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Author(s): Philip Lymbery

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OPINION

# Could humanity's hoofprint overwhelm nature?[1]

Philip Lymbery

Philip Lymbery is Chief Executive of leading international farm animal welfare organisation Compassion in World Farming, a Visiting Professor at the University of Winchester and Vice-President of Brussels-based Eurogroup for Animals. He is author of *Farmageddon: The True Cost of Cheap Meat* and *Dead Zone: Where the Wild Things Were*. philip@ciwf.org

## Abstract

*Humanity's global footprint is greatly affected by food and the way it is produced. Agriculture already occupies nearly half the useable land surface of the planet – 80% of which is devoted to meat and dairy. As an equation, humanity's footprint has three components: the number of consumers multiplied by the amount consumed multiplied by the way those resources were produced. Future sustainability relies on addressing all three components of humanity's footprint: population, consumption and method of production. Global action is therefore needed to alleviate poverty, address overconsumption of livestock products and move food systems to regenerative forms of conservation agriculture.*

**Keywords:** Agriculture; Anthropocene; biodiversity; climate change; factory farming; food system; mass extinction(s).

1 This article is based on extracts from *Dead Zone: Where The Wild Things Were* by Philip Lymbery, published by Bloomsbury (2017) and a speech given to the Population Matters conference, *The Last Elephant in the Room*, held in London on 27th April 2019.

## Why our children's future relies on what we eat

Imagine opening your morning newspaper to read the headline, 'Government agrees to building a hundred new cities the size of London'. Well that, plus 30 more cities the size of Los Angeles, is what one billion extra people looks like. From three billion of us in 1960, there are 7.5 billion today. By the middle of this century, we are set to add another two billion people to the planet. And like a fried egg with a small yolk within a sprawling area of white, each of those cities requires much more land elsewhere to grow food. We know in Britain that about a tenth of our land surface is urban, (ONS, 2014) whilst 70% is devoted to agriculture (World Bank, 2019a). Yet, as a nation, we're still only about half self-sufficient in feeding ourselves (Defra, 2017).

Then there's the second population explosion: of livestock. As it stands, a billion extra people means 10 billion extra farm animals produced every year, together with all that means for land, water and soil. Once we realise that agriculture already occupies nearly half the useable land surface of the planet – 80% of which is devoted to meat and dairy – we can quickly see that our planet is under great strain.

## Environmental footprint

Within the last half-century, humans have changed the face of the Earth to such an extent that the traditional scientific way of classifying its main habitats (into forest, grassland, desert and tundra) looks hopelessly outdated (WorldBiomes, 2009). Genuine wildland now makes up just a fraction of the Earth's land surface. With most of 'nature' engulfed within human land use, some scientists believe there needs to be a new land-classification system. Ellis and Ramankutty (2008) have suggested terms such as 'dense settlement', 'villages', 'croplands' or 'wildlands'.

The biggest single driver of this dramatic change is farming. Accounting for 47% or more of useable land globally, an area the size of South America is devoted to growing crops, and an area bigger still to raising livestock (Owen, 2005; Searchinger et al. 2013).

As the population rises, so does the quest intensify for more land to cultivate. Right now, we are in no danger of running out of food (distributional problems notwithstanding), but the environmental damage attached to the way we are

choosing to produce it may be irreversible. Flora and fauna are falling extinct one thousand times faster than the rate viewed by scientists as the expected 'background' rate (Gavrilles, 2014). Food production is the biggest driver of this biodiversity overkill.

The last half-billion years have seen five mass extinctions: episodes of sudden dramatic loss of biodiversity. Dinosaurs developed after one of the biggest mass-extinction events at the end of the Permian period some 250 million years ago. They disappeared, or underwent vast changes, about 66 million years ago, over a brief span of geological time. Although the exact causes of past mass extinctions remain a mystery, volcanic eruptions and large asteroid strikes are two prime suspects. The resulting dust clouds probably blocked out sunlight for months if not years, causing plants and plant-eating creatures to die. Heat-trapping gases would also have triggered runaway global warming.

Of course, planet Earth is tough. Ecosystems bounce back eventually. After one of the most devastating extinction events of all time, things did recover, but it took a long time: some 30 million years. Some scientists believe we are now on the cusp of the sixth mass extinction. It is expected to be the most devastating since the asteroid impact thought to have wiped out the dinosaurs. This time, the cause is much closer to home: us. It appears that we have moved into our own geological era, one like none before, the ultimate expression of humanity's growing footprint; the combined effect of our population and our impact through consumption, production and destruction.

Welcome to the Anthropocene.

## Humanity's footprint

Humanity's footprint has been calculated as our human population multiplied by what we consume. Using this calculation, some have suggested that action on consumption alone will be enough to save the planet. However, there is growing recognition of the need by policymakers to address all parts of the equation. Take consumption of meat and dairy in Britain as an example. In the ten years from 2006, the number of vegans in the country rose from 150,000 to more than half a million (Vegan Society, 2016) – impressive growth of over 300%, until one realises that in the same ten-year period, the number of people in the country grew by

five million (World Bank, 2019b). By implication, the impact on meat consumption by an increased number of vegans was far outweighed by an increase in people choosing to eat meat.

From my own research, I conclude that humanity's footprint equation, particularly around food, has a third component: method of production. The way that food is produced; whether it be intensively on farms factory, or extensively on free ranging or organic systems, can have a dramatic impact on the resources needed to produce a unit of food. Similarly, the production method can have a profound effect on wildlife and the environment.

Since the dawn of agriculture, 10,000 years ago, farming has pretty much worked in harmony with nature. However, the middle of the last century saw the rise of a particularly resource-intensive and damaging form of food production – factory farming – which saw farm animals disappear from the fields into windowless sheds crammed with cages and crates. Age-old crop rotations that utilised nature's ways of fertilising soil and controlling pests and disease gave way to monocultures doused in chemical fertilisers and pesticides. The age of industrial agriculture was born.

## Two sides

Yet, it wasn't only farm animals that started to disappear from the countryside. Wildlife too suffered steep declines that continue to this day, Barn owls and hedgehogs close to home, jaguars and elephants on continents far away. In the last 40 years, since the widespread adoption of factory farming, the total number of wild mammals, birds, reptiles, amphibians and fish worldwide has more than halved. That's a shocking statistic.

And much of this decline is down to the two sides of factory farming, the first side being where the animals are kept. Chickens taken from bushes and rangelands to be kept in cages. Mother pigs who prefer to raise their piglets in woodland edges, kept in crates so narrow they can't turn around. Cattle taken from pastures to be confined in mega-dairies or feedlots where they are fed grain instead of grass. What looks like a space-saving idea actually isn't. By keeping them caged, crammed and confined, we then have to grow their feed elsewhere, on scarce arable land, using chemical pesticides and fertilisers – factory farming's second side.

As crop fields expand in the wake of industrialisation, so the trees, the bushes and the hedges disappear, along with wildflowers. And when they disappear, so too do the insects, and the seeds; and the birds, the bats, the bees that depend on them. Even worms disappear, along with other soil-living biodiversity and soil fertility, leaving little else but the crop.

Then we take this crop and feed it to factory farmed animals, losing most of the food value of that crop, in terms of calories *and* protein, in conversion to meat, milk and eggs. In this way, we waste enough food to feed an extra four billion people on the planet. That's not to say an extra four billion people all at once would be a good idea. It wouldn't; it would be an environmental disaster. It is to say that without industrial agriculture, we could feed everyone on less farmland, not more.

Yet, instead of switching to more sustainable regenerative farming and reining in meat consumption, vested interests use growing population pressure to encourage more industrial agriculture, regardless of the fact that more than half our food is lost or wasted; with the biggest single portion of food waste on the planet being the feeding of human-edible crops to factory farmed animals. To keep pace with this short-sighted vision, by 2050, we will need an area of extra cereal cropland the size of France and Italy combined. Up to a fifth of the world's remaining forests are likely to be lost, including an area of tropical forest equivalent to much of Argentina.

## Overwhelming nature

As humanity's footprint grows, agricultural encroachment, together with the further industrialisation of farming, causes irreversible damage to biodiversity, forests, soil and water. More wildlife extinctions follow. Nature is overwhelmed.

The alternative to bulldozing forests for more arable land to feed a burgeoning intensive livestock population is to keep farm animals on pasture – in other words, land that is unsuitable for crops. Indeed, a quarter or more of the world's land surface is covered in grassland pastures, (Searchinger et al., 2013). Farm animals have also long been kept on permanent pastures, or as part of a rotational farming system where grass is interspersed with crops to build soil fertility naturally.

Some pasture, particularly in temperate lowlands as in Britain, is there by choice: we choose to graze cattle rather than grow crops. Yet much of the world's pasture or 'rangelands' is in places too steep, too dry or on too poor a soil to be much use for arable land without copious chemicals and irrigation (FAO, 2011). The steep slopes of the chalk downlands where I live are a prime example. They are largely covered in grass, as crop farming would be difficult and precarious. Other examples of grasslands in areas unsuitable for major crop farming include the drylands of Africa, the steppes of Central Asia and the highlands of Latin America. Places like these are prone to drought and desertification if the land is worked too hard. Nevertheless, they remain productive as grazing land for animals (FAO, 2011).

The best way to produce healthy meat with the fewest resources is to use permanent pasture or keep animals on the grassland rotation of a mixed farm. In this latter routine, soils are rested from the relentless demands of arable cropping for a few years by turning them for a while into grazing land. By transforming grass into meat, milk and eggs, we convert something we can't eat – grass – into something we can. Instead, by taking animals off grass and feeding them grain, we have created a rivalry between people and animals for food. That makes it harder, not easier, to feed a growing world population. Yet there is no sign of a change of approach. Policymakers and the food and farming industry continue to argue for more industrial meat production to meet what is predicted to be a near-doubling of demand for food by the middle of the century.

This notion is totally misconceived. Globally, we already produce enough food calories for around 16 billion people, way more than enough even for the huge projected population rise[2]. The trouble is we waste so much of it, not least by shovelling food enough for billions of people into the grain-troughs of factory farmed animals. So, who benefits from this 'produce more' narrative? Those industries set to benefit from yet more factory farming – of both crops and animals. Chemical fertiliser and pesticide companies, pharmaceutical companies (half the world's antibiotics are fed to farm animals); equipment manufacturers;

2 For crop and animal production see FAOSTAT Production databases, production data for crops primary, crops processed, livestock primary. Production data from 2012–2014 period is available on database. For calorific values see FAOSTAT Food supply database, food balance and food supply. People fed calculated as 2250 kcal per person per day for one year (FAOSTAT, ND).

and grain companies who, of course, have worked out you can sell far more grain to a given population by selling it to feed farm animals rather than simply using it to make bread.

Unless there is a major global policy shift, the majority of additional farm animals will be raised on grain-guzzling factory farms, and pressure for additional land will be so intense that farming is likely to replace forests as well as spread further into marginal lands, heaping yet more pressure on wildlife already on the edge. An area of extra cereal cropland the size of France and Italy combined will be needed by 2050 to keep pace. Up to a fifth of the world's remaining forests are likely to be lost over the next three decades, including an area of tropical forest equivalent to much of Argentina (OECD, 2012; Keenan et al., 2015). Great swathes of extra croplands look set to join the chemical-soaked arable monocultures of East Anglia in England. There'll be more fields of maize to grow animal feed when it could be feeding people. And more virgin forest will be converted to palm plantations; yes, palm products are also used as animal feed.

The encroachment of agriculture into remaining wildlands, together with the onward march of industrial farming, will almost certainly cause irreversible damage to biodiversity, forests, soil and water. Wildlife extinctions will follow. Conservationist and explorer, Dereck Joubert interviewed by *National Geographic* (Langin, 2014) noted that fifty years ago there were nearly half a million lions left in the world, and that every time the human population rises by one billion, the population of lions' falls by half. "*Today we're at 20,000 to 30,000 lions and the same is true for leopards, for cheetahs, for snow leopards*," he said. As nature retreats, she stops providing essential services like pollination, soil replenishment and carbon sequestration too.

Throughout human history, for better or for worse, *Homo sapiens* has outdone all-comers, from magnificent mammals like the bison that roamed the American plains in vast numbers, to birds like the passenger pigeons that once flocked like great rivers in the sky. Whatever has stood in our way, and sometimes just within reach, has been seen off. With scientists now suggesting that we have moved into our own geological era, the Anthropocene, the major force shaping the planet is us. What is now starting to be recognised is that one of the biggest victims of the Anthropocene could be… us.

It was legendary conservationist, Sir David Attenborough, who said there are few environmental problems that "*wouldn't be easier to solve with fewer people, or harder, and ultimately impossible, with more.*" (BBC, 2009).

Humanity currently faces major problems. Talk grows of an existential threat. Scientists warn that we have 12 years to solve climate change. Pollinators essential for the very existence of a third of our food are in steep decline. Antibiotics, half of which we feed to farm animals to prop-up factory farming, could soon stop working. Wild fish stocks are set to be depleted within 30 years. And the UN itself warns that if we carry on as we are, we could have just 60 years of harvests left in the world's soils before they are depleted too (UNEP). At the heart of all these declines is the expansion of industrial agriculture.

Global warming is the wild card, the game-changer that threatens to throw a world already stretching planetary limits into chaos. Sea-level rises could see land disappear just when more is needed. It could disrupt the water cycle, just when freshwater is at a premium. And if there's still enough soil for planting, it could reduce crop yields across the globe by as much as a fifth (Leclère, 2014).

The world's governments gathered in Paris in December 2015 to strike an historic deal to limit global warming to within 2 degrees Centigrade; a temperature rise deemed by scientists to be the 'safe' maximum level. Even at this level, scientists believe a third or more of all land-based species of plants and animals are doomed to extinction (Thomas et al., 2004). A third or more! The figure bears repeating. Think about what that actually means: so many mammals, birds and plants gone for ever: a massacre of life's variety. Millions of years of evolution wiped away in a geological heartbeat.

One thing is for sure – business as usual is not an option; not if we want our children and grandchildren to know a world anything like as beautiful and plentiful as the one we inherited.

Fuelled by runaway meat production, the climate impact of the way we produce food alone could take us to the brink of catastrophic global heating. That's without adding in the negative role of other industries, like energy and transport. As the temperature creeps up, the world as we know it starts to change. Drastic

changes are likely this century to water cycles, ecosystems and forests, which could mean whole forests disappearing and the Amazon turning to savannah or even desert. The world could be lashed by greater and more severe storms, drought, floods and crop failures. This may sound apocalyptic; but it is only what leading climate authorities like the Intergovernmental Panel on Climate Change (IPCC) are warning (Field et al., 2014).

People are going to be deeply affected. Low-lying cities and regions could disappear underwater, including hundreds in America (Le Page, 2015a; 2015b; Strauss et al., 2015). Bangladesh faces the threat of disappearance. Millions of 'climate migrants' are likely to be forced from their homelands by extremes of weather, crop failures, or conflicts over increasingly scarce resources. If we don't do something and fast, these changes will be irreversible. They're already happening. Yet it doesn't have to be like this; there is another way.

## Key to the future

The key to that better way lies in addressing all three components of humanity's footprint: population, consumption and method of production. A decent future for our children tomorrow relies on us starting a big conversation today about longstanding taboos, those elephants in the room around population pressure and the need to eat less meat. It relies on embracing positive, life-affirming ethical solutions, like alleviating poverty and empowering women and girls worldwide: both seen as effective at addressing population pressure (Population Matters, ND) and are things that we should be doing anyway, regardless. Gender equality, female empowerment and making poverty history are surely the cornerstones of an ethical and decent society.

The future for our children also relies on more balanced consumption; diets that don't overdo livestock products, not least for the climate. As already mentioned, scientists tell us that if we carry on eating meat and dairy in the way we are, then our food alone could trigger catastrophic climate change. To stabilise the climate and save the natural world on which we all depend, there is a pressing need to reduce meat and dairy production by at least half. High-consuming regions like Europe and North America need to take the lead, with governments introducing policies to encourage greater consumption of alternative foods to livestock products. Companies too need to do their bit; setting measurable targets for

reductions in the amount of meat and dairy they use or sell in their businesses, be they retailers, fast food restaurants or ready-made meal manufacturers. Everyone can play their part.

On production, the key to better food lies with the world's pastures; on moving away from factory farming; instead, rearing animals like cattle and sheep by grazing them for life on pastures instead of feeding them grain. By keeping animals on the land, in mixed rotational systems, we have a much more efficient way of producing food that genuinely adds to our global food basket, rather than factory farming, which takes away from it. In this way, we have a recipe for better, more nutritious food for all, not just for today, but for future generations.

Clearly, this isn't about people versus animals – far from it. I am not arguing for draconian population control. What I am saying is we need an urgent conversation about how to address all three parts of humanity's growing footprint; population pressure, consumption and production. And the time for that conversation is now. With our children's future at stake, it is so important that we look for win-wins; for people, animals and the environment. Moving to genuinely regenerative ways of producing food – that put back natural capital and save our ability to produce food for the future – has to be one of the most glorious opportunities available to us.

When we restore animals to the land in the right way – in well-managed, mixed rotational farms – amazing things can happen. There can be a cascade of positive benefits for farmers, consumers, the local environment, forests both near and far, and for animal welfare too. Landscapes start coming back to life. Free-ranging animals on pasture can run and jump and stretch their legs and wings. They can scratch and graze and peck and root. They can feel fresh air and sunshine, roll in grass, bathe in dust or wallow in cooling wet mud. They can express their nature, enjoy that freedom to behave normally something viewed as so important by the internationally recognised guidelines known as the 'Five Freedoms' (Farm Animal Welfare Council, 2009). And this gift of freedom matters so much to them.

Is it really too much to ask? After all, animals just want the space and scope to be themselves. And allowing them to do so brings more contented animals with better immunity and less disease. Returning animals to the farm can help soils

regenerate too. The age-old nitrogen cycle comes back into play: sunlight, soil, plants and the droppings of farm animals work together to return fertility to the soil. Cowpats from naturally healthy animals (without chemical treatments) become hives of life – harbouring numerous insects, like the dung beetles that thrive on taking parcels of poo underground to further enrich the soil. Healthier soils encourage all sorts of creatures in a magical circle of life, from earthworms and oribatid mites to springtails and a whole host of tiny microscopic creatures. Small they may be, but their contribution to our survival can be huge. They play key roles in maintaining fertility, structure, drainage and aerated soils, breaking down plant and animal tissues, releasing stored nutrients and converting them into forms that plants can use. Earthworms, perhaps the most important topsoil creatures, can multiply; mixing soil and nutrients together, stirring up essential ingredients for healthy plant growth.

Restoring animals to the land in mixed, rotational systems – breathing new life into tired soils – brings benefits to crop yields and the overall sustainability of the system. It can reduce reliance on chemical pesticides and fertilisers, encourage more plants, insects and other farmland wildlife. The landscape can then grow more varied, bursting with plants and flowers, luring back indispensable pollinating insects like bumblebees, along with hoverflies, butterflies, beetles and moths. This revitalised landscape provides patches of cover, homes for voles and other small creatures that also offer a living to barn owls and other predatory birds. Seeds and insects provide food for farmland birds to thrive once again, sustaining them through the harshness of winter and feeding hungry chicks during the summer.

Grasses with their mass of deep roots and perennial growth help stop precious soil and its nutrients being washed away by the rain, encouraging the soil's sponge-like quality in holding water too. Their deeper roots enable them to tap into water sources shorter-rooted plants can't reach, so that landscapes grow resistant to drought as well as to flood. Without soil erosion and nutrient pollution, rivers become cleaner and less likely to silt up. Natural communities of flora and fauna have a chance to revive, like water crowfoot, starwort and water celery on chalk streams, providing home to all manner of aquatic creatures as well as cover, shade and refuge for fish. These, together with insects like the mayfly, encourage fish like the native brown trout in a web of life graced by the scurry of the water vole.

Rearing animals on pastures rather than grain crops takes less water from rivers and aquifers for irrigation. Switching from grain-feeding, which is forty times more water-intensive than grass, helps relieve some of the relentless demand on hard-pressed water courses. Reducing the clamour for more farmland by cutting down on grain-fed farm animals, plus easing-off on resource-intensive meat, can cut the risk of the axe to remaining forests. Trees that might otherwise go the way of the chainsaw are free to carry on removing carbon from the atmosphere and returning oxygen for us to breathe. And at the same time, we gain healthier, more nutritious food. Animals fed on grass – the fruit of a timeless interaction between sun, rain and soil – provide meat lower in saturated fats and higher in health-giving nutrients like omega-3s. Remarkably, wherever I have gone in the world – Africa, America, China or Europe – the one thing people consistently say about food from the land is that it tastes so much better, has so much more flavour.

Crossing continents in recent years, I've discovered that when animals are returned to the land in the right way, in well-managed mixed and rotational farms, whole landscapes spring to life. Helping to revive a living countryside can be as easy as choosing to eat less and better meat, milk and eggs from pasture-fed, free-range and organic animals. With care, the food on our plate really can support the best animal welfare, bring landscapes to life and safeguard the future for our children.

## Global Agreement

Whilst as consumers, we have great power to help rebalance the food system, the scale of the task now facing humanity requires nothing short of decisive action by the world's leaders: governments, business and the UN, working with civil society. That is why, to save a world worth having for future generations, I call on the United Nations to forge a global agreement to create a regenerative food system without factory farming and excessive meat production. To set a course where the world moves beyond destructive, climate-destabilising, wasteful and cruel methods of food production. Instead, replacing them with the kind of food systems that support life on Earth tomorrow and that preserve our legacy of a decent future for our children.

We have nothing to fear from addressing these issues in a way that empowers people to create a better future. In fact, given the crisis facing food and the natural world, there is everything to fear from simply carrying on as we are. For our way

of life to stay anything like the same, a great deal has to change. As teenage climate activist, Greta Thunberg, says, "*…the rules have to change, everything has to change, and it has to start today.*" (Thunberg, 2018). We are, after all, the last generation who can hand over a planet worth having to our children. Let's create that better future so that, whatever form newspapers take in the years to come, headlines talk of a positive future for people, animals and the planet - for our children, forever.

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