



## The adverse environmental impact of animal agriculture

**The animal agriculture sector occupies 30 per cent of the earth's ice-free surface, provides a means of livelihood to more than 1.3 billion people and contributes 40 per cent of global agricultural gross domestic product.<sup>1</sup> However, the animal agriculture sector is also a significant contributor to global climate change and has a substantial impact on our ecosystem. Greenhouse gas emissions from animal agriculture are estimated to be 7.1 gigatonnes CO<sub>2</sub>, that is, 14.5 per cent of total global greenhouse gas emissions.<sup>2</sup> The impact of the animal agriculture sector on air and water pollution is projected to worsen with growing populations, urbanization and rising incomes leading to higher global demand for meat, eggs and dairy products.**

### Inefficiency of meat consumption

Raising animals for consumption of meat is highly inefficient as it requires huge quantities of grains and water as well as a large land area to produce

a small quantity of meat. It has been estimated that one hectare of land devoted to potato plantation feeds 22 people, rice feeds 19 people, lamb feeds two people and beef feeds one person.<sup>3,4</sup> About 10 kg of vegetable protein is required to produce just one kilogram of animal protein. A calf must be fed 21 pounds of protein to produce one pound of meat for human consumption, and the production of that one pound of meat consumes 2500 gallons of water.<sup>4,5</sup> The equivalent ratio is 4:1 for pork and 2:1 for poultry.<sup>5</sup> Hence, when a country becomes sufficiently prosperous for a large part of its population to eat meat regularly, the amount of grain required to be grown rapidly increases, with direct implications for greenhouse gas emissions.

Intensive animal farming causes a net annual addition of 4.5 – 6.5 billion tonnes of carbon to the atmosphere.<sup>2</sup> As compared to traditional animal farming where 9 kcal of fodder is consumed to produce 1 kcal of meat, intensive animal farming requires 9 kcal of fodder to produce the equivalent quantity of meat.<sup>6</sup> The majority of the resulting carbon emission is attributed to the burning of fossil fuel to produce fertilizers used in feed production, methane released from breakdown of fertilizers and manure, land degradation, and fossil fuel used in transportation and refrigeration of animal products. Greenhouse gases are also released from fossil fuel used in feed production, processing, transporting and marketing.

To keep pace with the growing demand for meat, higher amounts of nitrogenous chemical fertilizers, pesticides and insecticides are used. The consequences of this include deforestation, land degradation and the pollution of ground water. Further, methane and nitrous oxide are also emitted, due to enteric fermentation and excretion, respectively.

The impact of raising animals for meat consumption on environment is further

aggravated by the type and source of origin of the feed. Cultivation of energy-dense feed based on soya and maize requires large quantities of fertilizers and herbicides. The majority of the developed countries import such energy-dense feed for their intensively-farmed animals from countries like Argentina and Brazil that are situated far away.<sup>7</sup>

This practice of importing feed from far-off countries has direct as well as indirect harmful consequences on our environment. First, transportation of feed from far-off countries directly contributes to global anthropogenic CO<sub>2</sub> emissions through the need for transport. This contributes to the outsourcing of carbon emissions to middle-income countries, as they are primarily involved in feed production with heavy use of chemical fertilizers and herbicides.

Secondly, it creates an imbalance in the symbiotic relationship between plants and animals through changing the land-usage and depleting the diversity of soil nutrients. In traditional farming, the coexistence of plants and animals enriches the biodiversity of the land through the excretions of grazing animals. In intensive animal farming, however, animals and plants are grown in isolation, which alters their symbiotic balance and causes detrimental environmental consequences.

Lastly, raising large mammals and poultry in captivity generates enormous quantities of manure that is a formidable challenge to dispose of, due to scarcity of land. In the United States alone, intensive animal farming produces 600 million tonnes of waste annually.<sup>8</sup> According to an estimate, the farming of 20,000 animals requires approximately 30,000 hectares of land for adequate disposal of manure.<sup>2,7</sup> This ratio is rarely achieved, due to scarcity of land, and only about half of all farmed-animal waste is effectively fed into the crop cycle. The excess of nitrogen-rich manure is inevitably spread on the fields, polluting land, water and air. Nitrate from manure can seep

into groundwater, causing severe public health risks that include miscarriage, blood-poisoning and cancers. Exposure of manure to the air releases gaseous ammonia and hydrogen sulphides, causing air pollution and serious respiratory ailments.

The animal agriculture sector is responsible for emitting nine per cent of global carbon dioxide, 35 – 40 per cent of methane, 65 per cent of nitrous oxide and 64 per cent of ammonia. It is further responsible for 55 per cent of erosion, 32 per cent of nitrogen and 33 per cent of phosphorous load in freshwater resources.<sup>9</sup>

Raising animals for food is, therefore, grossly inefficient for our environment, as it contributes to global greenhouse gas emissions through five major sectors: energy, industry, waste, land use, land-use changes, and forestry and agriculture.



## Intensive animal farming and welfare issues

Around 60 billion land animals are slaughtered and 1.18 trillion eggs are produced, every year, for human consumption.<sup>1</sup> These numbers are not only a cause of concern for our environment, but also for the welfare of the animals. The majority of meat and eggs are supplied by intensive animal farming, wherein animals are raised in confinement. Given the consumption of eggs and

meat, the poultry industry is the most glaring violator of animal welfare. These egg-laying hens are deprived of a natural and social environment, as they are grown in small, barren battery cages that lack enough space for hens to fully stretch. Although the European Union banned the use of battery cages in 2012 and made it mandatory for producers to use either a cage-free environment or 'enriched' cages, these improvements neither allow hens to behave in natural ways nor allow them to develop a social hierarchy.



Similarly, commercial farming deprives pigs of space and a natural environment. Pregnant sows are caged in narrow crates that restrict movement beyond a step, and that are devoid of bedding material. Moreover, before they are thoroughly weaned, piglets are separated from their mother for 'fattening'.<sup>10</sup> These unnatural practices leave many animals incapacitated, with metabolic diseases, bone deformities and gait abnormalities, in addition to the psychological suffering endured. The growing trade in animal products has increased public awareness of welfare concerns, which in turn has prompted the European Union to pass legislation for improving the conditions in which farmed animals are confined.

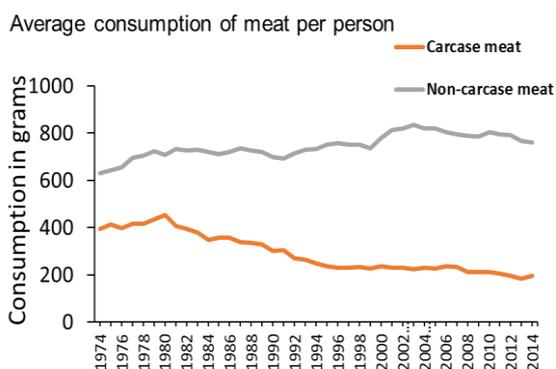
## Growth in demand for meat

The global food economy is driven by population growth and a shift in diet and food consumption patterns towards farmed-animal products. This has led to a declining share of cereals, tubers and roots, and a rising share of meat and dairy products. Owing to steady population growth, rising per capita incomes and urbanisation, the per capita meat consumption in developing countries increased by 150 per cent between 1967 and 1997 – 1999, and that of dairy products by 60 per cent. Moreover, an increase of 44 per cent is estimated in the per capita consumption of farmed-animal products between now and 2030.<sup>11, 12</sup>

In the developing countries, which account for the majority of the increase in world population, consumption of meat has grown at an average rate of 5.1 per cent per annum since 1970, and that of milk and dairy products by 3.5 per cent.<sup>2</sup> According to the FAO, global meat consumption will increase by an annual average of 1.4 per cent, whereas poultry consumption will grow by two per cent between now and 2024. While consumption of pork grows by less than one per cent per annum, poultry will account for half of the additional meat consumed by 2024. The OECD-FAO Agricultural Outlook projects an expansion of demand for dairy products by 23 per cent over the next ten-year period, approaching 48 Mt by 2024.<sup>13</sup>

As the demand for meat and dairy products increases, there will be a resulting pressure on the intensive animal agriculture sector, leading to increased production of feed, utilization of land and greenhouse gas emissions. Demand for meat will grow in developing countries due to population growth and rising income levels. Although the meat-demand in developed countries remains robust, the ageing population in these countries means limited further growth in

demand for meat. Thus, world meat-consumption growth will decline to nearly the pace of population growth. The growth in consumption of beef has now dropped below the population-growth rate, while the consumption of pig-meat has been decreasing since the 1960s, and has reached saturated levels.



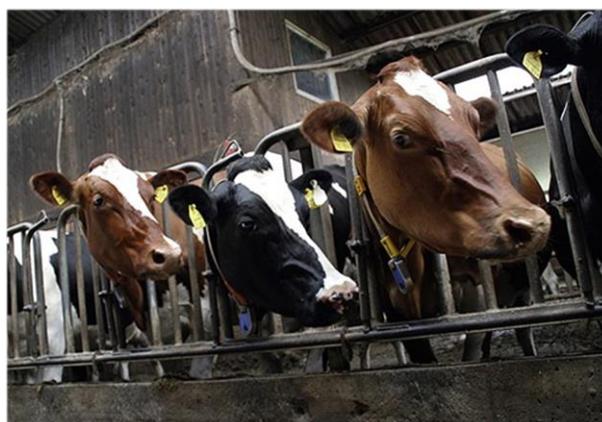
Source: DEFRA

Data accumulated in the United Kingdom by DEFRA shows that average per-person per-week consumption of carcass meat (which includes beef, veal, mutton, lamb and pork) has declined steadily from 453g in 1980 to 195g in 2014. In contrast, the average per-person per-week consumption of non-carcass meat (which includes bacon, ham, cooked meat and other meat products) has increased from 630g in 1974 to 760g in 2014.<sup>14</sup>

A continually-evolving diet influenced by expanding economy, rising per capita income, lifestyle, and sociocultural preferences is a deterministic factor in the growth of meat consumption in the future. Dietary shifts have reduced the relative consumption of cereals, fresh vegetable and fruits compared to meat, fish and eggs. Whereas this dietary shift occurred from 1961 – 1973 in developed countries, most developing countries have been witnessing these changes only in the last decade.<sup>4</sup>

Therefore, the global scenario for the future of growth in meat consumption in developed countries will be in contrast to that of the developing countries. With increased health awareness and environmental awareness, growing numbers of people in developed countries are now interested in reducing the proportion of animal products in their daily diet and replacing them with fresh green produce. Moreover, given the increase in life expectancy, with an elderly population being more susceptible to diseases, there has been growing interest in consumption of a balanced energy- and nutrient-rich organic diet.

However, in developing countries where the majority of the population are young, the consumption of meat is estimated to grow substantially till 2030.<sup>13</sup> Rapid urbanization in developing countries further facilitates the consumption of meat and dairy products, due to improvements in cold storage and increasing trade.



## Conclusions

Globally, the emissions from the farmed-animal industry will increase as the numbers of farmed animals reared for meat, egg and dairy production increase. The impact on climate change due to these emissions will be inevitable, unless a range of immediate measures are undertaken. To mitigate the impact of animal agriculture on

climate change, individual consumption of meat in high income countries must be reduced to no more than 90g/day.<sup>6</sup> Also, sustainable farming methods need to be developed to reduce the industry's greenhouse gas emissions and to help address the animal welfare issues. As the growth of the meat industry mirrors the increase in global population, appropriate measures should be taken towards maintaining a sustainable rate of population growth in developing countries. Reducing meat consumption and stabilizing our population are the two critical factors in alleviating the burden of animal farming on our environment.



8. <http://www.fao.org/docrep/009/a0607e/a0607e00.HTM>
9. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2367646/>
10. <http://www.theguardian.com/news/datablog/2013/jun/05/meat-consumption-uk-global-trends>
11. <http://www.theguardian.com/commentisfree/2006/jul/12/comment.animalwelfare>
12. <http://www.pnas.org/content/110/52/20888.abstract>
13. <http://www.agri-outlook.org/>
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1. [http://www.fao.org/ag/againfo/resources/en/publications/tackling\\_climate\\_change/index.htm](http://www.fao.org/ag/againfo/resources/en/publications/tackling_climate_change/index.htm)
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