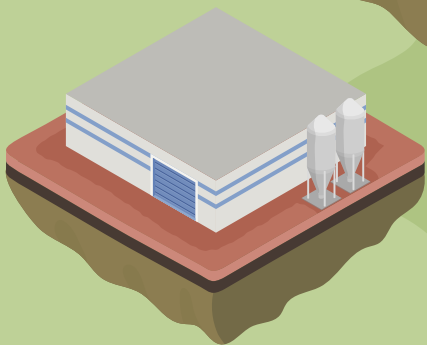




FOR
YOUR
WORLD



THE FUTURE OF FEED: HOW LOW OPPORTUNITY COST LIVESTOCK FEED COULD SUPPORT A MORE REGENERATIVE UK FOOD SYSTEM

EXECUTIVE SUMMARY

This report is the second in WWF-UK's 'Future of Feed' series. Part one, 'A WWF Roadmap to Accelerating Insect Protein in UK Feeds' is available via our web site.

ACKNOWLEDGEMENTS

Authors

3Keel
Julian Cottee, Caitlin McCormack, Ella Hearne, Richard Sheane. Design by Robbie Dawson, Richard Scott

The authors would like to acknowledge the guidance, comments and suggestions provided by a large number of WWF contributors in putting together this report.

WWF Team

Piers Hart, Mollie Gupta, Sabrina Goncalves Krebsbach, Callum Weir, Sarah Halevy, David Edwards, Pete Pearson

Additional thanks to:

Hannah van Zanten, Renee Cardinaals and Wendy Jenkins (Wageningen University)

Defra Crop Statistics Unit

Judith Murdoch (Efeca)

Published June 2022 by WWF-UK. Any reproduction in full or in part of this publication must mention the title and credit WWF-UK as the copyright owner. Text © 2022 WWF-UK. All rights reserved.



THE FUTURE OF FEED: HOW LOW OPPORTUNITY COST LIVESTOCK FEED COULD SUPPORT A MORE REGENERATIVE UK FOOD SYSTEM

EXECUTIVE SUMMARY

The way we feed our livestock animals places huge burdens on the UK food system and the natural environment. This exploratory report outlines the opportunity to do things differently. If, instead of using land to grow crops for animals to eat, we used these crops to feed humans and prioritised 'low opportunity cost' animal feed sources that do not compete with human nutrition, millions of hectares of arable land could be released for other purposes. By reducing the intense pressure on cropland to produce high yields, land use could be transformed to enable nature to thrive alongside food production in a resilient and resource efficient future.

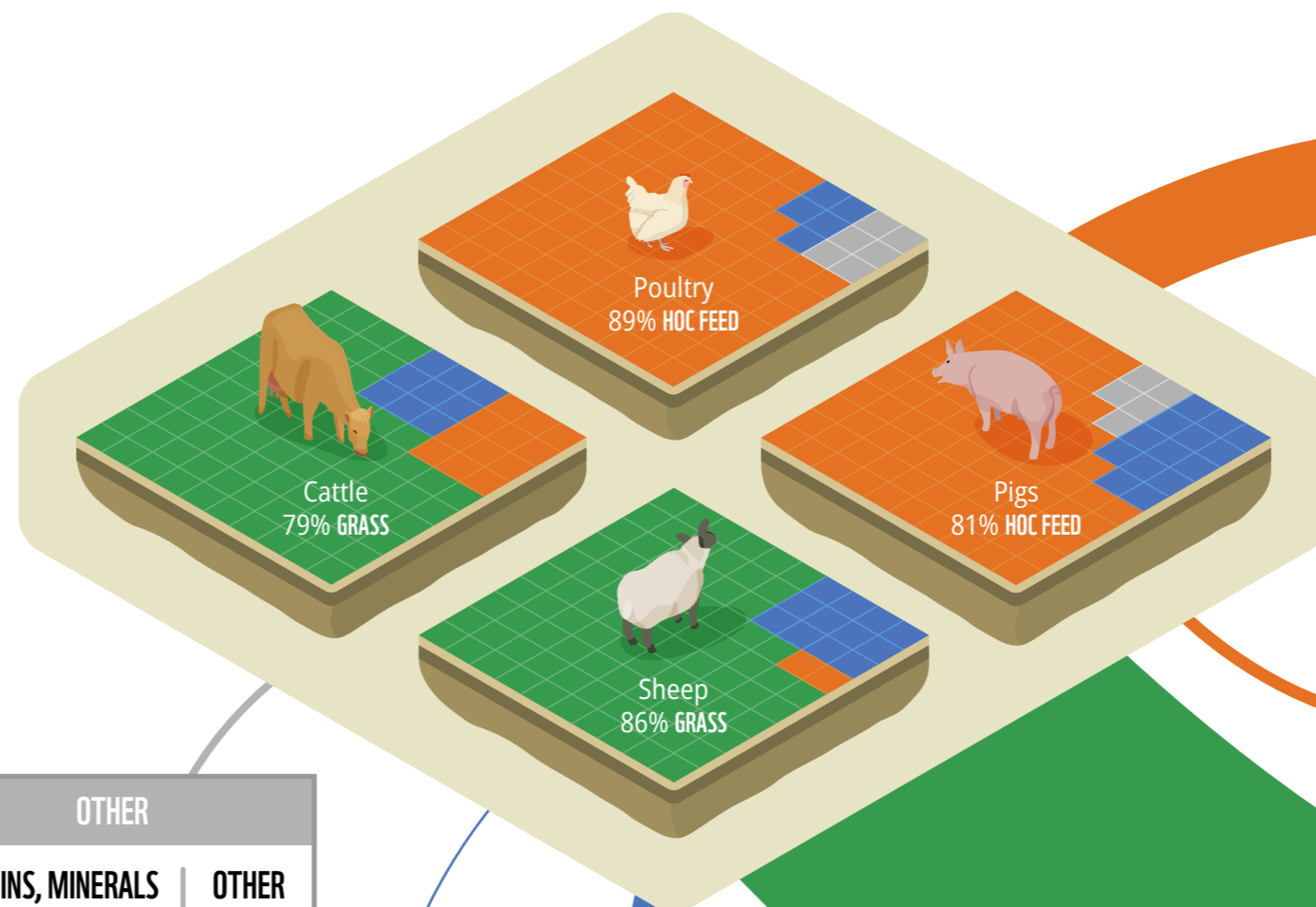
THE WAY WE FEED LIVESTOCK IS INHERENTLY INEFFICIENT

The UK's livestock population in June 2019 stood at 230 million animals, the vast majority of them poultry. Over the course of the year, over 1 billion meat birds were raised and 12 billion eggs were produced. Whilst much of the nutrition for the UK's cattle and sheep is provided by grass, with some supplementation from food industry by-products, fodder crops and grains, our industrially-produced chickens and pigs have a diet consisting primarily of cereal grains and soybean meal. Growing cereal crops to feed animals uses 40% of the UK's entire arable land area - around 2 million hectares - and consumes half of our annual wheat harvest, the nation's most important staple crop.

The land footprint of animal feed is not limited to within our borders.¹ Abroad, an additional 850,000 hectares is used for producing soy cake and meal to feed to livestock in the UK. Most of this soy was grown in South America where it carries a high risk of being associated with deforestation, conversion of non-forest habitats, and biodiversity loss. In addition to land use and land use change, growing crops for animals to eat - in the UK or abroad - is a driver of pesticide and fertiliser use, soil degradation and nitrogen pollution. It is also a substantial contributor to the greenhouse gas emissions associated with producing and consuming animal products - globally, feed represents 75% of the climate impact of poultry production and 60% for pork.

Yet the ecological burden of feeding our livestock is out of proportion to the contribution made by meat, eggs and dairy ('animal source food') to calories and protein in the UK diet. Grazing and crops grown for animal feed combined represent 85% of the nation's total agricultural land footprint - at home and abroad - whilst supplying only 32% of our calories and 48% of our protein. This is because the way in which we currently produce much of our animal source food is inherently inefficient. Using arable land to feed livestock, rather than using it to feed people directly, means that far fewer calories reach the human population than might otherwise be the case. Rather than consuming the products of animal agriculture fed on crops that humans can eat, it would be more efficient, in terms of land use and inputs, for people to consume those crops directly. On one estimate, if all edible crops were consumed by humans instead of some being fed to livestock, enough extra calories would be available to feed an additional 4 billion people globally.

HOW WE FEED OUR LIVESTOCK

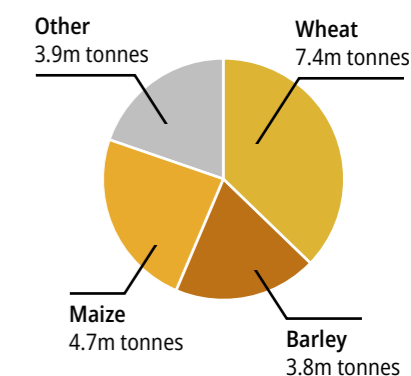


HIGH OPPORTUNITY COST (HOC)

Feed that could have been consumed by humans or was grown on arable land

CROPS

19,700,000 tonnes



SOY CAKE & MEAL
2,500,000 tonnes

OTHER

VITAMINS, MINERALS OILS AND FATS
800,000 tonnes

OTHER
600,000 tonnes

LOW OPPORTUNITY COST (LOC)



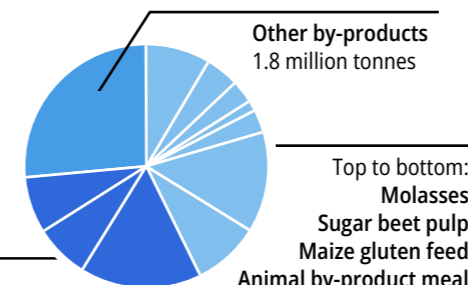
Feed made from inputs that do not compete with human nutrition.

FOOD THAT WOULD OTHERWISE BE WASTED
600,000 tonnes

FOOD INDUSTRY BY-PRODUCTS
6,800,000 tonnes



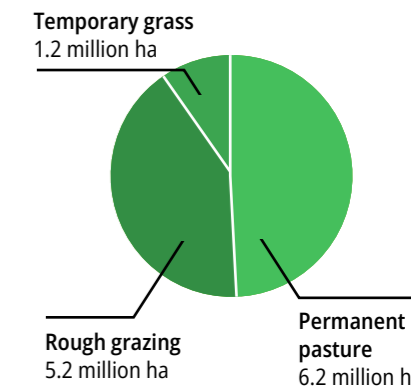
Left to right:
Rapeseed meal
Sunflower meal
Palm kernel meal
Total: 2.1 million tonnes



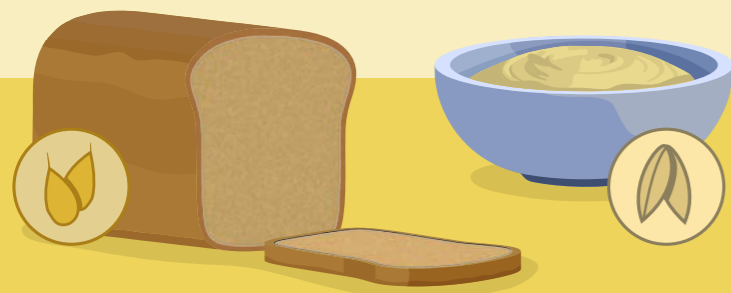
Total: 2.9 million tonnes

GRASS

90m tonnes estimated dry matter availability from 12.6m ha of grassland



THE OPPORTUNITY COST OF FEEDING THE UK LIVESTOCK POPULATION



The amount of **wheat** used to feed animals is equivalent to

10.7 BILLION LOAVES OF BREAD

The amount of **oats** used to feed animals is equivalent to

5.8 BILLION BOWLS OF PORRIDGE



LIVESTOCK HAVE THE POTENTIAL TO PLAY A KEY ROLE IN A REGENERATIVE, AGROECOLOGICAL FOOD SYSTEM

IF WE FEED LIVESTOCK DIFFERENTLY THEY CAN BE PART OF A SUSTAINABLE FOOD SYSTEM

Despite the inefficiency of feeding animals with edible crops, livestock are not necessarily bad news for the planet. Livestock animals have the potential to be fed without competing with direct human nutrition at all, and in so doing, play a key role in a resource-efficient, regenerative and agroecological food system. This paper explores the idea of feeding livestock using 'low opportunity cost' feedstuffs that are non-competitive with human nutrition. By using resources such as grass, food waste, and food industry or agricultural by-products instead of cereals or soy, more food can be produced overall than in a vegan food system, whilst reducing demand on arable land globally. And ruminants in particular can play an important role in building soil fertility without the need for artificial nitrogen fertilisers - a key opportunity to build a resilient and climate-friendly farming system.

WHAT IS LOW OPPORTUNITY COST LIVESTOCK FEED?

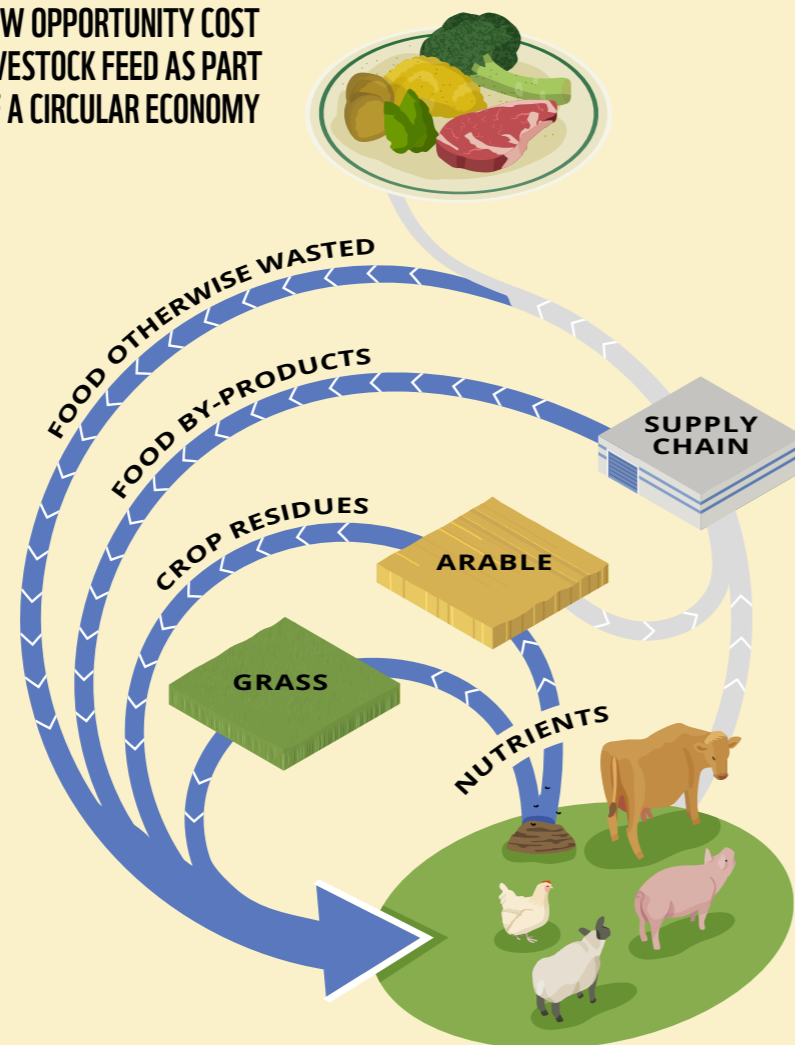
In short, low opportunity cost feed refers to "feed resources unsuitable or undesired for human consumption" - using them does not entail the 'opportunity cost' of forgoing their use as food for people. This includes primarily grass, food industry by-products and food that would otherwise be waste.

"High opportunity cost" feed, by contrast, could have been consumed directly by people, or is grown on land that could have been used to grow food directly for people. For the purposes of this paper, this refers primarily to cereal crops and soy products.

The concept does hold some complexities. For example, soy meal could be considered to be a by-product of crushing soybeans for edible oil. However, in practice, over two thirds of the economic value of the soybean comes from the meal, making animal feed the main driver of production. The same cannot be said of other oilseed meals, where the meal generates a lower proportion of the overall value and is therefore more genuinely a byproduct.

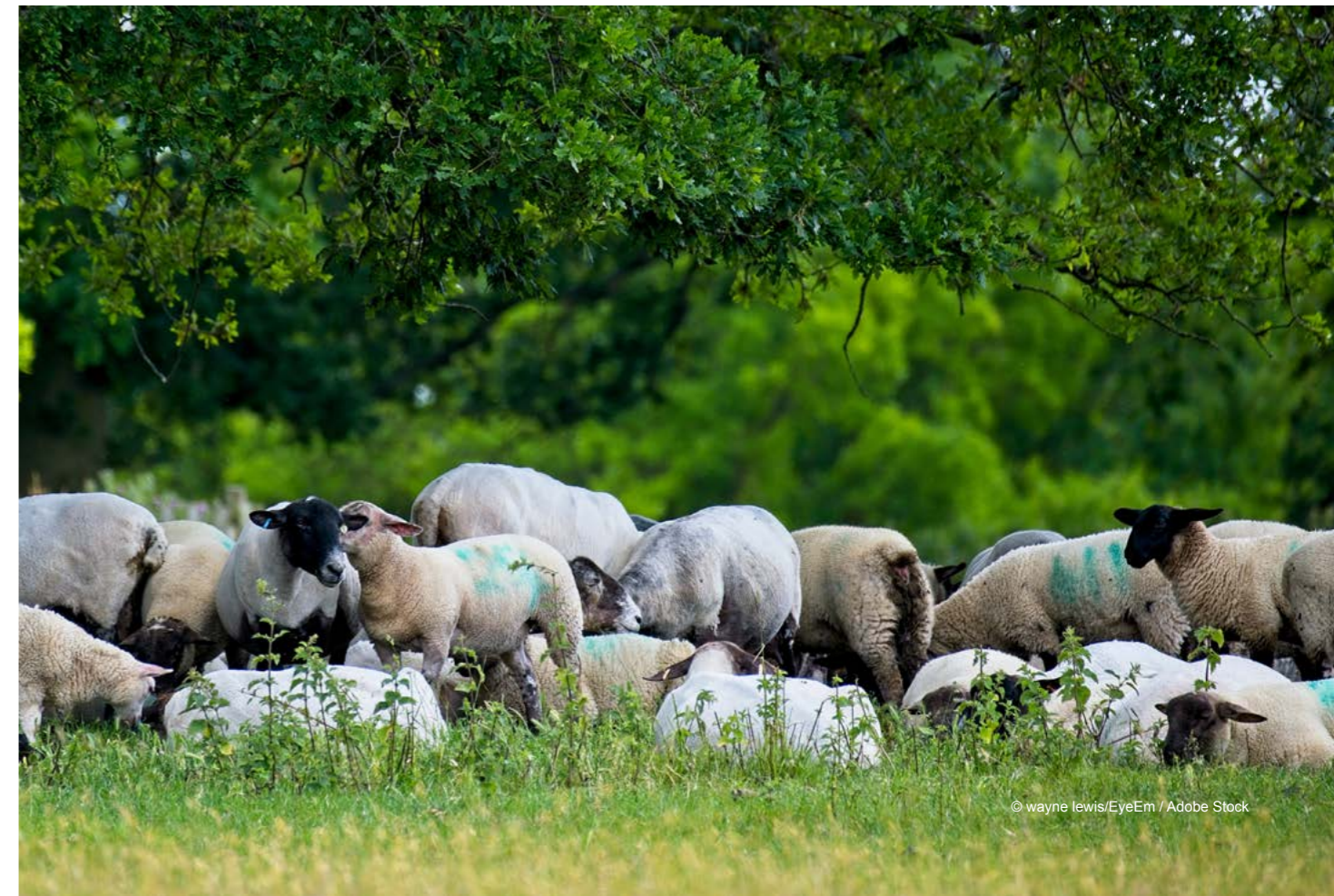
Figure 1

LOW OPPORTUNITY COST LIVESTOCK FEED AS PART OF A CIRCULAR ECONOMY



When grown on land not suitable for arable cropping, or as part of a crop rotation, grass is a low opportunity cost feed source, and flourishes in our climate. Grass can provide high quality nutrition for ruminants for much if not all of the year, either grazed in its fresh state, or consumed as hay or silage. UK grassland is primarily permanent pasture, including both rough grazing land and lowland grazing 'improved' with fertiliser applications to support higher stocking densities. Our national grass resource also includes a smaller area of temporary grass, legume and herb leys, which build soil health as part of crop rotations. Incorporating ruminants alongside temporary grass in an agroecological system can build soil fertility whilst also providing nutritious forage. Overall such systems have the potential to reduce the need for synthetic nitrogen fertilisers in crop production - an essential ambition in tackling climate change and nature loss. Grass is the predominant source of nutrition for most of the UK's cows and sheep, however, there is a trend towards larger farms with more indoor rearing - especially in dairy - which often entails an increase in grain and soy consumption.

Monogastric livestock - pigs and poultry - cannot readily digest grass as a primary food source. However, despite their current diet heavy in soy and cereal grains, pigs are omnivores that traditionally consumed a low opportunity cost diet of food waste and scraps. Even commercial housed poultry, which now generally consume over 90% grains and soy, have been proven on a diet consisting of 100% food industry by-products alongside surplus from food manufacturing and retail that would otherwise go to waste. Whilst the rapid growth and weight gain of hens in intensive poultry systems is underpinned by protein-dense imported feed, poultry can also be incorporated into pasture-based systems, where they are slower growing, and in which up to 25% of concentrate feed can be replaced with foraged foods such as vegetation, seeds, berries, insects and slugs. There is therefore no inherent need for our livestock animals to consume feed that is in competition with direct human consumption.





© Jiri Rezac / WWF-UK

A LIVESTOCK SYSTEM BASED ON LOW OPPORTUNITY COST FEED WOULD LOOK VERY DIFFERENT

Livestock production in the UK already entails using some low opportunity cost feed, particularly grass and by-products. But what if high opportunity cost feed ingredients like soy and cereals were excluded entirely? Whilst this may sound like a radical proposition from the current standpoint, it is not unimaginable. Indeed, it is already practised in some farming systems. If this became universal, overall livestock numbers would need to decline due to the reduced availability of feed sources, and the mix of livestock and the availability of different animal source foods would change considerably. First, numbers of poultry would need to be reduced drastically, as low opportunity cost by-product feedstocks suited to the current production paradigm (such as the bakery waste used by Dutch firm Kipster) are limited. In the medium term, legal and technological developments to allow the processing of food waste by insects, producing a high-protein insect meal, could provide an additional feedstock. The first report in WWF UK's Future of Feed series suggests that, with appropriate investment and policy support, insect meal could replace half a million tonnes, or around 20%, of soy in feed by 2050.²

Under current rules and systems, the pig population too would need to be reduced. Pigs are well suited to consuming food waste and scraps, but legislation introduced following serious biosecurity breaches and human health hazards including BSE means that this is currently prohibited under most circumstances. Some experts argue, however, that a total ban on food waste is not necessary in order to ensure adequate food safety and contamination standards, and that changes in the law could safely allow some kinds of food waste to be fed to pigs again. This would not be a niche consideration - one academic model has found that appropriate food waste sources could support as much as double the current UK pig population. In Japan, the regulated market for 'eco-feed' allows food waste from catering to be processed through heat treatment, becoming a valuable ingredient in compound feeds for both pigs and poultry.

Ruminants, however, are the key to a system based on low opportunity cost feed. Moving away from current trends favouring higher levels of indoor housing and concentrate feed, cows and sheep in a future system would take advantage primarily of the nutrition provided by the UK's permanent and temporary grasslands. This could be done at stocking densities that allow coexistence with biodiversity and healthy soils, and would also boost UK food system resilience in the face of global supply chain disruptions. Suitable breeds would need to be prioritised, and the most efficient approaches would maximise the potential for producing both milk and meat from the same animals. Beyond grass, ruminant diets in a low opportunity cost system could also be supplemented with limited quantities of by-product based feeds such as wheat feed (by-products from milling), molasses, and rapeseed meal, especially at key stages in the life cycle. A number of studies in dairy cows have shown that replacement of cereal or soy inputs with by-products can occur without detrimental impacts on milk yields, despite their notably different nutritional profile.



INSECT MEAL PRODUCED FROM FOOD SURPLUS AND BY-PRODUCTS COULD REDUCE SOY IMPORTS BY 20%



REPLACING GRAINS AND SOY WITH BY-PRODUCTS HAS BEEN SHOWN TO HAVE NO DETRIMENTAL IMPACT ON DAIRY COW MILK YIELDS

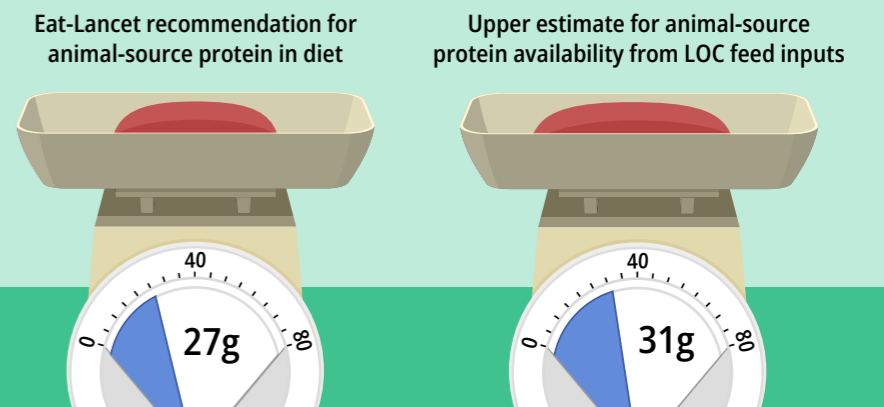
LOWER LIVESTOCK NUMBERS COULD STILL PROVIDE ENOUGH PROTEIN FOR EVERYONE

All of the low opportunity cost feed sources described in this report are limited in their availability. Food waste, though currently standing at over 9.5m tonnes in the UK annually, must be reduced radically at source to meet over-arching environmental goals - the UN's SDG 12.3 targets a 50% reduction by 2030 - making less available for animals. Following the food waste hierarchy, any edible surplus should also be redirected to human consumption in preference to animals, further reducing the amount available for feed. By-products for use in animal feed are limited to the volumes made available by food manufacturing processes and, if edible, should also be prioritised for human consumption if markets exist. Suitable grassland for livestock is limited by climate and geography and in a future world less reliant on synthetic fertilisers, some current areas of heavily 'improved' pasture would support lower numbers of animals. Grassland availability needs to be constrained further still by imperatives for nature restoration over large areas of land. The UK Committee on Climate Change recommends that 21% of current agricultural land should be prioritised for carbon sequestration - though in many cases, carbon sequestration through nature restoration may not be incompatible with, and may even be enhanced by, livestock grazing at low stocking densities.

This all means that the overall quantity of animal source food produced in the UK under a low opportunity cost feed system would be much lower than currently. Despite this, however, it is striking that an increasing number of academic studies suggest that the amount of meat and dairy produced could be enough to fulfil population nutritional needs at macronutrient level. This is because in the UK we currently consume more calories, protein and animal source foods than recommended. Our protein consumption is 50% higher than national dietary recommendations, and 70% higher than the EAT-Lancet Commission Planetary Health Diet. Furthermore, EAT-Lancet suggests that more than half of protein in the diet on average should come from plant-based sources. If we were to recalibrate our consumption in line with such recommendations, models suggest that UK-reared livestock fed only on low opportunity cost feed could supply sufficient animal protein. The remaining protein requirement would already be met by existing levels of plant-source food consumption, meaning that little if any additional land would be required to produce more plant-based protein. Further research is required to assess the sufficiency of such diets in terms of micronutrients, but at a protein and caloric level, initial studies suggest that a livestock system based on low opportunity cost feed is plausible from a dietary standpoint.



UK-REARED LIVESTOCK FED ONLY ON LOW OPPORTUNITY COST FEED COULD SUPPLY SUFFICIENT ANIMAL PROTEIN TO MEET NUTRITIONAL GUIDELINES





ENVISIONING A DIFFERENT FEED FUTURE

A low opportunity cost feed system in the UK could transform land use, enabling nature to thrive alongside food production, whilst providing sufficient animal source protein for healthy, sustainable diets.

HOW WE FEED OUR LIVESTOCK NOW

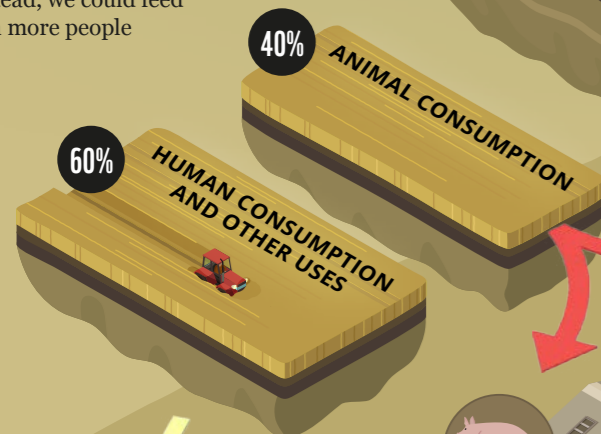
The UK's livestock population is highly dependent on imported soy, and cereal crops that could have been consumed by humans

230 MILLION LIVESTOCK ANIMALS

Including grazing land and feed production, livestock use 85% of the UK's total agricultural land footprint, but supply only 32% of our calories

40% OF UK CROPS CONSUMED BY LIVESTOCK

Globally, if all the crops currently fed to livestock went directly to humans instead, we could feed 4bn more people



FEED IMPORTS



OVERSEAS LAND USE DRIVES DEFORESTATION

Soy fed to UK livestock uses 850,000ha of land abroad, driving deforestation and land conversion

A LOW OPPORTUNITY COST FEED SYSTEM

Feeding our livestock with only grass, food industry by-products, and food that would otherwise be wasted

A SIGNIFICANTLY REDUCED LIVESTOCK POPULATION

Fewer livestock means that land is freed up for other purposes including nature restoration

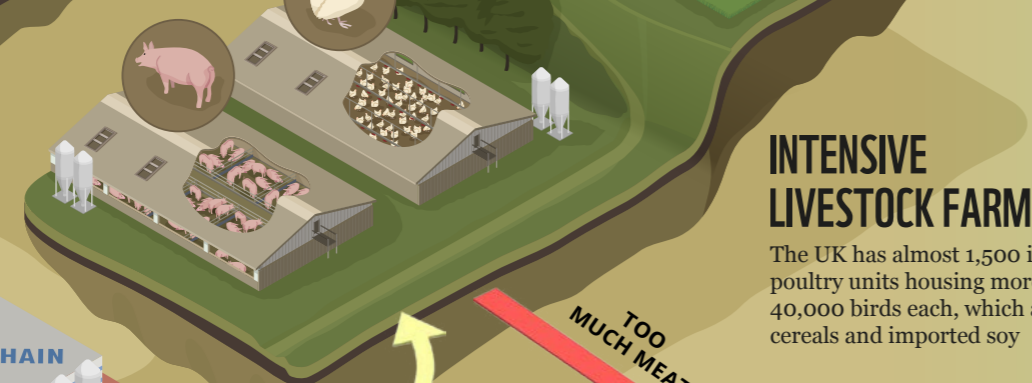


REDUCING THE UK'S OVERSEAS FOOTPRINT

UK meat consumption no longer drives the degradation of critical ecosystems abroad

CIRCULAR AGRICULTURE

Crops are no longer fed to livestock, making space for agroecological farming integrating animals in crop rotations



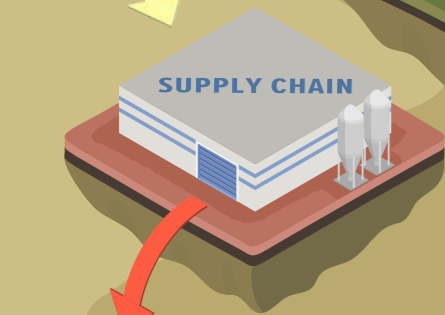
INTENSIVE LIVESTOCK FARMING

The UK has almost 1,500 intensive poultry units housing more than 40,000 birds each, which are fed on cereals and imported soy



EXTENSIVE LIVESTOCK SYSTEMS

Grazing is prioritised for ruminants, and the push to ever greater size and intensity of chicken and pig units is reversed



WASTED FOOD

Currently the majority of food waste and surplus is not retained within the food system

FOOD WASTE AND BY-PRODUCTS

HIGH MEAT CONSUMPTION

We over-consume calories and protein and have a diet heavy in animal products



FOOD WASTE AND BY-PRODUCTS

A MORE BALANCED DIET

A reduced livestock population fed on low opportunity cost inputs could supply sufficient animal protein to meet nutritional recommendations





© David Lawson / WWF-UK

THE IMPLICATIONS FOR NATURE COULD BE TRANSFORMATIONAL

Changing the way we think about livestock feed by phasing out grains and soy and prioritising grassland and circular economy inputs such as waste and by-products would have huge implications for nature. Critically, releasing the 40% of arable land in the UK currently producing animal feed (2m ha - around the size of Wales) for other purposes could enable a 'land-sharing' approach to farming, with regenerative agriculture at its heart. This extra slack in the system would allow for a landscape in which an interconnected patchwork of crops, livestock and nature are designed for people, biodiversity and resilience rather than maximum yield per hectare. This will be critical for achieving both carbon sequestration and biodiversity conservation in the UK, one of the most nature-depleted countries in the world. In this future, nature and productive activities go hand in hand, with both supporting farmer livelihoods and rural communities.

An agroecological farming system in the UK would be one in which grazing livestock - albeit in smaller numbers - are at the centre, and integrated with arable cropping systems. Ruminants would play a key role in soil fertility and landscape management, spending the bulk of the year outside. There would be a far smaller role for year-round indoor-housed livestock fed on concentrate and compound feed, reducing nitrogen pollution from manure management and feed. The new feed paradigm would also see a move away from the intensive poultry and pig farming that now predominates in the UK, with 7 out of 10 of the UK's largest poultry farms housing more than 1m birds, and pig farms housing up to 23,000 animals. These systems are optimised for rapid growth and high outputs, but low opportunity cost feed sources would provide neither the volume nor the highly calibrated and protein-dense nutritional inputs that they depend on, necessitating a move towards lower intensity systems. This would help to address the nitrogen pollution and associated damage to aquatic ecosystems linked to intensive indoor animal rearing, as well as responding to concerns around animal welfare.

Benefits for nature would go beyond the UK. Removing our reliance on imported soymeal would ease the pressure on 850,000 ha of land abroad producing soy primarily for UK animal feed. Farming of soy in South America is a major cause of deforestation and land conversion, a prime driver of biodiversity loss and the major contributor to emissions of 4.5 Mt CO₂e annually. Overall, reductions in deforestation, reductions in land area for arable crops, and reductions in overall livestock animal numbers would result in lower greenhouse gas emissions, directly addressing the 14.5% of global emissions caused by livestock.



MOVING TO A LOW OPPORTUNITY COST FEED SYSTEM WOULD ALLOW FOR A LANDSCAPE DESIGNED FOR PEOPLE, BIODIVERSITY AND RESILIENCE



FEEDING INCREASING AMOUNTS OF CEREAL CROPS AND SOY INTO INTENSIVE PRODUCTION SYSTEMS HAS DEPLETED NATURAL CAPITAL AND MADE LITTLE TANGIBLE DIFFERENCE TO FARMER LIVELIHOODS

ENVISIONING A DIFFERENT FEED FUTURE

Feeding livestock only on low opportunity cost inputs would be a sweeping departure from the direction of travel for livestock feed over the last 50 years, which has incorporated increasing quantities of cereal crops and soy into ever more specialised and intensive production systems. There are barriers to challenging the status quo. Even as it has depleted natural capital and made little tangible difference to farmer livelihoods, the current way of feeding livestock has developed because it has made economic sense within a system that fails to internalise environmental impacts. High opportunity cost feed provides concentrated and efficient nutrition delivered through international commodity markets and a network of specialist companies, resulting in high feed conversion ratios and cheap meat. Low opportunity cost feed sources such as food waste are more nutritionally variable, and less easily traded, transported, blended and stored. More work is required to discern the extent to which low opportunity cost feeds could become a viable replacement for grains and soy in a future in which the UK has fewer livestock animals, and animal-source food has a less central place in our diet. Such a system would certainly require the prioritisation of different animal breeds, and different expectations around yields of meat and milk per animal. However, existing 100% pasture-fed livestock systems show that this can be commercially viable and indeed that on upland and marginal farms, focusing on naturally available grass can increase profitability.

The prioritisation of ruminants does raise important questions around greenhouse gas mitigation pathways, as on a per gram of protein basis, ruminant animals produce the most greenhouse gas intensive meat, whilst chicken is the least intensive. This is particularly pertinent given current debates around the role of methane in climate change. However, a mono-dimensional view of cost-benefit through the lens of immediate greenhouse gas emissions alone fails to factor in the wider systemic benefits of maintaining a relatively small number of ruminant animals in a mixed agroecological farming system, and overlooks the disbenefits of large-scale intensive poultry farming in terms of land use for feed, air and water pollution, and animal welfare. There is therefore a need to develop new and more systemic ways of assessing overall impacts. Also requiring a systemic approach would be very practical economic questions around the role of trade in a future where the UK decided to prioritise low opportunity cost feed. While this paper looks at the UK as a semi-closed system on the basis of our current high levels of self-sufficiency for animal source food products, any future policy directions in this area would need to avoid the risk of offshoring environmental impacts by replacing or supplementing UK meat and dairy with imported food produced under lower environmental standards.

While many questions remain, what is clear from this report is the huge potential benefit that could come from significantly decreasing cereals and soy in livestock feed and prioritising animal nutrition from low opportunity cost sources. Such a move would not be starting from zero - low opportunity cost feed sources including grass and by-products already represent a significant proportion of animal nutrition in the UK, and with innovation and investment have huge potential to achieve further scale. With its implications for a greatly reduced livestock population, lower meat and dairy consumption and resource efficiency, this approach is in line with a range of vital sustainability imperatives to reach net zero carbon and halt biodiversity loss. In a world where the majority of our protein came from plant-based food, an integrated agroecological livestock system using grass, waste and by-products as the main feed inputs could provide enough animal protein for everyone whilst facilitating the huge changes in land use, improvements in biodiversity, and reduction in greenhouse gas emissions that are needed to ensure the sustainability of human life on earth.

RESEARCH, INNOVATION AND POLICY DIRECTIONS

This report has six recommendations for increasing the proportion of animal feed from low opportunity cost sources:

1

BE CLEAR ON THE NEED FOR 'LESS AND BETTER' MEAT AND DAIRY IN THE UK

Despite overwhelming evidence that reducing meat consumption in western economies is essential for achieving sustainability goals including climate change, this is still not reflected in the UK's official net zero strategy. It is vital to keep making the argument, emphasised in WWF's Livewell reports,³ that rebalancing the UK's average dinner plate substantially in favour of plants, and reducing all meat, not just red meat, will be needed to ensure a sustainable, healthy future. This can be accomplished at the same time as prioritising 'better' production systems that value nature, animal welfare, and farmer livelihoods. Food businesses and government have a key responsibility to provide farmers with the economic and policy support that will enable a just transition to a 'less and better' system to occur.

2

NORMALISE A MULTI-METRIC APPROACH TO SUSTAINABLE FOOD POLICY

In the urgent drive to tackle climate change there is a risk that food policy is made on the basis of one-dimensional greenhouse gas metrics. For instance, some dietary sustainability recommendations prioritise poultry meat consumption because of its low greenhouse gas emissions per gram of protein. The low opportunity cost feed framework turns this on its head, highlighting the pressures that intensively-produced poultry places on the environment locally and globally. An opportunity cost lens on sustainability shows that it is essential that food policy takes a systemic, multi-metric approach including land, water and biodiversity, not just greenhouse gas emissions.

3

BRING LOW OPPORTUNITY COST FEED INTO MAINSTREAM POLICY DISCUSSION AND CORPORATE TARGETS

Ideas around low opportunity cost feed are currently largely absent from government and corporate narratives around food sustainability, especially given the growing dominance of the net zero discourse and associated action frames. However, moving towards such a system could be an important part of building a sustainable and resilient food sector, reducing reliance on global commodity markets and artificial fertilisers, and building instead on the skills and knowledge of farmers to deliver regenerative agricultural solutions. This could be encouraged through incentives such as Environmental Land Management Schemes (ELMS), which could promote agroecological practices such as the inclusion of grass and livestock in arable rotations. There is a need for advocacy to push low opportunity cost feed into government policy and corporate strategy discussions and targets, spurring innovation and opening up new possibilities for action.

4

PROMOTE INNOVATION IN LOW OPPORTUNITY COST FEED

Technological innovations already under development offer multiple opportunities that could transform the availability and utilisation of low opportunity cost feed inputs to the livestock sector, and accelerate a transition away from cereals and soy for monogastric animals as well as ruminants. These include insect-rearing, microbial proteins from fermentation, seaweed, and biorefinery, alongside others. With adequate investment and government support including enabling policy, research funding and subsidies, these kinds of technologies are potentially scalable to represent a substantial contribution to high-protein, low opportunity cost animal feed. Businesses should seize the opportunity for innovation and work with supply chain actors to share costs and promote R&D.

5

FUND UK-SPECIFIC DATA, RESEARCH AND MODELLING

There is currently very little UK-specific research and modelling on what a livestock system based on low opportunity cost feed could look like. This is needed to test whether the assumptions of EU and global models hold true. There are also significant gaps in official Defra data relating to the UK's current livestock feed inputs and these need to be filled in order to provide a complete picture. Far greater transparency and traceability around feed inputs is required - not just for compound feeds but across the board. Attention is also needed to drive practical, on-farm research around business models, practices and the nutritional optimisation of low opportunity cost feeds.

6

REVIEW CURRENT REGULATIONS ON THE USE OF FOOD WASTE IN ANIMAL FEED

Reducing the production of food waste needs to remain the policy priority. The experiences of other countries, coupled with new technologies, offer the potential that food waste could safely become a source of low environmental impact feed - both directly, for pigs, and indirectly, via insects. Whilst the disease transmission risks from poor practice are real, it is plausible that control measures could provide appropriate safeguards. The EU has already softened some regulations around food waste as a feed source - the Food Standards Agency should now be mandated to research whether a partial reintroduction of food waste as a feed source could be feasible.



For a future where people and nature thrive | wwf.org.uk

© 1986 panda symbol and ® "WWF" Registered Trademark of WWF. WWF-UK registered charity (1081247) and in Scotland (SC039593). A company limited by guarantee (4016725)