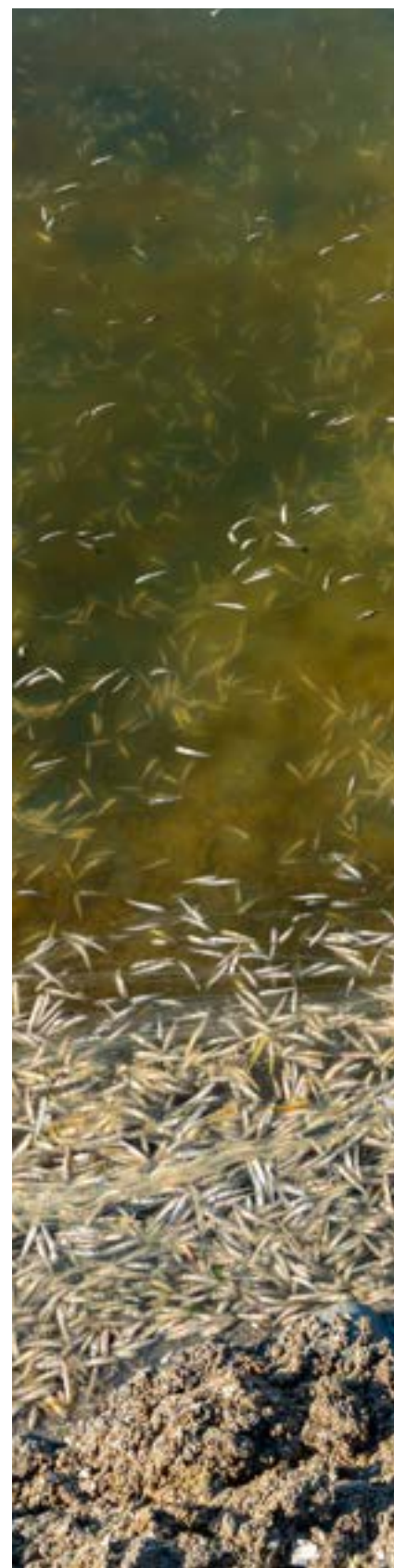


Table 8



GHG emissions from broiler production in the Netherlands, Brazil, the US, and China.

All emissions are kg CO₂eq/kg carcass weight.

Country	Overall emissions	Emissions due to feed production	Emissions due to land use change (LUC)	% of emissions due to feed production & LUC
Netherlands	4.02	1.27	2.00	81.3%
Brazil	5.80	1.32	3.98	91.3%
US	2.58	1.60	0.14	67.4%
China	3.34	1.32	1.23	76.3%



Table 9



GHG emissions from pig production in the Netherlands, Brazil, the US, and China.

All emissions are kg CO₂eq/kg carcass weight.

Country	Overall emissions	Emissions due to feed production	Emissions due to land use change (LUC)	% of emissions due to feed production & LUC
Netherlands	5.05	1.52	1.00	49.9%
Brazil	8.51	1.31	3.77	59.6%
US	4.84	1.99	0.04	41.9%
China	6.84	2.09	2.58	68.2%

The negative impact on the planetary boundaries of growing cereals and soy for animal feed

Research has established nine planetary boundaries which, if crossed, could generate irreversible environmental changes and drive the planet into a much less hospitable state.⁹⁹ In the case of two planetary boundaries – land and water use – we have crossed from a *Safe Operating Space* to a *Zone of Increasing Risk*.

In four cases – (i) climate change, (ii) biodiversity loss, (iii) nitrogen and phosphorus flows, (iv) introduction of novel entities such as antibiotics and pesticides – we have crossed from the *Zone of Increasing Risk* and entered a *High Risk Zone*.

Table 10 shows the contribution of the production of grain and soy for feed to the crossing of the planetary boundaries.

Table 10

The contribution of the production of grain and soy for feed to the crossing of the planetary boundaries

Land system change	77% of global soy production is used as animal feed, making it a key driver of deforestation. ¹⁰⁰
	Around 45% of global arable land is used to grow crops for animal feed. ¹⁰¹ This is a wasteful use of cropland as animals convert these crops very inefficiently into meat.
Freshwater use	Industrially farmed animals use much more surface- and groundwater than extensively farmed animals, and pollute far more water; this is due to feed production. ¹⁰²
Climate change	The UN Environment Programme states: ‘Animal agriculture, including animal feed production, is estimated to contribute 14.5 – 20% of global human-caused GHG emissions’. ¹⁰³
Biosphere integrity (biodiversity loss)	The demand for huge quantities of feed crops has led to biodiversity loss through both the intensification and expansion of arable production. ¹⁰⁴
Biogeochemical flows (nitrogen & phosphorus)	Nitrogen and phosphorus are primarily used in fertilisers much of which are used to grow crops for animal feed. ^{105 106 107}
Novel entities	Pesticides are often used in the growing of animal feed crops.

Economic implications of feeding human-edible crops to animals

Research funded by the FAO has calculated the difference in environmental impacts in 2050 between (i) business as usual (BAU) as regards feeding human-edible crops to animals and (ii) ending the use of such crops as animal feed.¹⁰⁸ On the basis of these impacts Compassion in World Farming has estimated that BAU use of human-edible crops as feed in 2050 will entail global costs of US\$1,323 billion (i.e. US\$1.32 trillion) per year as compared with not using such crops as animal feed. These costs arise mainly due to the inefficiency with which animals convert human-edible crops into meat and milk, and the consequent detrimental impacts on the environment. However, the overall cost may be much greater than US\$1.32 trillion per year as several costs could not be reliably estimated, e.g. the cost of arable land and energy use, costs in respect of pollinator loss, the impact of pesticides on biodiversity, and loss of livelihoods and increased risk of conflict due to soil erosion.

Forcing up the price of grain for human consumption

Moreover, the industrial livestock sector’s huge demand for grain exerts upward pressure on their market prices^{109 110}, potentially placing them out of reach of poor populations in the Global South. A World Food Programme analysis in 2021 notes that: ‘a heavy demand for meat, especially from major food-importing nations, has driven up prices on animal feed grains like corn and soybeans’.¹¹¹ These dynamics show that when more grain is required for livestock feed – thereby adding another layer of demand for grain - the result is often increased prices for staple crops on world markets. The predicted increase in global consumption of meat will entail rising demand for grain as feed, which could drive up the price of grain as both feed and food. Mergos (2022) cautions that the projected rise in demand for feed grains will have ‘strong adverse effects on global food security’.¹¹²



**SOY:
A BOOMING MARKET
FUELLED BY ITS USE AS
ANIMAL FEED**



MIGHTY EARTH

Soy is a booming global commodity, with production doubling over the past decade and reaching 396 million tons in 2024.¹¹³ This surge has largely been driven by the growing demand for cheap meat. More than three-quarters of global soy is used by the meat industry to feed livestock kept in industrial farms.¹¹⁴ Much of the remaining amount is used for biofuels, industry or oils, while only 6% is used to make products like tofu or soy milk for human consumption.¹¹⁵

Brazil is by far the world’s largest producer of soy, dominating 40% of the market with an estimated 169 million tons produced in the 2024/2025 season.¹¹⁶ The majority of soy is destined for the export market. In 2023, 84% of Brazil’s total soy produced (127.3 million tonnes) was exported.¹¹⁷ Approximately three-quarters of these exports are destined for China, with other significant destinations including Argentina, Europe, Thailand and Iran.¹¹⁸

The US is the world’s second largest producer and exporter of soy with its soybean exports reaching 52.4 million tons in 2024. Its main markets are China, the EU and Mexico.¹¹⁹

The EU imports over 30 million tonnes of soy annually.¹²⁰ Brazil is a key supplier for the EU, accounting for 62% of the soybean meal/oil cake imports and 42% of soybean imports in 2023.¹²¹ Spain and the Netherlands are the EU’s largest importers of Brazilian soy. In 2024, Brazil exported 5.5 million tons to Spain and 3.7 million tons to the Netherlands, although most of this will be re-exported from the Netherlands. Given the introduction of new US tariffs, Brazil could see a further increase in soy production and exports, particularly to China, as demand shifts away from the US.¹²²

Most of the soy exported from Brazil is used by the meat industry as a high-protein feed for animals living miserable lives in intensive farming systems, to enable them to reach market weight in the shortest possible time. Over the past 50 years, global meat consumption has more than tripled¹²³ – a trend largely driven by an industry that has shaped demand through production systems designed to churn out vast quantities of cheap meat, often at the expense of animal welfare, health and the environment. Poultry is now the largest consumer of soy feed globally, accounting for 37% of use, followed by pigs at 20%.¹²⁴

FIGURE 3

**Global Soybean production
in million tonnes**

Source: Our World In Data



SOY EXPANSION'S HIGH TOLL ON NATURE

Soybean production is the second biggest driver of tropical deforestation. Brazil's dominance in the global soy market comes at a steep cost – over 20 million hectares of the country's forest cover has been lost to soy expansion over the past three decades.¹²⁵ While beef is the leading driver of Brazilian deforestation, accounting for 72%,¹²⁶ soy cultivation often follows on land previously cleared for cattle grazing, making the impact of soy on forest landscapes even greater.

Although deforestation in the Amazon has slowed, the Cerrado savannah has been devastated by expanding soy production and is being lost at twice the rate of its more famous neighbour.¹²⁷ The Cerrado, the world's largest and most diverse savannah, is home to 5% of the planet's diversity,¹²⁸ including endangered species such as the jaguar and maned wolf. The biome also plays a crucial role in stabilising the regional climate and regulating the watersheds that supply 40% of Brazil's freshwater.¹²⁹ Known as an “upside-down forest” its vast and immense root system stores around 13.7 billion tons of carbon, as much as a tropical forest.¹³⁰

Half of the Cerrado's native vegetation has already been lost, largely to the meat industry.¹³¹ With 52% of Brazil's soy planted area,¹³² the impacts on the Cerrado are far-reaching. As precious ecosystems are converted to farmland, often into extensive soybean monocultures, biodiversity suffers due to habitat destruction and the fragmentation of wildlife corridors, leading to the isolation of threatened wildlife populations. This land conversion also drives climate change, as carbon stored in vegetation, soils and roots is released into the atmosphere. Converting habitat in the Cerrado for agricultural production generates approximately 230 million metric tons of carbon per year, equivalent to the annual emissions of 50 million cars.¹³³ Soy cultivation also disrupts water systems, contributing to droughts, floods and changes in rainfall patterns.¹³⁴



Cerrado clearance. Credit: Jim Wickens, Ecostorm/Mighty Earth

LANDGRABS, VIOLENCE AND HEALTH IMPACTS

Beyond environmental impacts, large-scale soy production can have significant social and health consequences, particularly for Indigenous and rural communities in Latin America. As major agribusiness corporations expand industrial soy farms, land disputes, violence, land grabs and the displacement of local communities are becoming increasingly common.¹³⁵ In Brazil, where Indigenous lands make up about 13% of the country’s territory, many communities face growing pressure as agriculture expansion consumes the ecosystems surrounding their territories, impacting lives and livelihoods.¹³⁶

In the Cerrado, Indigenous and traditional peoples have reported psychological and physical threats, corruption, loss of livelihoods, rural exodus, and even murders linked to soy-driven land conflicts.¹³⁷ Several investigations have also found that some of the world’s largest agricultural companies are sourcing soy grown illegally on Indigenous lands.¹³⁸

Land is not the only source of conflict between soy producers and local communities. Large-scale soy cultivation requires intensive irrigation, which can deplete local water resources and lead to water scarcity. The widespread use of pesticides and herbicides associated with monoculture farming also poses serious health risks linked to water, air and soil pollution. In Brazil in 2022, nearly 7,000 families were affected by agrochemical use and 193 people were directly contaminated by pesticides.¹³⁹

HOTSPOTS IN WHICH HUGE NUMBERS OF ANIMAL FARMS ARE CLUSTERED TOGETHER

A tendency has emerged for large number of industrial farms with high densities of pigs, poultry and cattle to be crowded into certain regions. This intensification has been made possible by the large-scale production and global trade of feed crops such as maize and soy, which now dominate the diets of industrially raised animals.

This gathering together of large numbers of intensive farms in certain regions leads to serious environmental, health and animal welfare problems. It also results in substantial amounts of grain and soy having to be transported to these regions to feed the high concentrations of animals. In some cases feed crops are imported from distant countries. For example, the EU and China import huge amounts of soy from Brazil.

CHAPTER

5. SOLUTIONS & RECOMMENDATIONS



How many more people could be fed if the feeding of human-edible grain to animals was ended?

A detailed study by Compassion in World Farming calculates that if the use of grain as animal feed was ended, an extra 2 billion people could be fed each year, even allowing for the fact that if we reared fewer animals we would need to grow more crops for direct human consumption.¹⁴⁰ This figure is very cautious; other studies calculate that ending the use of grains as animal feed would enable an extra 3.5-4 billion people to be fed.^{141 142}

“ If the use of grain as animal feed was ended, an extra 2 billion people could be fed each year ”

How much arable land could be saved if the feeding of human-edible grain to animals was ended?

Data indicate that around 350 million hectares of arable land are used globally to grow grain and oil seed cakes (e.g. soy) for animal feed.^{143 144}

This contrasts with the much smaller amounts of arable land used for many other forms of food production – these are set out in Table 11.

It is questionable that more arable land is used to grow grain and oil seed cakes for animal feed – 350 million hectares – than is used to produce fruit, vegetables, pulses, tree nuts, and roots and tubers combined – 318 million hectares.

If the use of grain and oil seed cakes as feed was ended, 350 million hectares of arable land could be saved though, as explained in Table 11, around 50% of this would be needed to grow crops for direct human consumption to replace the proportion of animal-source food that was no longer available due to the halving in the use of grain as feed. Accordingly, the net saving of arable land would be around 175 million hectares.

Table 11

Amount of arable land used globally for various forms of food production in 2023

Source: Our World in Data

Crop	Amount of arable land used globally in hectares
Grain & oil seed cakes for animal feed	350,000,000
Fruit	78,695,006
Pulses	96,648,152
Roots & tubers	70,325,104
Tree nuts	13,355,374
Vegetables	59,131,840



If we ended or significantly reduced the amount of land used to grow grain for feed, important benefits would ensue:

- 1.** More fruit, vegetables, legumes such as peas and beans, and nuts and seeds could be grown; these are key components of a diverse, healthy, nutritious diet. Crucially, the crops grown for human consumption on land released from feed production should not be grown in monocultures and with agro-chemicals. They should instead be produced in regenerative systems.
- 2.** A move to agroecology and regenerative farming would become more feasible. In the Global South agroecology tends to boost yields^{145 146} but in the Global North agroecology generally produces lower yields per hectare than intensive agriculture. However, this would not be problematic if less grain was needed as animal feed.

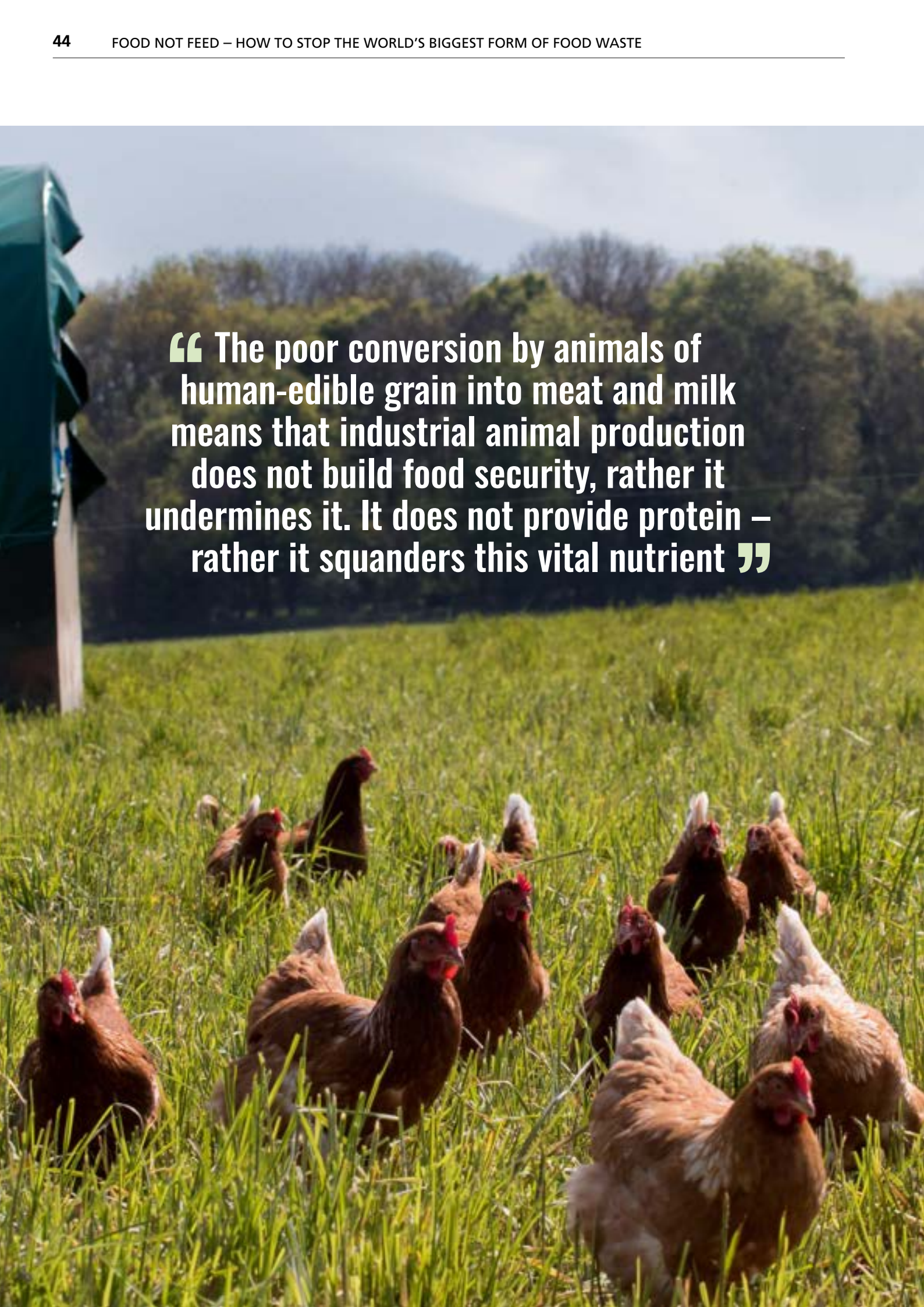
Of course, if human-edible crops were no longer fed to animals, a proportion of these crops – or other crops such as legumes, pulses, fruit, vegetables and nuts – would need to be used for direct human consumption to replace the animal-source foods. Studies^{147 148} indicate that when grain is no longer used to feed animals, around 50% of these crops (or other crops) are still needed to feed the human population while around 50% are ‘saved’ and can be used to feed additional people – or to compensate for the fact that in the Global North agroecology tends to have lower yields per hectare than intensive agriculture.

A move to agroecology and regenerative farming is arguably essential. Land that is farmed too intensively is at risk of degradation and declining yields. The FAO has warned that undue emphasis on high productivity can in time lead to declining soil quality with the result that ‘food production is seriously affected, the result being a vicious downward spiral’.¹⁴⁹ In contrast to this, agroecology can build soil quality and restore biodiversity thus ensuring good crop yields for future generations.

We need to shift from considering yield per hectare to counting number of people fed per hectare

A key study is entitled ‘Redefining agricultural yields: from tonnes to people nourished per hectare’.¹⁵⁰ This calculates that worldwide, a hectare of cropland produces on average sufficient calories to feed ten people but that as 40% (the figure has now risen to 45%) of global crops are used to feed animals, a hectare of cropland on average only delivers sufficient calories to feed six people (even allowing for the meat and milk produced by the animals).



A photograph of a flock of brown chickens in a lush green field. In the background, there are trees and a clear sky. On the left, a portion of a green structure is visible. Overlaid on the image is a quote in white text with green quotation marks.

“ The poor conversion by animals of human-edible grain into meat and milk means that industrial animal production does not build food security, rather it undermines it. It does not provide protein – rather it squanders this vital nutrient ”

HOW SHOULD ANIMALS BE FED?

Animals only make an efficient contribution to food security when they are converting materials we cannot consume into food that we can eat.^{151 152}

So, animals should mainly be fed on:

- pasture or other grassland
- by-products e.g. brewers grains, citrus pulp, sunflower meal
- unavoidable, properly treated food waste e.g. unwanted bakery products, fruit and vegetables; where necessary food waste must be properly treated to make it safe for consumption
- crop residues.

Such materials are often referred to as 'low opportunity cost' feed as they have not entailed the use of land which could have been used to grow food for direct human consumption. The use of by-products and food waste as feed contributes to the circular economy in that materials that would otherwise have to be disposed of are converted into nutritious food, so recycling nutrients into the food system.¹⁵³



Farm animals have a vital role to play in healthy, nature-friendly agriculture

The farming of animals to high welfare and health standards should increasingly be located within regenerative agriculture. Farm animals can be an integral part of healthy, nature-positive farming. Systems that combine good welfare, high environmental standards and ‘low opportunity cost’ feed include:

Pasture-based systems

Good grassland systems for raising cattle and sheep do not feed grain to the animals and minimise the use of synthetic fertilisers.¹⁵⁴ The animals are fed on grass, crop residues, and root crops grown on the farm. The pasture includes legumes such as clover which can minimise the use of (i) soy as they are rich in protein and (ii) nitrogen fertilisers as they are able to ‘fix’ atmospheric nitrogen into forms plants can use.

Pasture-based systems that rotate different species around the pasture

Industrial livestock production is in essence a monoculture. It entails producing just one species on a farm; the farm specialises in pigs or poultry or cattle. Regenerative agriculture sometimes includes cattle, poultry and pigs on the same pasture-based farm. The animals are regularly rotated around the farm to give the pasture time to recover. Cattle, who like longer grass, are followed by sheep who prefer shorter grass. Then come pigs and finally chickens. These roam freely during the day, pecking around in the grass, feeding on bugs, seeds and worms, scratching in the cow dung to find larvae. This acts to spread the manure onto the soil.

UK farmer Tim May states: ‘The health of the system is promoted by mixing the class of livestock that run over the ground. The carrying capacity of the land will be increased by following the grazing animals with a mobile pig and poultry unit, a technique called enterprise stacking’.¹⁵⁵



Pigs and poultry: nature's great foragers and recyclers

Globally most pigs and poultry are farmed industrially, consuming huge amounts of grain and soy. This is unsustainable – and unnecessary. Pigs and poultry are nature's great foragers and recyclers. They should be kept outdoors where much of their diet can come from pasture and foraging. As well as from by-products and food waste such as bakery products, fruit, and vegetables that are no longer suitable for human consumption. Already, some innovative farmers are able to provide 70% of their pigs' feed in these ways.¹⁵⁶

Pigs and poultry can also be kept indoors or in mixed indoor-outdoor systems to high welfare standards and fed on by-products and food waste. Several Dutch farms are successfully doing this. The Dutch Kipster indoor egg farm provides first-rate animal welfare including a natural wooded environment. No human-edible feed is used – the hens are fed on sunflower meal and left-over bakery products.

The Zonvarken pig farms combine circular feed (by-products and food waste) with high welfare standards including no use of farrowing crates, piglets not being weaned until eight weeks of age and no tail docking or teeth clipping.¹⁵⁷ The Oranjevoen farm combines high welfare standards with local circular feed.¹⁵⁸ They say: 'We use residual flows from arable farming to feed the chickens, and we then use the manure from the chickens to feed the arable farming'.

Some feed manufacturers are now providing circular feed. Voerwaarts produces feed composed of residual flows from human food including old bread and industrial waste flows from the production of chips, chocolate sprinkles, meat substitutes, sugar, and bread.¹⁵⁹ The company emphasises that their feed does not compete with human food and that no agricultural land has been used in its production. Voerwaarts calculates that conventional feed emits 639 CO₂ eq/tonne, while circular sow feed produces much less – just 354 CO₂ eq/tonne.¹⁶⁰

Another feed manufacturer, FeedValid, states that for its circular products 'we process foods that are no longer suitable for human consumption. We convert flows of bread, dough, biscuits, chocolate, breakfast cereals, confectionery, chips, pasta, pastries, and snacks into high-quality ingredients for animal feed'.¹⁶¹ An Australian company, Food Recycle, converts commercial food waste into animal feed.¹⁶² It calculates that for every two tonnes of food waste, it can produce one tonne of animal feed.



Integrated crop-livestock systems

Some farmers operate rotational integrated crop-livestock systems. One typical system would involve, Year One: wheat; Year Two: barley; Year Three: oats; Years Four to Seven: grazing (the composition of the rotation will vary depending on the climate in the region concerned). In such farms the animals are fed on grass, crop residues, and root crops grown on the farm. Soil fertility and the nutritional quality of the grass are built through animal manure, the ability of the roots of grasses to collect minerals from deep in the soil, and the inclusion in the grass of herbs, wildflowers and protein-rich legumes such as clover. Because good soil fertility has been developed during the grazing phase, the arable stage of the rotation can be undertaken without the use of artificial fertilisers.

The EU’s Platform on Sustainable Finance’s (PSF) report sets out detailed parameters that aim to make a substantial contribution to (i) biodiversity and ecosystems, (ii) sustainable use and protection of water and (iii) pollution prevention and control.¹⁶³ The report’s emphasis on the value of on-farm nutrient creation and cycling, and on-farm feed production is also relevant to the transition to a circular economy.

The PSF report describes how in an integrated crop-livestock system the nitrogen (N) needed as nutrients for crops is primarily produced on the farm through animal manure and biological fixation, e.g. the inclusion of legumes in rotations. It states that the animals act as ‘onsite nutrient recyclers’. They are mainly fed on crops and grass grown on the farm, with the N in their excretions being used to fertilise the holding’s crops and pasture.

In particular, the PSF proposal:

- requires at least 80% of N fertilisers to be organic fertilisers produced on-farm (either manure or biological N fixation e.g. by the use of legumes); a maximum of 20% can be bought-in chemical fertilisers
- requires all livestock excreta to be recycled on-farm or treated through nature-based solutions
- limits the proportion of bought-in feed such as grain and soy to 10% of total feed. It requires a farm to grow at least 75% of any livestock feed on-farm and get the rest locally/from certified sources. This 75% cannot be grown intensively; it must be either grazed, or must comprise agroecology outputs such as catch crops and cover crops. A maximum of 25% can be produced in cooperation with other farms primarily in the same region.

The PSF report adds that all herbivore and poultry species must have permanent access to pasture, and pigs must have permanent access to pasture or to vegetated range.



Silvo-pastoral systems for cattle in South America with feed available at three levels

Alongside pasture at ground level, these systems also provide shrubs (preferably leguminous) and trees with edible leaves and shoots.¹⁶⁴ Such systems produce more biomass than conventional pasture and so result in increased meat and milk production per animal and per hectare. This approach and other forms of agroforestry can reduce the competition between agriculture and forests.

Feeding animals on by-products, food waste, grass, and crop residues would lead to a reduction of about 50% in global production and consumption of animal-sourced food, as such materials could not provide sufficient feed to maintain current levels of production and consumption.¹⁶⁵ Reduced consumption of animal products must take place in high- and middle-income countries. People in the Global South with low intakes of animal-sourced food should be able to increase their consumption; however increased production must not take place in industrial operations as these pose significant health (zoonoses and high use of antimicrobials) and environmental risks, while outcompeting small-scale farmers.

While a reduction in animal production may appear alarming to some, a global decrease in consumption of animal-source foods – accompanied by a shift to plant-rich diets – is essential if we are to meet the Paris climate targets and feed ourselves within planetary boundaries.

Indeed, major reports highlight the need to move to diets where proportionally more of the food is from plant sources. The World Bank's *Recipe for a Liveable Planet* states: 'Emissions from agrifood must be cut to net zero by 2050'.¹⁶⁶ Studies show that further major growth in the livestock sector is incompatible with the World Bank target.¹⁶⁷ Harwatt et al. (2024) surveyed over 200 climate scientists and sustainable food agriculture experts.¹⁶⁸ The survey indicates:

- there are no credible pathways to meeting the Paris Agreement that allow the livestock sector to continue growing
- global emissions from the livestock sector should peak by 2025 and then drop rapidly, to 50% by 2030, and 61% by 2036 and that the most effective options for reducing emissions are through reduced production of livestock products.

A report, *The economics of the food system transformation*,¹⁶⁹ examines the shifts in diet needed to tackle what it refers to as the global climate, nature, and health emergencies. It states:

'While over- and under-consumption now occur across high-, medium- and low-income regions, on average, high- and middle-income regions need to reduce their per capita intake of animal-sourced food by 68 percent and 62 percent respectively from 2020 to 2050, and increase their intake of fruits, nuts, vegetables, and legumes. In low-income regions, such as Sub-Saharan Africa and India, overall intake – in particular intake of healthy foods – must increase to combat undernutrition. The outlook for their intake of meat varies. For instance, in order to meet healthy intake levels, some countries in Sub-Saharan Africa need to increase their intake of animal-sourced food to ensure adequate healthy protein intake, but some middle-income countries in the region need to reduce it. Similarly, high intake of particular animal-sourced foods, such as dairy products in India, needs to fall. In total, low-income regions see a 33 percent aggregate decline in the intake of animal-sourced foods under FST [Food Systems Transformation] even though their intake by currently undernourished groups in those regions should increase to improve health.'

A 2025 report by the UN Environment Programme states: 'relatively small shifts in the composition of diets to healthier patterns and in particular towards more plant-based patterns have the potential to free up significant amounts of land for the production of those nutritious foods that are currently underproduced'.¹⁷⁰

Greatly reducing the use of grain and soy as feed is essential if we are to meet the UN's Sustainable Development Goals

The continued use of large amounts of grain and soy will place several of the Sustainable Development Goals (SDGs) out of reach.

SDG 2: ACHIEVE FOOD SECURITY



Industrial animal agriculture undermines food security by using human-edible crops as animal feed.

Meeting this Goal: We should aim for a substantial reduction in the use of human-edible crops as animal feed: livestock's primary role in food production should become the conversion of materials that we cannot consume – grass, by-products, unavoidable food waste, crop residues – into food we can eat.

A CLUSTER OF SDGS FOCUS ON THE ENVIRONMENT



REDUCE POLLUTION;
RESTORE WATER-RELATED
ECOSYSTEMS



PREVENT
NUTRIENT
POLLUTION



RESTORE DEGRADED SOIL;
HALT DEFORESTATION &
BIODIVERSITY LOSS

Livestock's huge demand for feed drives both the expansion of cropland and pastures, and the intensification of crop production.

Intensification – Industrial livestock's massive demand for feed has fuelled the intensification of crop production. This, with its use of monocultures and chemical fertilisers and pesticides, has led to overuse and pollution of ground- and surface-water,¹⁷¹ soil degradation,¹⁷² biodiversity loss,¹⁷⁴ and air pollution.¹⁷⁵

Expansion – Increasing demand for land:

- to grow soy and cereals for the rising number of industrially farmed animals
- as pasture for cattle leads to expansion of farmland into forests and savannahs with massive loss of wildlife habitats and biodiversity, as well as release of stored carbon into the atmosphere.

Meeting the environment-related goals: We need to move to forms of farming that do not just reduce the harm caused by industrial agriculture but that positively benefit the environment by enhancing soil structure, restoring biodiversity, preserving water and storing carbon.

SDG 13: CLIMATE ACTION



Clark *et al.* show that even if fossil fuel emissions were eliminated immediately, emissions from the global food system alone would make it impossible to limit warming to 1.5°C and difficult even to realise the 2°C target.¹⁷⁶

Meeting this Goal: The use of grain and soy as feed should be greatly reduced as most of the GHG emissions from broiler and pig production come from feed production including the associated land use change. Indeed, the consumption of animal-sourced food should be much reduced if the food sector is to play its part in meeting the SDGs and the Paris targets.¹⁷⁷ ¹⁷⁸

Multiple benefits would arise from reducing global production of animal-sourced food and moving to diets with a higher proportion of plant-based food

In much of the world, minimising the use of grain and soy as animal feed and reduced meat and dairy consumption would deliver multiple co-benefits. This would:

- help feed the growing world population as a greater proportion of crops would be used for direct human consumption which is much more resource-efficient
- allow cropland to be farmed less intensively so enabling (i) biodiversity to be restored with birds, pollinators and insects being able to thrive once again and (ii) soil quality to be rebuilt, so improving soil fertility and its ability to store water and carbon
- enable us to halt the expansion of cropland (to grow crops for animal feed) into forests and other fragile ecosystems
- release some grazing land to support natural climate solutions such as restoration of forests and peatland
- reduce pressures on wildlife as habitat destruction and fragmentation could be reversed
- reduce the risk of future pandemics that could arise due to keeping animals in industrial conditions, and to the expansion of pastures and cropland for animal feed into wildlife habitats which increases the risk of pathogen spillover^{179 180 181 182}
- make it possible to meet the Paris climate targets
- enable animals to be farmed extensively to high welfare standards. Reducing the number of animals farmed and ending the use of grain as feed would release large amounts of land making it feasible to greatly improve welfare standards. Good animal welfare entails not only preventing negative factors but also providing opportunities for animals to have positive experiences – fresh air, daylight, the warmth of the sun on their backs, the feel of the breeze moving across their bodies, pleasure, confidence, a sense of control, caring for their young, being raised by their mothers.



POLICY PROPOSALS FOR A PHASED TRANSITION AWAY FROM THE HIGH USE OF GRAIN AND SOY AS ANIMAL FEED

1

Reducing the use of grain and soy as feed

Governments must establish clear policies for:

- preventing any increase in the use of human-edible grain and soy as feed. This is crucial as global feed production expanded by an estimated 16.7 million metric tonnes in 2024 and is projected to continue trending upward.¹⁸³
- reducing the use of human-edible grain and soy as feed.

2

Adopt a food first land policy

In the interests of food security, productive arable land must be used to produce food for direct human consumption.

3

End subsidy support for the production of grain and soy as feed

Subsidies should not be available for grain and soy produced for animal feed as it is inappropriate for public money to be used to support a resource-inefficient, environmentally harmful use of crops that undermines food security. That said, it may not always be possible to identify if particular crops are going to be used as animal feed or human food. Accordingly, it may be more practicable to place a tax on compound animal feed, with **all** the income generated by the tax being used to support farmers who farm to high environmental and animal welfare standards. Additionally, subsidies should not be available for feed-heavy industrial livestock production with the money being redirected to support farmers who wish to transition to organic or agroecological plant or animal production.

4 Increase public awareness of the resource inefficiency and environmental degradation inherent in feeding grain and soy to animals

Programmes are needed to increase public awareness of the implications of different animal farming methods and consumption levels for the environment, food security, human health, and animal welfare. This would be in line with SDG 12.8 which states that people should have 'the relevant information for sustainable development and lifestyles in harmony with nature'. Dietary guidelines should set out for consumers the differing implications of meat, milk, and eggs from (i) animals fed on human-edible grain and soy and (ii) those fed on materials that cannot be consumed by people.

5 Require public procurement to take the lead

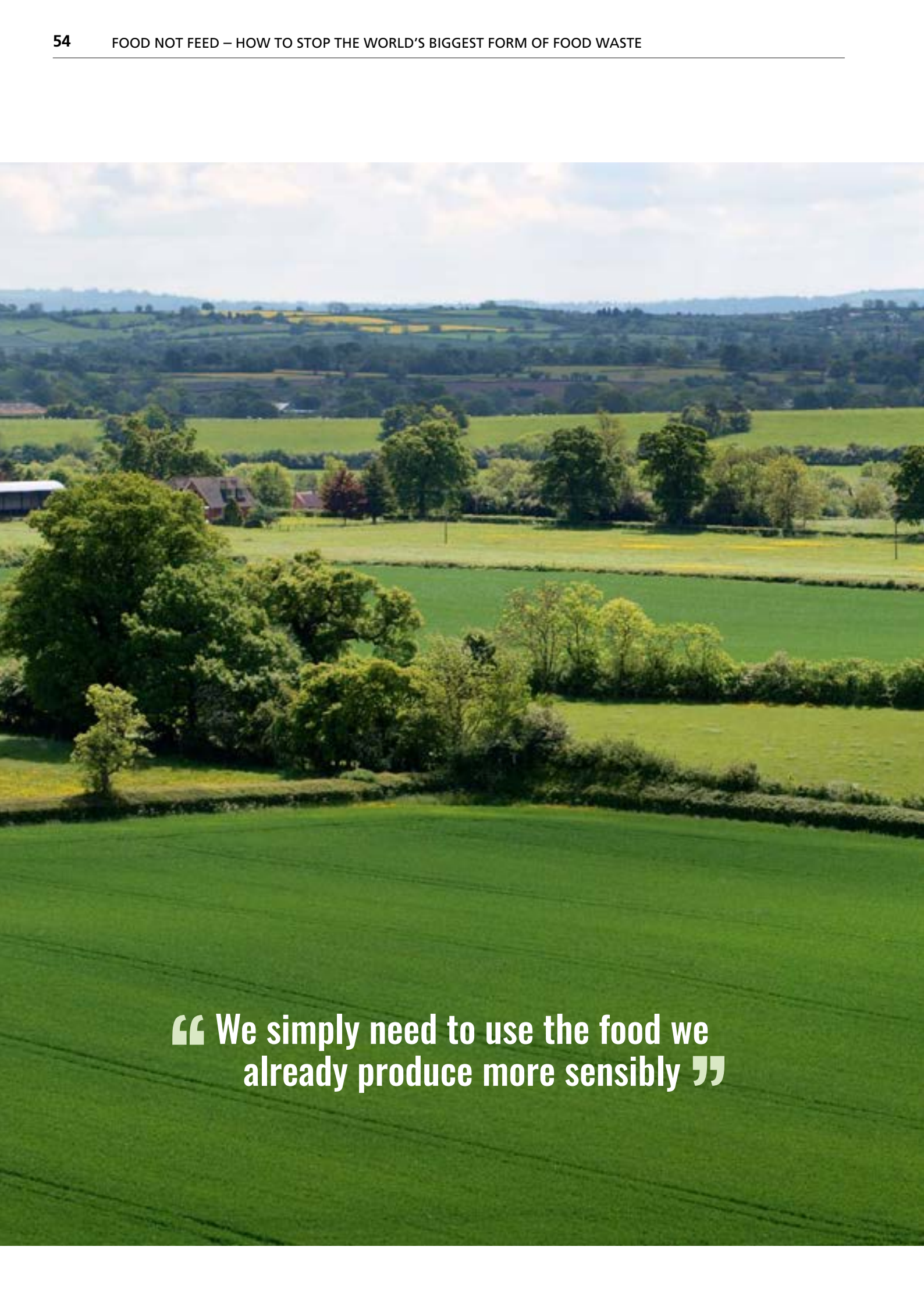
Public bodies providing food in schools, hospitals, care homes, prisons, and for the armed forces should use meat, milk, and eggs coming from animals that have not been fed – or have only minimally been fed – on human-edible grain and soy.

6 Encourage the adoption of plant-rich, flexitarian diets

Governments should set clear targets for reducing the consumption of animal-sourced foods in high-consuming populations and shifting towards plant-rich diets. These should be aligned with the Paris Agreement, the Kunming-Montreal Global Biodiversity Framework, and the UN's SDGs, as well as the need for food production to operate within the planetary boundaries. The reduction targets should also be supported with a holistic transformative food strategy or action plan, coordinated across government departments to ensure consistency.

7 Require banks and other financial institutions to stop funding industrial livestock production

Commercial banks and multilateral development banks (MDBs) fund and invest in livestock producers who use large amounts of grain and soy as feed. Indeed, the International Finance Corporation (IFC), which is part of the World Bank Group, even funds feed mills that incorporate grain and soy into compound feed. Commercial banks, MDBs, and asset managers must stop funding and investing in livestock producers and ancillary businesses (such as feed mills) that use grain and soy as feed.



**“ We simply need to use the food we
already produce more sensibly ”**

CHAPTER

6. CONCLUSION

The fact that the use of soy to feed farmed animals is a key driver of deforestation is reasonably well recognised. There is, however, much less awareness of the negative implications of feeding grain – wheat, maize/corn, and barley – to farmed animals.

Animals convert grain very inefficiently into meat, milk, and eggs, thereby undermining food security. This report shows that the food waste involved in feeding grain to animals is, in nearly all the countries we examined, much larger than food waste in the conventional sense. If the grain currently used to feed animals was instead used for direct human consumption, an extra two billion people could be fed globally each year. We do not need to produce large amounts of extra food to feed the world population anticipated by 2050. We simply need to use the food we already produce more sensibly. And that involves greatly reducing the use of grain and soy as animal feed – as well as achieving substantial cuts in overconsumption, the use of cereals as biofuels, and food waste in the conventional sense.

Animals only make an efficient contribution to food security when they are converting materials we cannot consume into food that we can eat. So, animals should mainly be fed on circular feed such as grass, crop residues, by-products, and unavoidable food waste. This will entail a substantial global reduction in animal farming as there is insufficient circular feed to maintain current levels of production. This will alarm some, but studies show that large reductions in the production and consumption of animal-sourced foods – coupled with a move to more plant-rich flexitarian diets – are essential if we are to successfully tackle the climate, nature and pollution challenges that threaten global wellbeing.

Let's move to forms of farming where animals are genuinely treated as sentient beings rather as meat and milk machines.



ANNEX

Table 5 - Additional details (page 16)

Key food waste data for several countries per year in million tonnes
(except US where million tons are used)

Country	Amount of grain fed to animals per year	Amount of grain lost per year by being fed to animals	Food waste per year in conventional sense
China	257.0	203.0	61.3 (i)
US*	202.7	160.0	66.5
EU**	158.0	124.6	59.2
Brazil	51.2	40.4	20 (ii)
Spain	27.6	21.8	4.2 (iiia)
France***	20.3	15.4	9.5
Italy	13.8	10.9	8.2 (iiib)
Netherlands	12.7	10.0	2.2 (iiic)
UK****	11.4	8.3	9.1
Poland	8.2	6.5	4.5 (iiid)
South Africa	7.6	6.0	10.0 (iv)
Czechia*****	1.9	1.5	1.0 (iiie)

* The US figures for the amount of cereals used as feed are from the Institute for Feed Education and Research (which has been established by the American Feed Industry Association); the figures are for 2023.¹⁸⁴ The amount of cereals used as animal feed was allocated to each species on the basis of figures from the Institute for Feed Education and Research.¹⁸⁵ The amount of food wasted in the conventional sense was taken from the U.S. Department of Agriculture. For details of how these figures were used, see the section ‘Methodology of the report’s calculations’ immediately before Table 5 and the *Supplementary materials*.

** The EU figures for the amount of cereals used as feed are from the European Commission’s EU cereals balance sheet; they show the annual average for the period 2021-2024.¹⁸⁶ The amount of cereals used as animal feed was allocated to each species on the basis of figures for 2022 published by FEFAC – Fédération Européenne des Fabricants d’Aliments Composés.¹⁸⁷ The amount of food wasted in the conventional sense was taken from Eurostat data. For details of how these figures were used, see the section ‘Methodology of the report’s calculations’ immediately before Table 5 and the *Supplementary materials*.

*** The French figures for the amount of cereals used as feed are from (i) FranceAgriMer, that operates under the authority of the French Ministry for Agriculture; they show the annual average for the period 2021-2024 and (ii) Réseau Action Climat. The amount of cereals used as animal feed was allocated to each species on the basis of figures produced by La Coopération Agricole, Nutrition animale.¹⁸⁸ The amount of food wasted in the conventional sense was taken from European Commission data. For details of how these figures were used, see the section 'Methodology of the report's calculations' immediately before Table 5 and the *Supplementary materials*.

**** The UK figures for the amount of cereals used as feed are from 'Agriculture in the UK 2024' produced by the Department for Environment, Food and Rural Affairs; they show the annual average for the period 2022-2024.¹⁸⁹ The amount of cereals used as animal feed was allocated to each species on the basis of figures produced by Mordor Intelligence.¹⁹⁰ The amount of food wasted in the conventional sense was taken from a UK Parliament research briefing. For details of how these figures were used, see the section 'Methodology of the report's calculations' immediately before Table 5 and the *Supplementary materials*.

***** For Czechia and all the other countries in the Table (except EU, US, UK, and France) maize, wheat, and barley feed data was taken from FAOstat (<https://www.fao.org/faostat/en/#data/FBS>). Data was used from 2020, 2021, 2022 and the average was calculated to indicate the total amount of grain fed to animals per year. To calculate the amount of grain lost per year that was being fed to animals we allocated the proportion of compound feed used by each species from either the Fédération Européenne des Fabricants d'Aliments Composés (FEFAC) based on 2023 data or the International Feed Industry Federation (IFIF) based on 2022 data. The IFIF allocated the following proportions for poultry (44%), pigs (28%), dairy (13%), other ruminants (8%), and other (7%). The FEFAC proportions are stated within the *Supplementary materials*. Once the proportions were allocated – then protein and calories conversions were carried out as described by Fry *et al.* (2018) and Cassidy *et al.* (2013).

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(iia-iiie) Data for 2022 from the EU Food Loss and Waste Prevention Hub at
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/eu-member-states
[a] [b] [c] [d] [e]

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Details of all the calculations can be found in our
Supplementary materials: www.ciwf.org/supplementary

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“ Let’s move to forms of farming where animals’ role is to convert materials we cannot consume into food we can eat, and where they are genuinely treated as sentient beings rather than as meat and milk machines ”

Compassion in World Farming is the leading specialist organisation for farm animal welfare worldwide.

We operate out of the UK, USA, Netherlands, Poland, France, Italy, Czechia, China, Belgium, and South Africa.

We campaign peacefully to end factory farming and create sustainable food systems that benefit animals, people, and the planet.

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