WHY WE NEED A GLOBAL AGREEMENT ON FOOD AND AGRICULTURE

"High-input, resource-intensive farming systems, which have caused massive deforestation, water scarcities, soil depletion and high levels of greenhouse gas emissions, cannot deliver sustainable food and agricultural production. Needed are innovative systems that protect and enhance the natural resource base, while increasing productivity. Needed is a transformative process towards 'holistic' approaches, such as agroecology, agro-forestry ... and conservation agriculture, which also build upon indigenous and traditional knowledge."

UN Food and Agriculture Organization, 2017[i]

COMPASSION in world farming

TOWARDS A HEALTHY, SUSTAINABLE, HUMANE FOOD AND FARMING SYSTEM

Food and farming are cross-cutting issues that connect many of the world's sustainability and health challenges.

Scientific research shows that the industrial model of agriculture and the Western diet will make it difficult to meet the Sustainable Development Goals (SDGs), the Paris Climate Agreement and the Convention on Biological Diversity.

Without a far-reaching rethink of our food and farming systems it will not be possible to fulfil the objectives of a number of other global Agreements including those on rural livelihoods in the poorest countries, food security, the environment, human health, antimicrobial resistance and animal health and welfare. Nor will it be possible to achieve healthy dietary patterns and we will not be able to halt the devastating impact of food production on wildlife.

The OECD stresses the need to break out of policy silos.[1] A Global Agreement on Food and Agriculture would help us do this as it would promote the development of cohesive food and farming policies that seek to fulfil a range of objectives. It would facilitate the proper integration of policies so that one objective is not achieved at the expense of another. It would strengthen the international community's ability to meet existing Agreements and commitments in the areas referred to above.

Food businesses and companies supplying farming inputs are increasingly global in their scope. So too are the adverse impacts of industrial livestock farming. For example, aquatic dead zones, often arising primarily from the use of nitrogen fertilisers to grow animal feed crops, can be found in many countries. Excessive greenhouse gas emissions arising from high meat diets cause harm not just in the countries in which they arise but globally. A Global Agreement is needed to help tackle problems that reach worldwide.

Industrial livestock production is responsible for a substantial proportion of the harm arising from today's food and farming systems.

"States [should] ensure the political and financial commitments needed to shift from current industrial agricultural systems to nutrition-sensitive agroecology that is healthy for people and sustainable for the planet."

Hilal Elver, UN Special Rapporteur on the right to food: 2015[ii]

1.HARM ARISING FROM INDUSTRIAL LIVESTOCK PRODUCTION AND OVERCONSUMPTION OF MEAT AND DAIRY

Industrial livestock production is an inherently inefficient use of resources and is undermining food security

Industrial livestock production is dependent on feeding human-edible cereals to livestock who convert them very inefficiently into meat and milk.

For every 100 calories fed to animals as cereals, just 17-30 calories enter the human food chain as meat.[2, 3] Some studies indicate that the conversion rates may be even lower.[4] Cassidy *et al* (2013) 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.[5]

Experts describe the use of cereals to feed animals as "staggeringly inefficient",[6] "colossally inefficient"[7] and "a very inefficient use of land to produce food".[8]

These inefficiencies matter as the quantity of crops used as animal feed is huge. 56% of EU cereals are used as animal feed.[9] 67% of US crop calories are used to feed animals;[10] globally the figure is 36-40%.[11, 12] 98% of global soybean meal is used as animal feed.[13] The sheer scale of the losses entailed in feeding cereals to animals means that this practice is increasingly being recognised as undermining food security.[14]

Industrial livestock production's detrimental impact on natural resources

Industrial livestock's huge demand for feed has fuelled the intensification of crop production which, with its use of monocultures and agro-chemicals, has led to overuse and pollution of ground- and surface-water,[15] soil degradation,[16, 17] biodiversity loss,[18] and air pollution.[19] The demand for soy as animal feed is a key driver of deforestation and the destruction of other natural ecosystems such as the Gran Chaco and the Brazilian Cerrado.[20]

Water pollution

The UN states that "Intensive livestock production is probably the largest sector-specific source of water pollution".[21]

Breaching planetary boundaries

Research has established nine planetary boundaries which, if crossed, could generate irreversible environmental changes and drive the planet into a much less hospitable state.[22] In two cases – (i) biodiversity loss and (ii) nitrogen and phosphorus flows – we have crossed the boundary and entered a high-risk zone. Industrial livestock production has played a major part in the crossing of both these boundaries. Nitrogen and phosphorus are primarily used in fertilisers much of which are used to grow crops for animal feed.[23, 24, 25] The demand for huge quantities of feed crops has led to biodiversity loss through both the intensification and the expansion of arable production.[26]

Threatening the survival of wildlife: elephants and earthworms

Studies show that population and species extinctions are proceeding rapidly and a sixth mass extinction may already be underway.[27] Human pressures including agriculture are an important factor in this. Ever more forests and savannahs are being destroyed to grow soy and cereals for industrially farmed animals. This is eating into wildlife habitats driving many species – including elephants and jaguars – towards extinction.[28]

Moreover, the chemical soaked monocultures that have arisen in part to satisfy the industrial sector's growing demand for feed crops have devastated birds, butterflies and pollinators.[29] Both the numbers and diversity of earthworms are being reduced by intensive agriculture;[30] earthworms are essential to human life as they play a key part in maintaining soil health and fertility.

> *"use of highly productive croplands to produce animal feedstuffs … represents a net drain on the world's potential food supply"*
>
> European Commission Joint Research Centre, 2018[iii]

"WHO and other health agencies are advising populations to reduce meat consumption as part of an overall healthy diet."

World Health Organization, 2017[iv]

Industrial livestock production's detrimental impact on human health

Non-communicable diseases

The high levels of consumption of red and processed meat that have been made possible by industrial livestock production contribute to heart disease, obesity, diabetes and certain cancers.[31, 32, 33] The World Health Organization (WHO) has classified red and processed meat as 'probably carcinogenic' and 'carcinogenic' respectively.[34]

Nutritional quality

Free-range animals – who consume fresh forage and have higher activity levels – often provide meat of higher nutritional quality than animals that are reared industrially. Pasture-fed beef has less fat and higher proportions of omega-3 fatty acids than grain-fed beef.[35]

Meat from free-range chickens contains substantially less fat and generally a higher proportion of the beneficial omega-3 fatty acids than meat from chickens reared industrially. Moreover, the fast growth rates of today's chickens are having a detrimental impact on the nutritional quality of chicken breast meat with increased fat content and less and lower quality protein.[36] This suggests that the claim that chicken meat is healthy is questionable. A paper published in the Journal of the American College of Cardiology challenges the health status of chicken stating that "much chicken is transformed into fast food and other calorie-rich, ultra-processed" products.[37]

Generating disease

Industrial livestock production plays an important part in the emergence, spread and amplification of pathogens, some of which are zoonotic i.e. they can be transmitted to people.[38, 39]

Antimicrobial resistance

Antimicrobials are regularly used in industrial livestock systems[40, 41] to prevent the diseases that would otherwise be inevitable where animals are confined in crowded, stressful conditions and are bred and managed for maximum yield. These conditions compromise their health and immune responses, and encourage disease to develop and spread. To prevent this, antimicrobials are routinely given to whole herds or flocks of healthy animals via their feed and water. The WHO stresses that the high use of antimicrobials in farming contributes to the transfer of resistant bacteria to people thereby undermining the treatment of serious human disease.[42]

Air pollution arising from agriculture

Agriculture is a major source of three important air pollutants: ammonia, particulate matter and nitrous oxide. Air pollution is a serious problem for human health as it contributes to conditions such as bronchitis, asthma, lung cancer and congestive heart failure. Studies show that in some countries – including Denmark and the UK – agriculture is responsible for a larger proportion of the health problems arising from air pollution than transport or energy generation.[43, 44] Agriculture's emissions largely result from livestock and fertilisers; a substantial proportion of these are used to grow crops for animal feed.

Climate change: reducing meat and dairy consumption is essential

If we are to avoid dangerous levels of climate change all sectors must reduce their greenhouse gas (GHG) emissions. However, on a business-as-usual basis the emissions from agriculture and food are likely to substantially increase by 2050.[45] Animal products generally generate substantially higher GHG emissions per unit of nutrition produced than plant foods.[46, 47] Research shows that our diets – with their high proportion of meat and dairy – will make it very difficult to respect the Paris targets.[48] A significant reduction in meat and dairy consumption is essential if food-related emissions are to decrease and if we are to meet the Paris targets.[49, 50]

INDUSTRIAL AGRICULTURE IS INCOMPATIBLE WITH THE FOLLOWING SDGS:

Achieve food security (Goal 2): The FAO has said intensive livestock "reduce the food balance" as they consume human-edible carbohydrates and protein and convert them into a smaller quantity of energy and protein for human consumption.[51] The FAO warns that further use of cereals as animal feed could threaten food security by reducing the grain available for human consumption.[52]

Meeting this Goal: A 50% reduction in the use of human-edible crops as animal feed with livestock's primary role becoming the conversion of materials that we cannot consume into food we can eat.

Doubling the productivity and incomes of small-scale food producers (2.3): Industrial animal agriculture out-competes small-scale food producers, thereby undermining their livelihoods. At the 10th Global Forum on Food and Agriculture in 2018, the Director General of the FAO said: ***"FAO estimates that more than half of the world's rural poor are livestock farmers and pastoralists … We need to make sure that smallholders and pastoralists will not be pushed aside by large capital-intensive operations."***

Meeting this Goal: Studies in Africa show that agroecology can more than double crop yields while substantially reducing pesticide use.[53, 54] With sufficient access to veterinary services and with improved management regarding animal health and animal welfare, global animal production could, according to the OIE, be increased by around 20%.[55] This would enable small-scale producers to increase their productivity without industrialisation.

Ensuring healthy lives (3.4 & 3.9): Current high consumption levels of red and processed meat will make it very difficult to reduce non-communicable diseases.[56] Industrial agriculture is a major cause of air pollution.

Meeting this Goal: Encourage consumption of less but better meat and dairy products in many parts of the world. The developing world should aim for a balanced intake of animal-source foods and should not adopt western diets as these have an adverse impact on health.

Reduce water use and pollution (6.3, 6.4 & 14.1): Industrial livestock production generally uses and pollutes more surface- and ground-water than grazing systems.[57] This is due to industrial systems' dependence on grain-based feed. Huge quantities of nitrogen fertilisers are used to grow this feed.[58] However, only 30-60% of this nitrogen is taken up by feed crops; much of the rest runs off to pollute water and marine ecosystems.[59] Further intensification of animal production systems will result in increasing use and pollution of water per unit of animal product.[60]

Meeting this Goal: Reduce meat and dairy consumption. Globally a 53% reduction in the consumption of animal-source products (compared with business-as-usual projections for 2050) would produce a 21% reduction in the use of water.[61]

Take urgent action to combat climate change (13): Current levels of meat and dairy consumption will make this goal unachievable.

Meeting this Goal: Hilal Elver, UN Special Rapporteur on the right to food stresses: "The world's current consumption pattern of meat and dairy products is a major driver of climate change and climate change can only be effectively addressed if demand for these products is reduced".[62]

Reverse land degradation and improve soil quality (2.4 & 15): Modern agriculture, in seeking to maximize yields, has degraded soils to the point where poor soil quality is thought to be constraining productivity.[63]

Meeting this Goal: Moving away from industrial animal agriculture with its huge demand for feed crops would allow cropland to be farmed less intensively with reduced use of monocultures and chemical fertilisers and pesticides. This would enable soil quality to be improved through the use of rotations, legumes, green manure and animal manure.

Halt biodiversity loss (15): The UNDP states that modern agricultural practices have been "responsible for considerable damage to biodiversity, primarily through land-use conversion but also through overexploitation, intensification of agricultural production systems, excessive chemical and water use, nutrient loading, pollution".[64] Livestock's huge demand for feed and land drives both the expansion of cropland and pastures and the intensification of crop production.

Meeting this Goal: Reducing meat and dairy consumption would enable us to farm cropland less intensively and halt the expansion of farmland into wildlife habitats. This would allow biodiversity to be restored and wildlife to flourish once again.

Halt deforestation (15.2)*:* The use of soy as animal feed is an important driver of deforestation.

Meeting this Goal: An end to industrial animal agriculture would massively reduce the demand for soy so contributing to this Goal. A reduction in meat consumption would also enable the expansion of pasture into forests to be halted.

Industrial livestock production's detrimental impact on animal welfare

Even with good stockmanship, industrial livestock production has no potential for providing satisfactory welfare. Animals are confined in cages or narrow crates or in barren, overcrowded units which make it impossible for them to carry out their natural behaviours. Many are pushed to such high yields or fast growth that they suffer from painful health problems including lameness, bone deformities and bone fractures.[65, 66, 67]

Concepts of animal welfare are evolving. Increasingly it is being recognised that animal welfare does not just entail preventing suffering but that animals must be able to have positive experiences. Mellor (2016) writes that such experiences include "comfort, pleasure, interest, confidence and a sense of control".[68]

Industrial livestock production flies in the face of the growing recognition that animals are sentient beings and that each is an individual with their own distinct characteristics. Animals have been placed in this world for their own sakes, to live their own lives not just to act as servants to our needs and wants. Industrial production takes a mechanistic view of animals as tools that can be made ever more efficient. This is unworthy of our finer, more generous instincts as humans. Let us recognise that animals are not pieces of machinery; they are our fellow creatures entitled, like us, to experience the joy of living.

Animal welfare should not be regarded as a peripheral consideration in the formulation of food and farming policy. Instead it should be accepted – together with food security, public health, the environment, climate change and farmers' livelihoods – as one of the core criteria that must be satisfied by our food and farming systems.

2. A FOOD AND FARMING RENAISSANCE IS NEEDED

"The International Panel of Experts on Sustainable Food Systems highlights the need to transition to agroecological systems. They stress: "This transition is viable and necessary whether the starting point is highly specialized industrial agriculture or forms of subsistence farming in poor developing countries".

IPES Food, 2016[v]

At present consumption is presumed to be unchangeable and that, whatever the planetary consequences, demand must be met. Policies about production and consumption need to be interwoven. Healthy eating patterns must be encouraged that enable food to be produced without causing irreparable harm to natural resources and the climate.

Production: Redefining the role of livestock

Studies show that livestock are only efficient when they are converting materials that people cannot consume – grass, by-products, crop residues, unavoidable food waste – into food that we can eat.[69, 70] The role of livestock should be transformed so that their agricultural function is

primarily seen as converters of inedible materials into meat and milk. The use of human-edible crops as animal feed should be reduced with the main emphasis being on:

- ***raising animals on extensive pastures and other grassland:*** Extensively reared ruminants convert grass and other vegetation into food that we can eat and are able to use land that is generally not suitable for other forms of food production. Well-managed grasslands support biodiversity and store large carbon stocks;
- ***integrated crop/livestock production***: The link between animals and the land should be restored through mixed rotational farming where animals are fed on crop residues and pasture and their manure, rather than being a pollutant, fertilises the land;
- ***raising pigs and poultry outdoors***: Pigs and poultry are nature's great foragers and recyclers. They should be kept outdoors where some of their diet can come from foraging, pasture, cull vegetables from local farms and properly treated food waste. This could replace part of the cereal, soy, palm and fish-based feed currently used;
- ***agro-forestry***: This can be more productive, profitable and sustainable than forestry alone or agricultural monocultures. In Galicia in Spain, pigs are farmed in forest areas[71] while in Denmark pig rearing is combined with fruit and vegetable production.[72] In Italy some farmers integrate pig rearing with trees which provide shade for the pigs in the hot summer months.[73]

The Communiqué agreed by 69 Agriculture Ministers from across the world at the Global Forum for Food and Agriculture in 2018 supports "locally adapted animal production systems", "integrated crop-livestock-forestry systems", "pasture and rangeland restoration", "agro-ecological methods", "organic farming" and "traditional animal husbandry systems such as pastoral farming".[74]

The Communiqué also recognises the wastefulness of feeding human-edible crops to animals saying they aim "to reduce food losses and wastage within livestock production systems, in particular by making better use of human-inedible feed resources". It also aims to "minimise losses and waste of water, energy and nutrients, in particular by improving the integration of livestock into the circular bio-economy".

Rather than using high external inputs, circular agriculture strives to obtain inputs such as nutrients from within its world. It works in harmony with nature. It ensures that its wastes are recycled into productive agricultural use rather than being allowed to escape and pollute the environment. It recognises the ethical imperative of farming to the highest standards of animal welfare.

Consumption: Eating less and better meat and dairy products

A reduction in meat and dairy consumption would deliver multiple co-benefits. It would:

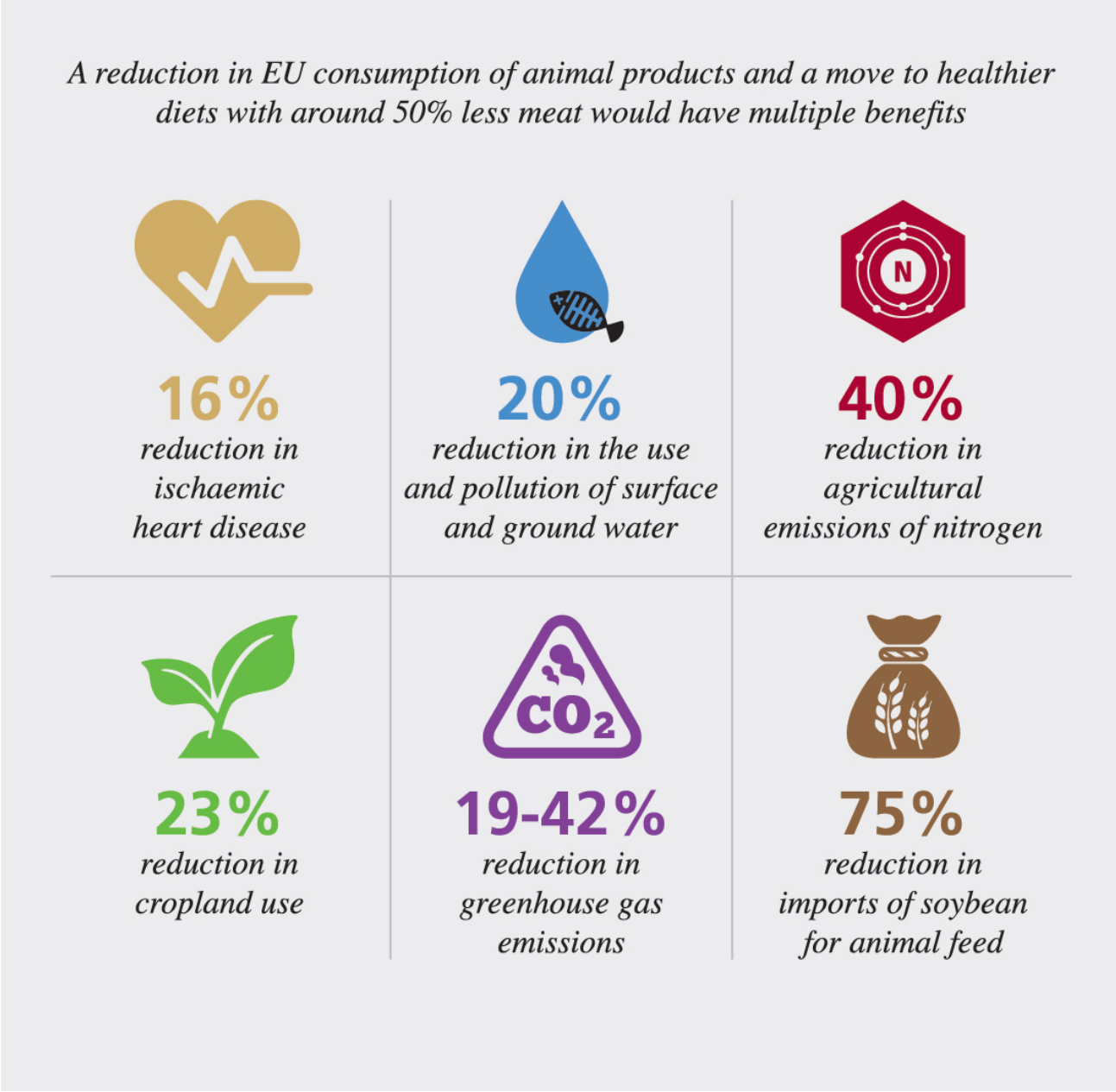
- reduce the incidence of heart disease and certain cancers (this applies to reduced consumption of red and processed meat)
- make it possible to meet the Paris climate targets
- allow cropland to be farmed less intensively so enabling biodiversity, soils and water quality to be restored
- help feed the growing world population as a much greater proportion of crops would be used for direct human consumption
- reduce pressures on wildlife as habitat destruction could be reversed
- enable animals to be farmed extensively to high welfare standards.

Studies show that a 50% reduction in EU consumption of meat and dairy products would produce important benefits: see Figure 1.[75, 76, 77]

"Overconsumption of meat is bad for our health and for the health of our planet ... we need to decide whether to act now to reduce human meat consumption or wait until the decay of sufficient parts of the global system tip us into much poorer planetary, societal, and human health".

John Potter, Professor of epidemiology, British Medical Journal 2017[vi]

Figure 1



Source: see endnotes 75-77

A global study looked at food production in 2050 on a business-as-usual (BAU) basis and its use of resources and environmental impacts. It then compared these with what would happen in 2050 if there were a 53% reduction in the consumption of animal-source products. The final column of Table 1 shows that, compared with BAU, this 53% reduction would produce multiple benefits in terms of reduced use of arable land, freshwater, energy and pesticides as well as reduced GHG emissions, nitrogen and phosphorus surpluses, deforestation and soil erosion.[78]

Table 1: 2050 – Comparison of BAU with 53% reduction in consumption of meat, dairy, fish and eggs with only non human-edible materials being used as animal feed

Production inputs and environmental outcomes	Reference scenario: FAO projections for 2050	2050: 53% reduced consumption of animal products	% reduction achieved by 53% reduced consumption of animal products in 2050 compared with reference scenario
Arable land use: billion hectares	1.63	1.20	26%
GHG emissions: Gt CO_2-eq	12.8	10.4	18%
Freshwater use (for irrigation): km^3	2178	1718	21%
N-surplus: million tonnes N	121.8	65.2	46%
P-surplus: million tonnes P	64.0	38.4	40%
Non-renewable energy use: exajoules	26.7	17.2	35%
Pesticide use	15.4	12.0	22%
Deforestation: million ha	7.2	6.5	9%
Soil erosion from water: billion tonnes soil lost	36.8	32.2	12%

Source: Schader *et al*, 2015

Reducing meat production and consumption: should the focus be on ruminants or monogastrics?

Some argue that the reduction should be made in ruminants as they have higher GHG emissions than monogastrics. It is also argued that ruminants need more land than monogastrics. However, this point does not distinguish between (i) intensively and extensively raised ruminants and (ii) arable land and grassland. Extensive ruminants utilise land very efficiently when they graze grassland which cannot be used for other forms of food production. In contrast, monogastrics and intensive ruminants need arable land for feed which could be used more efficiently to grow crops for direct human consumption.

In several respects extensive ruminants make a much better contribution to sustainable food production than monogastrics (most pig and poultry production is in the industrial sector).

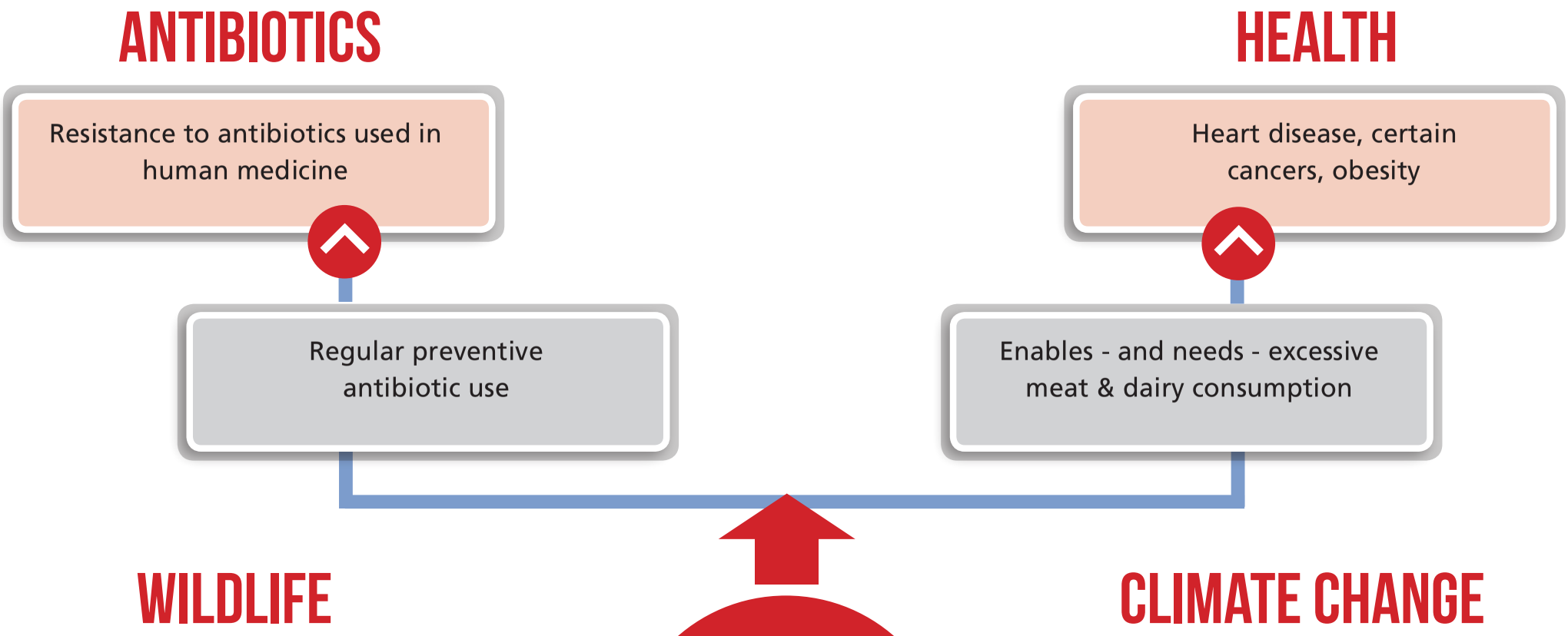
Extensive ruminants augment food security by converting inedible materials into food we can eat. Monogastrics, however, undermine food security as they consume much more nutrition when eating human-edible crops than they deliver as meat.

Any expansion of the monogastrics sector would fuel increased demand for cereals and soy as animal feed. This would lead to expansion of cropland into forests and other important ecosystems and/or intensification of crop production through the use of monocultures and agro-chemicals.

Animals raised in industrial systems are vulnerable to disease. As a result antibiotics use is much higher in such systems than in extensive ruminants. Animal welfare is poor in industrial pig and poultry operations while well-managed extensive ruminant production has the potential to deliver high welfare standards.

COMPASSION in world farming

Intensive livestock systems are at the heart of – or contribute to – many problems affecting health, food security, the environment and animal welfare



INDUSTRIAL LIVESTOCK PRODUCTION

Need for cereals & soy as feed has led to deforestation & erosion of wildlife habitats threatening animals with extinction

GHG emissions – impossible to reach Paris climate targets

Need for cereals as feed has fuelled intensification of crop production

Soil degradation, biodiversity loss, water & air pollution

NATURAL RESOURCES

Animals convert cereals very inefficiently into meat & milk. This undermines food security by reducing cereals available for people

FOOD SECURITY

Animals in cages & barren overcrowded sheds & selection for fast growth

Very poor animal welfare; animals treated as machines

ANIMAL WELFARE

For more information visit www.ciwf.org or email engagement@ciwf.org

Registered Charity Number 1095050. (England & Wales)

In summary, the fact that ruminants produce more GHG emissions per unit of meat produced than pigs and poultry is crucial. However, it does not follow that meat production should switch from ruminants to monogastrics as this would result in detrimental impacts on food security, biodiversity, use of arable land, deforestation, antibiotic resistance, animal welfare and the quality of soil, water and air. The best response to ruminant GHG emissions – while at the same time ensuring that other key factors are not undermined – is to substantially reduce meat consumption but for the bulk of meat production to be extensive ruminants as industrial pig and poultry production is responsible for a very wide range of harms.

We should add that all the concerns set out above regarding intensive monogastric production apply also to intensive ruminants such as those kept in feedlots. It is only extensive ruminants that produce benefits as regards food security, impact on natural resources, animal welfare and low disease levels and use of antibiotics.

Empowering consumers

Governments should develop programmes to increase public awareness of the implications of different livestock farming methods and consumption levels for human health, the environment, food security, climate change and animal welfare. SDG 12.8 requires people "to have the relevant information and awareness for sustainable development and lifestyles in harmony with nature".

Consumers should be empowered to play a greater part in driving improvements in animal welfare. Mandatory labelling of meat, dairy products and eggs as to farming method would enable consumers to make informed choices when buying food.

Ending hunger and increasing the productivity of small-scale farmers

Increasing food production will not of itself be sufficient to combat hunger.[79] It must be combined with improved livelihoods for the poorest, particularly small-scale farmers in the developing world. Smallholder farmers must be helped to increase their productivity but this should not entail the introduction of industrial systems as these exclude participation of the poorest farmers. They are out-competed by industrial production which provides little employment.

Small-scale farmers should be helped to provide improved healthcare and nutrition for their animals through better disease prevention and management, the expansion of veterinary services and the cultivation of fodder crops such as legumes. Better animal health and nutrition result in increased livestock productivity and longevity. This will improve smallholders' purchasing power, making them better able to buy the food that they do not produce themselves and to have money available for other essentials such as education and health care.

Non-industrial approaches can deliver substantial productivity gains. Research has studied silvopastoral systems for cattle that, alongside pasture also provide shrubs (preferably leguminous) and trees with edible leaves and shoots. Such systems do not need synthetic fertilisers, produce more biomass than conventional pasture and hence result in increased meat and milk production.[80] In East Africa fodder shrubs have been identified that provide cheaper and easily available protein feeds for improving milk production and boosting incomes in smallholder farms.[81]

In an area in Ethiopia prone to drought deep water-harvesting holes have been dug; these are lined with a geo-membrane to stop leakage. Rainwater is stored allowing farmers to irrigate their crops at times of need. Their livestock no longer have to be sold during the dry season, when feed becomes scarce. Farming is now a viable livelihood, where once food-handouts or migration were the only options.[82] In the Philippines small-scale enterprises rearing free-range chickens are proving to be commercially viable.[83]

Analyses of some 300 projects in the developing world show substantial benefits in the form of increased crop yields, improved water efficiency and reduced pesticide use arising from techniques such as integrated pest and nutrient management, agro-forestry and conservation agriculture.[84, 85]

Replacing routine use of antimicrobials with health-orientated systems for rearing animals

A Joint Scientific Opinion by the European Medicines Agency and the European Food Safety Authority highlights the "need to rethink those particular farming systems which place much reliance on antimicrobial use ... The stress associated with intensive, indoor, large-scale production may lead to an increased risk of livestock contracting disease."[86]

Heath-orientated systems should be used in which good health is integral to the system rather than being propped up by routine use of antimicrobials. This approach would build good health and strong immunity by:

avoiding overcrowding: high densities are a risk factor for the spread and development of infectious disease; such densities can allow rapid selection and amplification of pathogens;[87, 88, 89]

reducing stress: stress tends to impair immune competence, making animals more susceptible to disease;[90]

enabling animals to perform natural behaviours: inability to engage in natural behaviours is a major source of stress in intensive systems;[91]

ending the early weaning of pigs: this is stressful due to premature removal from the sow, change in diets, mixing with unfamiliar pigs and being moved to a new environment.[92]

avoiding excessive group size: The O' Neill Review states: "large numbers of animals living in close proximity ... can act as a reservoir of resistance and accelerate its spread. There are often many opportunities in intensive farming environments for drug-resistant bacteria to be transferred between, for example, thousands of chickens being reared in the same indoor enclosure";[93]

maintaining good air quality: poor air quality and inadequate ventilation are risk factors for respiratory disease;[94]

encouraging a move away from genetic selection for high production levels: these appear to involve an increased risk of immunological problems and pathologies.[95]

Such health-orientated systems would also have much greater potential for delivering good welfare outcomes than industrial systems.

Diversifying our sources of protein: meat analogues and artificial meat

Meat analogues and artificial meat are being developed. These will facilitate reduced consumption of real meat with concomitant benefits for health, the environment, climate change and animal welfare.[96, 97] Meat analogues (imitation meat), based on plant sources of protein such as soy and wheat gluten, resemble meat in flavour, texture and appearance. The market for meat analogues is expected to grow strongly.[98]

Artificial meat ('lab-grown' meat) could make a major contribution to meeting the growing demand for meat while at the same time reducing the global population of farm animals. Moreover, its production would not entail the routine use of antimicrobials which is endemic in industrial livestock production or carry the risk of zoonosis outbreaks. Artificial meat would have much lower environmental impacts and GHG emissions and would need less land and water than real meat.[99]

Artificial meat is made from cells collected from an animal which are then grown in a culture medium. Lab-grown burgers and meatballs as well as chicken meat have already been produced.[100, 101, 102, 103] A number of start-ups are working in this field.[104] Costs are coming down.[105] Governments should adopt policy positions that strongly support the development of artificial meat.

Replacing distorting economics with true cost accounting

Industrially produced meat and milk are cheap at the supermarket checkout. However, the low cost of these products is achieved only by an economic sleight of hand. We have devised a distorting economics which takes account of some costs such as housing and feeding animals but ignores others including the detrimental impact of industrial agriculture on human health and natural resources.

"in many countries there is a worrying disconnect between the retail price of food and the true cost of its production. As a consequence, food produced at great environmental cost in the form of greenhouse gas emissions, water pollution, air pollution, and habitat destruction, can appear to be cheaper than more sustainably produced alternatives."

UN Food and Agriculture Organization, 2015[vii]

These "negative externalities" represent a market failure in that the costs associated with them are borne by third parties or society as a whole and are not included in the costs paid by farmers or the prices paid by consumers of livestock products. In some cases the costs are borne by no-one and key resources such as soil and biodiversity are allowed to deteriorate undermining the ability of future generations to feed themselves.

Need to internalise negative externalities

The UK Foresight report on the future of food and farming said: "There needs to be much greater realisation that market failures exist in the food system that, if not corrected, will lead to irreversible environmental damage and long term threats to the viability of the food system. Moves to internalise the costs of these negative environmental externalities are critical to provide incentives for their reduction."[106]

We need to develop ways of internalising these negative externalities so that the costs and losses they engender are properly reflected in the price of food. If this were done, industrial meat and milk would be more expensive than their more nutritious, extensively produced counterparts.

Mending our price system

Olivier De Schutter, former UN Special Rapporteur on the right to food, stresses that "any society where a healthy diet is more expensive than an unhealthy diet is a society that must mend its price system."[107] This applies equally to a society where environmentally damaging, low animal welfare food is cheaper than food that respects natural resources and animals' well-being.

Fiscal measures should be used to lower the cost of quality food for both farmers and consumers. Farmers producing to high environmental and animal welfare standards could be compensated for the extra costs involved by subsidies and, in their tax affairs, by generous capital allowances and an extra tranche of tax-free income. This could be paid for by placing taxes on the inputs of industrial agriculture such as chemical fertilisers and pesticides.

Taxes should be placed on unhealthy, inhumanely produced food with the revenue raised being used to subsidise the price of healthy food produced to high standards of animal welfare. In countries which charge a sales tax such as VAT on food, the price paid by consumers for quality food could be reduced by placing a lower or nil tax or VAT rate on such food.

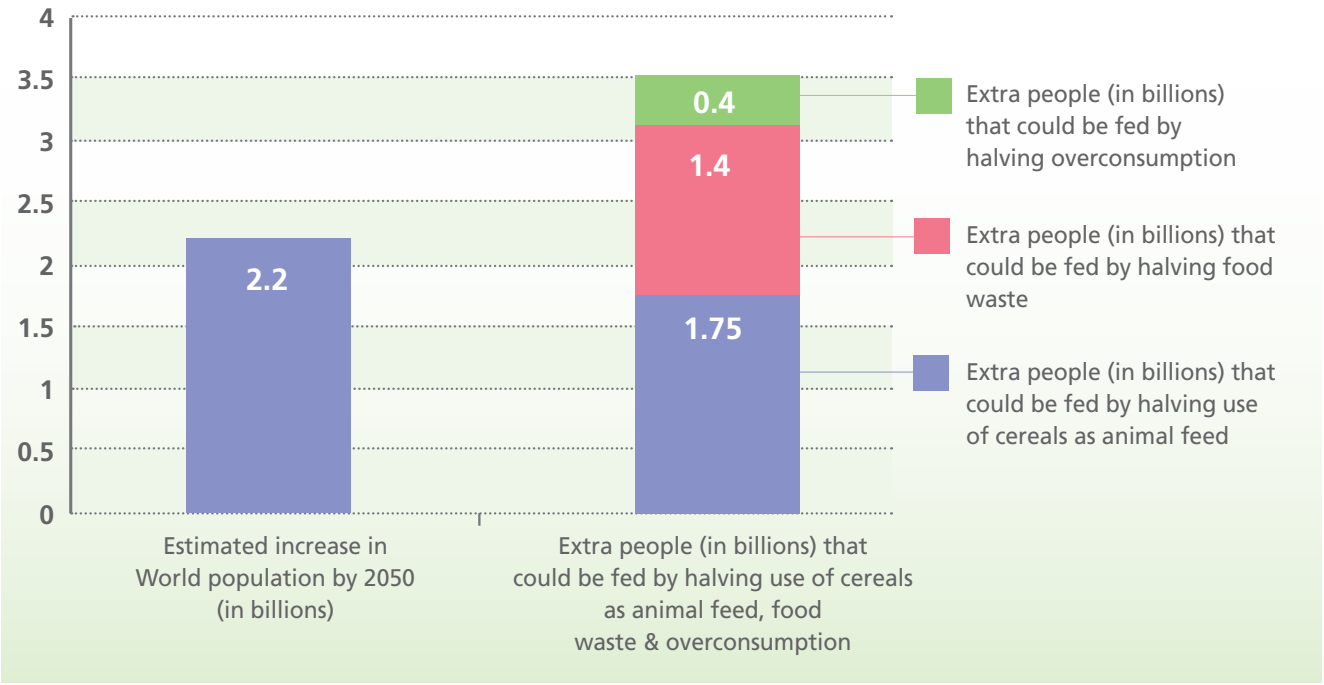
Rebutting the 70% myth

One thing more than any other drives current food policy: the assumption that by 2050 we need to produce 70% more food to feed the growing world population. And on this basis we are told that further industrialisation is necessary. However, estimates of the number of people that could be fed from current food production vary from 11.5 billion to nearly 16 billion.[108, 109, 110] We produce sufficient food; the problem is that over half is lost or wasted in various ways.

The UN Environment Programme calculates that the cereals which, on a business-as-usual basis, are expected to be fed to livestock by 2050, could, if they were instead used to feed people directly, provide the necessary food energy for over 3.5 billion people. If a target were adopted of halving the use of cereals for feed an extra 1.75 billion people could be fed.[111]

A report by the High Level Panel of Experts on Food Security and Nutrition states that worldwide 25% of food calories are lost or wasted post-harvest or by being discarded by consumers or food businesses. If such loss and waste could be halved an extra 1.4 billion people could be fed.

Figure 2. Feeding the 2.2 billion extra people anticipated by 2050.



Based on data from: UNEP, 2009; High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2014 & Alexander *et al*, 2017

Alexander *et al* (2017) calculate that 2.9 EJ (exajoules) are lost each year through overconsumption i.e. consumption in excess of nutritional requirements.[112] An extra 400 million people could be fed if such overconsumption was halved.

If all the above steps were taken, an extra 3.55 billion people could be fed; this is more than the anticipated 2.2 billion increase in world population by 2050[113] (see Figure 2). We do not need to produce large amounts of extra food; we simply need to use our food more wisely. This said, increased production is needed in certain regions such as sub-Saharan Africa and South Asia but this must be achieved in a genuinely sustainable manner.

Challenging vested interests

The WHO points out that a handful of large multinational corporations now control the food chain.[114] They stress the need for governments "to make bold political choices that take on powerful economic operators, like the food and soda industries. If governments understand this duty, the fight against obesity and diabetes can be won. The interests of the public must be prioritized over those of corporations".[115]

Multi-national companies that provide agricultural inputs such as livestock feed, genetics and pharmaceuticals; fertilisers, pesticides and commercial seeds; and farm equipment have a vested interest in promoting industrial agriculture, including industrial livestock production.

"much food production is now divorced from its primary purpose of providing the nutrients that sustain human life in good health"

World Health Organization, 2017[viii]

These providers of inputs are dependent on agriculture being industrial. If farming were to become extensive demand for their products would fall very substantially. Accordingly, they endeavour to protect industrial agriculture from criticism. Such companies wish not just to protect their markets but to keep on growing; hence their desire to see further expansion of the industrial model in the developing world. Indeed, the global South is the prime growth region for industrial agribusiness.[116]

Even those input providers with no apparent connection to industrial livestock – such as manufacturers of pesticides and fertilisers – are in fact dependent on it as 36% of global cereals[117] and 98% of the world's soybean meal are used as animal feed.[118]

The major international grain traders also have a strong interest in the continued expansion of industrial livestock production as it is their products that are used by manufacturers of the concentrate animal feed that is the norm in the industrial sector.

These companies have immense political influence which they use to influence policymakers and regulators and to obstruct reforms. They are able to shape the narratives that entrench the status quo e.g. industrial agriculture gives us cheap food and is vital to feed the world. Hilal Elver says: "Political will is needed to re-evaluate and challenge the vested interests, incentives and power relations that keep industrial agrochemical-dependent farming in place".[119]

Conclusion

A Global Agreement on Food and Agriculture would enable the problems arising from industrial agriculture and the Western-style diet to be addressed in a cohesive, integrated manner and facilitate global action to be taken in respect of global challenges. Without such a Convention it will be difficult to meet many of the Sustainable Development Goals, the Paris Climate Agreement and the Convention on Biological Diversity.

A Global Agreement could yield crucial benefits including a major reduction in food and farming's contribution to climate change and the destruction of wildlife habitats.

A Global Agreement could ensure that small-scale livestock farmers in the developing world are not, to use the words of the FAO Director General, "pushed aside by large capital-intensive operations" but instead are helped to improve their productivity and livelihoods in ways that are appropriate to their circumstances.

A Global Agreement could stimulate a substantial reduction in overall global meat consumption leading to reduced levels of heart disease, diabetes, obesity and certain cancers in societies with high meat diets. However, people with low consumption of meat are not expected to reduce their intake.

Reduced global meat consumption would allow us to replace industrial livestock production with extensive animal farming; this would lead to reduced use of antimicrobials, a decrease in infectious animal diseases and much improved animal welfare. It would also reduce the vast quantities of cereals needed to feed industrial livestock. Crops could be grown less intensively enabling soils and biodiversity to be restored and water pollution to be reversed. Less soy would be needed as animal feed so halting the expansion of soy production into forests and other important ecosystems.

Industrial livestock's dependence on human-edible cereals undermines food security as animals convert these crops very inefficiently into meat and milk. A Global Agreement could promote recognition that livestock only make an efficient contribution to food production and boost food security when they convert materials we cannot consume into food we can eat.

A Global Agreement would underpin and guide the development of approaches to food and farming that produce healthy, nutritious food, restore and enhance natural resources, improve smallholder livelihoods and respect animal welfare.

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