Research Paper

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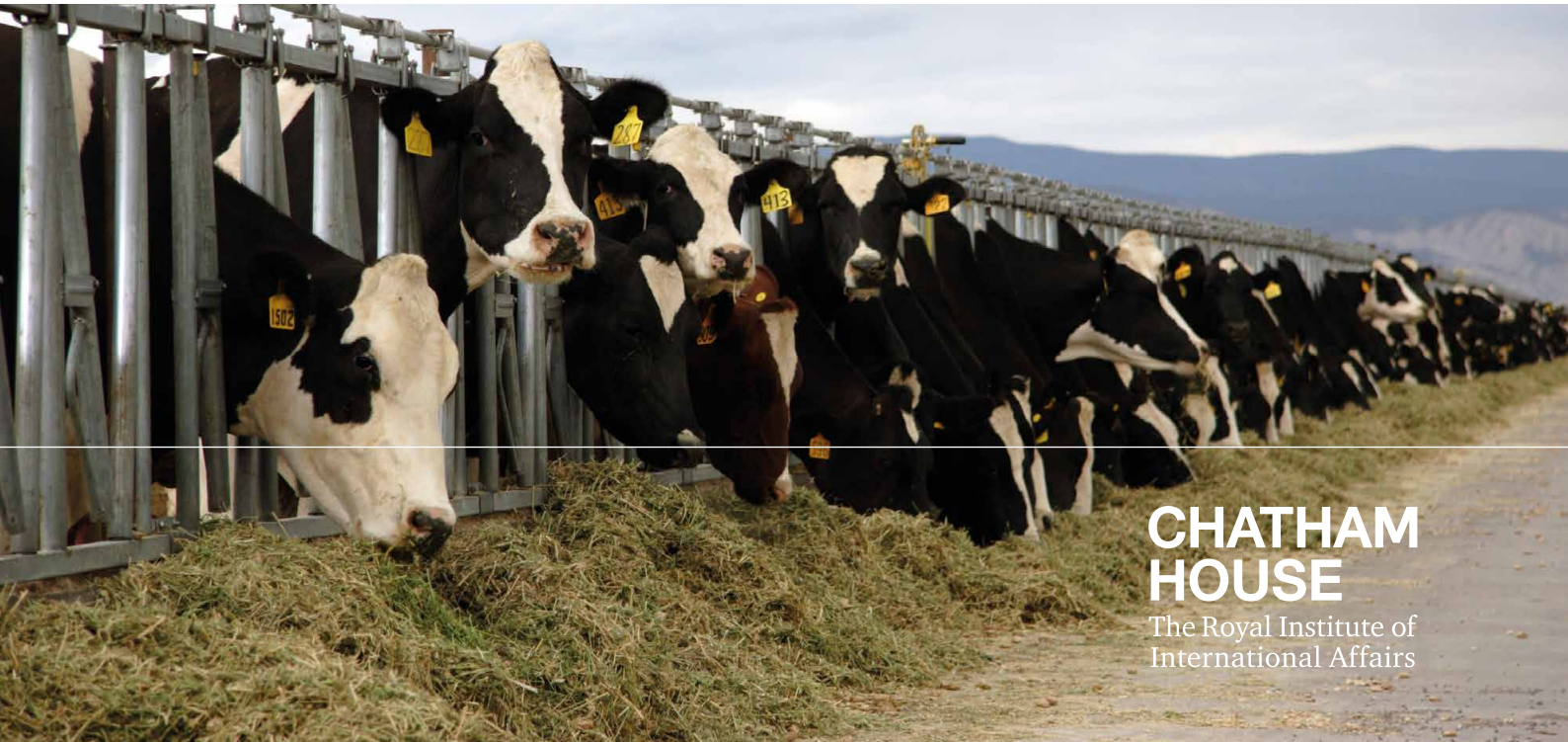
Livestock – Climate Change's Forgotten Sector

Global Public Opinion on Meat and Dairy Consumption



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Summary

Consumption of meat and dairy produce is a major driver of climate change.

- Greenhouse gas emissions from the livestock sector are estimated to account for 14.5 per cent of the global total, more than direct emissions from the transport sector.
- Even with ambitious supply-side action to reduce the emissions intensity of livestock production, rising global demand for meat and dairy produce means emissions will continue to rise.

Shifting global demand for meat and dairy produce is central to achieving climate goals.

- Recent analyses have shown that it is unlikely global temperature rises can be kept below two degrees Celsius without a shift in global meat and dairy consumption.
- Reducing demand for animal products could also significantly reduce mitigation costs in non-agricultural sectors by increasing their available carbon budget.

However, there is a striking paucity of efforts to reduce consumption of meat and dairy products.

- A number of factors, not least fear of backlash, have made governments and environmental groups reluctant to pursue policies or campaigns to shift consumer behaviour.
- The lack of attention afforded to the issue among policy-makers and opinion-formers contributes to a lack of research on how best to reduce meat and dairy consumption.
- As a first step in addressing this lack of research, Ipsos MORI was commissioned by Chatham House to undertake the first multi-country, multilingual online survey specifically to explore public attitudes on the relationship between meat/dairy consumption and climate change.

The data presented in this paper reveal a major awareness gap about livestock's contribution to climate change.

- Compared with other sectors, recognition of the livestock sector as a significant contributor to climate change is markedly low.
- Consumers with a higher level of awareness were more likely to indicate willingness to reduce their meat and dairy consumption for climate objectives. Closing the awareness gap is therefore likely to be an important precondition for behaviour change.
- Those actors most trusted to inform consumers on the links between livestock and climate change are generally 'experts' and environmental groups, though important differences exist between countries.

Climate change is not currently a primary consideration in food choices.

- Climate change is generally secondary to immediate considerations of taste, price, health and food safety in shaping food choices.

- This has important implications for the design of strategies to moderate meat and dairy consumption: those that emphasize co-benefits (e.g. for health and expenditure) and do not require consumers to compromise on enjoyment are likely to be more successful.

Some of the greatest potential for behaviour change appears to lie in emerging economies.

- Respondents to the online survey in Brazil, China and India demonstrated high levels of acceptance of anthropogenic climate change, greater consideration of climate change when choosing meat and dairy, and a greater willingness to modify their consumption behaviour than the average of the countries assessed.
- This is encouraging as these countries are among the most important for future demand for meat and dairy products.

Introduction

Human consumption of meat and dairy products is a major driver of climate change. Greenhouse gas (GHG) emissions associated with their production are estimated to account for over 14.5 per cent of the global total. This is more than the emissions produced from powering all the world's road vehicles, trains, ships and aeroplanes combined.[1] It is considerably more than the emissions produced by the world's largest national economy, the United States.[2] New technologies and changes in livestock production practices offer important means to reduce livestock[3] emissions, but on their own cannot deliver the reductions needed to limit the rise in global temperatures to two degrees Celsius. Individual and societal behavioural changes are essential to moderate consumption of meat and dairy products. This in turn will require a greater level of public awareness and understanding of the links between diet and climate change, to both enable voluntary lifestyle changes and ensure acceptance of, and responsiveness to, government policies. However, insufficient attention has been devoted to raising public awareness and preparing to shift societal behaviours.

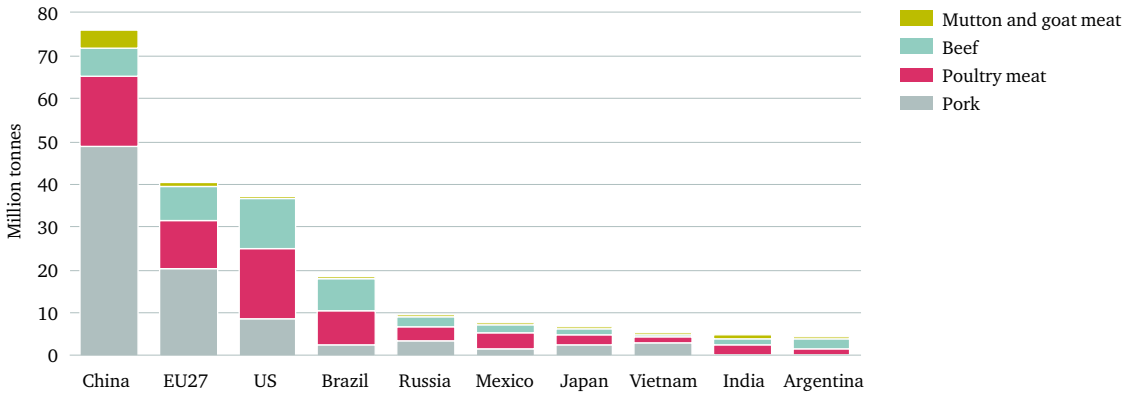
To examine the extent and nature of public awareness of this issue, in 2014 Chatham House and Glasgow University Media Group commissioned Ipsos MORI to undertake the first multi-country, multilingual survey specifically to solicit opinions on the relationship between meat/dairy consumption and climate change. This paper begins with an overview of the problem posed by livestock emissions before considering the opportunities and limitations of supply-side and demand-side responses. It argues that greater effort should be devoted to moderating consumption of meat and dairy products as a means to reduce GHG emissions. It then summarizes some of the key findings of the survey and considers the implications for closing the 'awareness gap' that characterizes public understanding of the links between climate change and livestock production.

[1] The UN Food and Agriculture Organization (FAO) estimates emissions attributable to the livestock sector amount to 7.1 $GtCO_2e$ per annum. This includes emissions associated with activities along the value chain, including feed production, livestock production, slaughter, processing and retail; see FAO (2013). The IPCC estimates direct emissions from global transport amounted to 7.0 $GtCO_2e$ in 2010; see IPCC (2014).
[2] Total US GHG emissions, including land-use change and forestry, were 6.1 $GtCO_2e$ in 2011 according to the World Resources Institute Climate Analysis Indicators Tool available at http://cait2.wri.org.
[3] For the purposes of this study, 'livestock' refers to FAO categories of land-based-animals raised as food sources, including, among others, cows, bison, pigs, chicken, other poultry, sheep and goats. The flesh of all the above animals is referred to as 'meat' and their products such as milk and eggs are referred to as 'dairy'.

The Problem

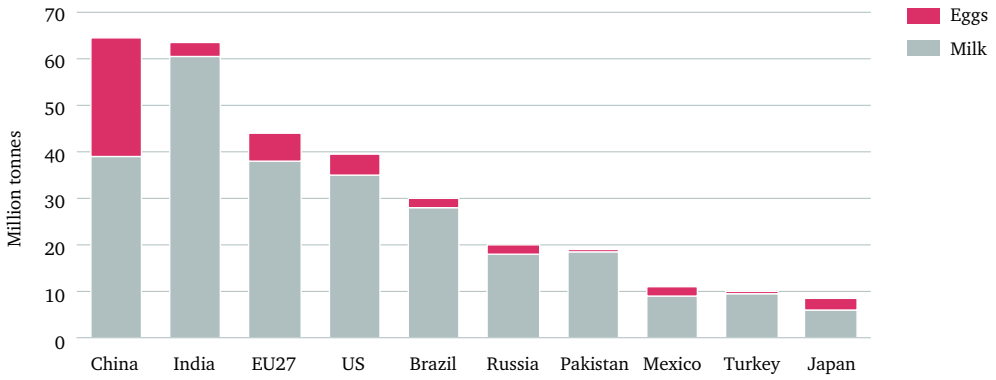
Demand for animal products is rising fast. By 2050, consumption of meat and dairy is expected to have risen 76 per cent and 65 per cent respectively against a 2005–07 baseline, compared with 40 per cent for cereals.[4] Currently, the biggest meat-consuming countries are China, the European Union, the United States and Brazil; major dairy consumers are China, India, the EU and the United States (see Figures 1 and 2). Growth in meat consumption in China is projected to be over four times that of the next fastest-growing consumer, Brazil, in absolute terms (see Figure 3).

Figure 1: The largest meat consumers, 2011



Source: Chatham House analysis based on data from FAOSTAT. China refers to mainland China in all diagrams.

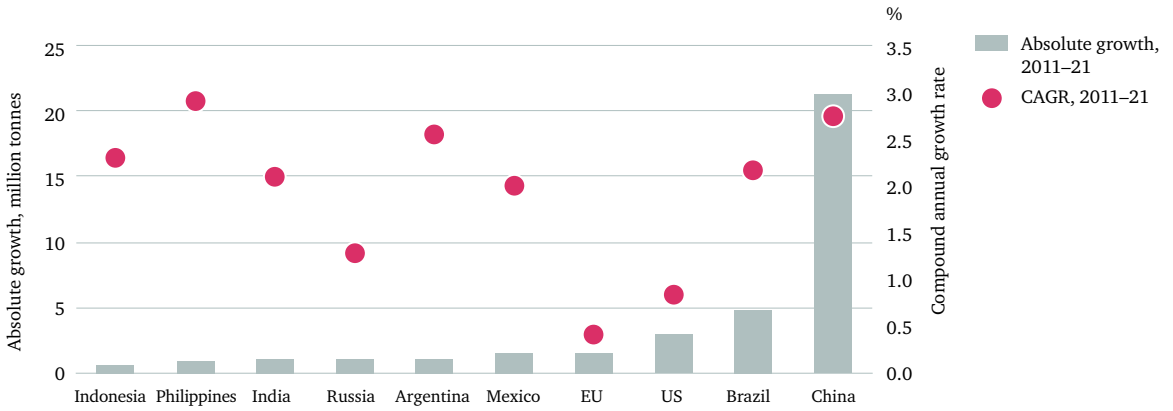
Figure 2: The largest egg and milk consumers, 2011



Source: Chatham House analysis based on data from FAOSTAT.

[4] Based on FAO projections for 2050 from FAO (2012).

Figure 3: Top 10 countries by forecast growth in beef, pork and chicken consumption, 2011–21



Source: Chatham House analysis based on projected consumption increases from FAPRI-ISU (2012).

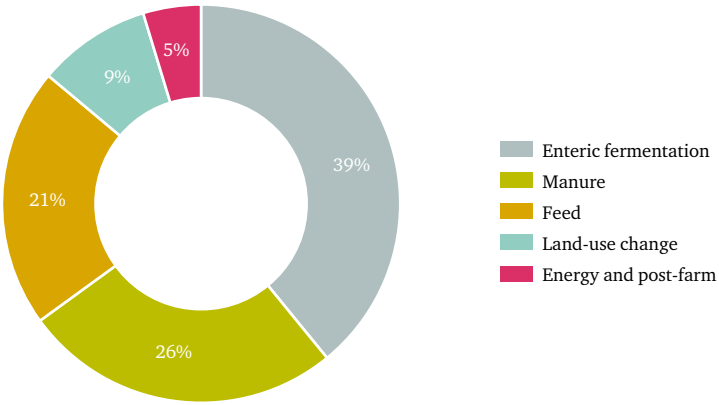
Livestock production is the largest global source of methane (CH_4) and nitrous oxide (N_2O) – two particularly potent GHGs.[5] The principal sources of N_2O are manure and fertilizers used in the production of feed (see Figure 4). The biggest source of CH_4 is from enteric fermentation – a digestive process of ruminant livestock such as cattle, goats and sheep. Rising demand for livestock products therefore translates into rising emissions of CH_4 and N_2O. According to one study, if current dietary trends (increasing global consumption of animal products) were to continue, emissions of CH_4 and N_2O would more than double by 2055 from 1995 levels.[6]

Livestock production is also an important driver of deforestation and associated carbon dioxide (CO_2) emissions – both directly, as forests are cut down to provide pasture or are degraded through animal grazing, and indirectly, as rising demand for animal feed drives the expansion of cropland into forests.

Beef and dairy are the most emissions-intensive livestock products and are responsible for the most emissions, accounting for 65 per cent of the total GHGs emitted by livestock.[7] Average global estimates suggest that, per unit of protein, GHG emissions from beef production are around 150 times those of soy products, by volume, and even the least emissions-intensive meat products – pork and chicken – produce 20–25 times more GHGs.[8] While beef produces more GHGs per unit, the scale and growth rate of pork and poultry production mean that their emissions are not exempt from concern. However, there are huge variances at farm level and at national and regional levels, and across different production systems.[9] Further disparities occur owing to the differing methodologies deployed in the life-cycle analyses. Moreover, in countries where production is largely extensive, and where natural forests are being converted into pasture or into cropland to grow feed, the emissions intensity of meat products, particularly beef, increases significantly.[10]

[5] Based on authors' comparison of FAO (2013) sector estimates with IPCC (2014) global estimates, the livestock sector is responsible for 39% of anthropogenic CH_4 emissions and 65% of anthropogenic N_2O emissions.
[6] Popp et al. (2010).
[7] FAO (2013), pp. 15–16.
[8] Global averages for meat products from FAO (2013) as compared with estimates of emissions intensity for soybean in Nijdam et al. (2012, supplementary data), and Gonzalez et al. (2011).
[9] See, for example, the range of life-cycle analyses assessed in Nijdam et al. (2012). Farm-level studies of extensive, grassland production in Wales show beef and sheep meat emissions intensities rising as high as 643 and 749 kg CO_2e per kg protein respectively, while modelled or sectoral estimates are as low as 45 kg CO_2e per kg protein for beef and 82 for sheep meat.
[10] FAO (2013).

Figure 4: Breakdown of livestock sector emissions by source



Source: Chatham House analysis based on FAO (2013).

The livestock policy vacuum

Despite the scale and trajectory of emissions from the livestock sector, it attracts remarkably little policy attention at either the international or national level.

International

Negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) have overlooked livestock. Efforts to establish a specific workstream on agriculture have failed, and talks have instead focused on a framework for reducing emissions from deforestation and forest degradation and enhancing forest carbon stocks in developing countries (REDD+). Of potentially more immediate relevance to livestock, the Global Alliance for Climate-Smart Agriculture – comprising 16 countries and 37 organizations – was launched at the UN Climate Summit on 24 September in New York. This counts among its objectives the 'reduction and/or removal' of agricultural emissions,[11] though the extent to which it will address livestock remains to be seen.

International finance for agricultural mitigation is also limited. Agriculture accounts for a tiny proportion of projects under the Clean Development Mechanism[12] – a market-based mechanism under the Kyoto Protocol which allows countries to fund emissions-reduction projects in developing countries that count towards reduction commitments at home. Furthermore, agriculture receives only four per cent of the total mitigation finance provided by the multilateral development banks.[13]

National

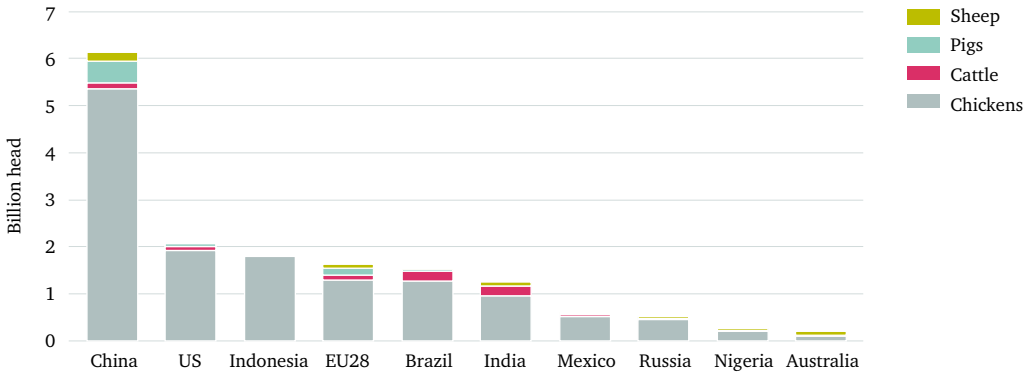
The marginalization of livestock within the international negotiations is reflected in national emissions reduction targets and plans. Very few targets consider either livestock or agriculture. Of the 40 developed countries listed under Annex I of the UNFCCC, only Bulgaria and France have

[11] UN (2014).
[12] See, for example, FAO (2013) and IPCC (2014).
[13] MDBs (2013).

established a quantitative reduction target for livestock-related emissions[14] (Costa Rica is also said to be developing one[15]). Internationally binding, non-sector-specific targets under the Kyoto Protocol cover just one per cent of global direct emissions from livestock.[16] Of the 10 countries with the largest livestock populations, only two – Australia and the EU – remain subject to binding emissions reduction commitments under the Protocol (see Figure 5).

Developing countries' mitigation plans submitted to the UNFCCC show a similarly marginal consideration of livestock. Only eight of the 55 developing countries to submit Nationally Appropriate Mitigation Actions (NAMAs) made mention of the livestock sector,[17] while just one country – Brazil – established a quantitative reduction target for livestock emissions.[18]

Figure 5: The largest livestock populations, 2013



Source: Chatham House analysis based on data from FAOSTAT.

Where they exist, national strategies and policies to tackle livestock emissions are typically less potent than those for other sectors. New Zealand remains the only country to include livestock within its cap and trade scheme, but even here farmers are required only to report emissions from their farms, not to take any mitigating action.[19] In other countries, government action has mostly taken the form of financial support for efficiency improvements, such as the use of anaerobic digesters and biogas production.[20] Mitigation plans have been largely industry-driven, with a number of national industries committing to reduction targets.[21] For example, in the United States, voluntary initiatives developed by industry and with support from government include a non-binding emissions reduction target of 25 per cent by 2020 from 2009 levels in dairy

[14] Authors' analysis of Annex I countries' 6th national communications; see UNFCCC (2014).
[15] FAO (2014).
[16] Based on 2012 CO_2e emissions from enteric fermentation, manure management and manure left on pasture, in FAOSTAT for Annex I countries, excluding the US, Canada, New Zealand, Russia and Japan.
[17] Brazil, the Gambia, Guinea, Jordan, Malawi, Mongolia, Swaziland and the African Group all mention livestock; authors' analysis of NAMAs submitted to the UNFCCC; see UNFCCC (2013).
[18] NAMAs submitted to UNFCCC.
[19] National Emissions Trading Scheme; see MoE New Zealand (2013).
[20] For example, government investment in biogas digesters in China (Wilkes 2014; IIED 2014), and public and private funding for anaerobic digestion systems in the United States (Global Methane Initiative 2013), and support for the development of anaerobic digestion systems in the United States (USDA et al. 2014).
[21] See, for example, the UK Dairy Roadmap, a multi-stakeholder task force which establishes a 20–30% emissions reduction target from dairy farms by 2020 from 1990 levels (Dairy Roadmap 2013).

production.[22] In Brazil, voluntary initiatives include a low-interest credit programme to promote sustainable intensification of cattle production[23] and a multi-stakeholder coalition to develop best-practice guidelines.[24]

The dearth of policies and funding to tackle livestock emissions stands in marked contrast to the abundance of government support afforded to meat and dairy producers. Livestock subsidies among OECD countries amounted to $53 billion in 2013.[25] In the EU, cattle subsidies alone exceeded $731 million, equivalent to $190 per cow.[26] This largesse is not confined to industrialized countries. In China, for example, pork subsidies exceeded $22 billion in 2012, equivalent to about $47 per pig.[27]

[22] USDA (2013).
[23] ABC Plan (Agricultura de Baixa Emissão de Carbono); see Haupt (2014).
[24] Brazilian Roundtable on Sustainable Livestock (Grupo de Trabalho da Pecuária Sustentável) (2012).
[25] Authors' analysis of Producer Commodity Transfers based on OECD (2014).
[26] Authors' calculation based on EU Producer Commodity Transfers for milk, beef and veal from OECD (2014) and 2013 EU cattle herd of 88.3 million from FAOSTAT. It should be noted, however, that livestock production subsidies from the EU have seen a downward trend, following reform of the Common Agricultural Policy; see European Commission (2014).
[27] Authors' calculation based on 2012 China pig herd of 474 million from FAOSTAT.

The Search for a Response

The search for responses to livestock emissions has focused on reducing the GHG intensity of meat and dairy, either through increasing productivity or through technical mitigation measures to reduce emissions. However, these strategies face challenges in terms of implementation, and on their own are unable to contain emissions growth.

Technical mitigation

Developing, implementing, monitoring and enforcing technical mitigation policies raise challenges in terms of complexity, transaction costs and a lack of data. The livestock sector is heterogeneous in nature, with practices and approaches influenced by a variety of contextual factors ranging from climatic and biophysical conditions to levels of economic and infrastructural development, and institutional factors such as the regimes that govern land ownership and use. This makes identifying appropriate, context-specific strategies complicated, particularly where there may be distinct or competing objectives that could, for example, include economic development, biodiversity, food security and water management alongside emissions reductions.

A lack of sufficiently granular data may make it impossible to measure and manage emissions consistently across a diversity of farms and farming systems, and presents technical challenges to incorporating agriculture into emissions trading schemes.[28] Fragmented and dispersed farming systems increase the costs associated with measuring and monitoring on-farm emissions, whether for emissions trading purposes or for the elaboration and enforcement of 'command and control' policies.[29]

Increasing productivity

Increasing productivity, whether through intensive farming, technology or improved animal husbandry, offers an opportunity to reduce emissions while raising farm profitability. Intensive rearing of cattle on feedlots is less emissions-intensive than pasture-based grazing systems because grass-fed cows tend to produce more methane and take longer to reach slaughter weight.[30] However, this also raises the spectre of an unwanted 'rebound effect', whereby increased productivity drives down prices and increases demand for meat and dairy, potentially reducing the extent of emissions savings.

Some of the most productive livestock systems may also raise other problems. Large-scale feedlots are associated with water pollution from cattle effluent and from fertilizers used in feed production,[31]

[28] Moran and Wall (2011).
[29] A notable exception is the New Zealand Emissions Trading Scheme, which mandates the reporting of emissions from the agricultural sector. The scheme does not require trading, however.
[30] For further information on the relative emissions intensity of grass-fed versus grain-fed beef production systems see, for example, Gurian-Sherman (2011) and Nguyen et al. (2010).
[31] For further information on water pollution resulting from feed and beef production see, for example, Mekonnen and Hoekstra (2012).

increased use of resources (including energy in mechanized processes, crops for commercial feed, and water for irrigation),[32] concerns around animal welfare,[33] and increased potential for zoonotic disease transmission.[34]

The limitations of production responses

Even with a transformative step change in policies and implementation, supply-side mitigation alone would be unable to contain increasing livestock emissions. Estimates indicate that shifting all livestock farming to the least emissions-intensive production practices available within a particular region or agro-ecological zone could offer emissions reductions of 32 per cent at current output levels. This would be a remarkable achievement, but not enough to offset rising demand for meat and dairy products: livestock emissions would continue on an upward trajectory.[35] This is inconsistent with the downward trend in agricultural emissions needed to keep global warming below two degrees Celsius and avoid catastrophic climate change.[36]

None of this is to say that mitigation through the introduction of new technologies and efficiency improvements should not be pursued – indeed, the scale of livestock emissions demands that production-focused mitigation policies are afforded far greater priority than is currently the case. It is merely to acknowledge the limitations of this approach in the context of unchecked demand growth.

[32] Steinfeld et al. (2006).
[33] EFSA (2012).
[34] Slingenbergh et al. (2004).
[35] FAO (2013).
[36] Davidson (2012).

Addressing Consumption

In its latest review of the scientific literature on mitigation in the agriculture sector, the International Panel on Climate Change (IPCC) found that the greatest potential for emissions reduction exists on the demand side.[37] For example, one recent assessment of mitigation opportunities in agriculture estimated that shifting dietary trends so that average worldwide per capita meat consumption falls to 90g per day, as recommended in the Harvard healthy diet, could avoid 2.15Gt CO_2e of emissions per year by 2030.[38] This is considerably more than the estimated reductions available from supply-side mitigation of enteric fermentation, management of grazing soils, and manure storage combined. A study published in the journal *Nature Climate Change* estimated 5.6 Gt CO_2e of emissions savings per year by 2050 from reducing meat and dairy consumption to levels consistent with nutritional recommendations, compared with 4Gt CO_2e per year from 'sustainable intensification' of the entire agriculture sector (where global yields converge on maximum levels).[39] A study for the UK suggested that dietary GHG emissions in meat-eaters are approximately twice as high as those in vegans.[40]

Crucially, dietary change is essential if global warming is not to exceed two degrees Celsius – the stated objective of the international community.[41] Two recent studies have concluded that even with ambitious supply-side mitigation in the agriculture sector, without radical shifts in consumption of meat and dairy products, growth in agricultural emissions will leave insufficient space within a two-degree carbon budget for other sectors.[42]

Reducing meat and dairy consumption is a highly cost-effective mitigation strategy, not only in the agriculture sector but more broadly. Reduced meat and dairy consumption would increase the share of carbon budget available to other sectors. This in turn would allow the cost of carbon to rise more slowly, resulting in lower mitigation costs for energy use. The potential savings are remarkable. Modelling suggests that worldwide adoption of the Harvard healthy diet could reduce mitigation costs for energy by more than 50 per cent by 2050.[43]

Social and environmental benefits of reducing meat and dairy consumption

Reduced consumption of meat and dairy products could potentially bring a number of other important social and environmental benefits, including the following.

Health

In the majority of developed countries, and among urban and middle-class populations in many middle-income and developing countries, meat and dairy consumption has risen to unhealthy

[37] IPCC (2014) notes mitigation potential of up to 8.55Gt CO_2e in 2050 from dietary change and reduction of food waste, compared to a maximum 4.6Gt CO_2e from supply-side interventions in agriculture as a whole at a carbon price of $100 per tonne CO_2e.
[38] Dickie et al. (2014). According to FAOSTAT, worldwide per capita meat consumption in 2011 was 116g per day.
[39] Bajželj et al. (2014).
[40] Scarborough (2014).
[41] UNFCCC (2010).
[42] Hedenus et al. (2014) and Bajželj et al. (2014).
[43] Stehfest et al. (2009).

levels.[44] Diets high in animal products are associated with an increased risk of non-communicable diseases such as heart disease, diabetes and several forms of cancer.[45] Conversely, predominantly plant-based diets comprising minimally processed foods are 'decisively associated with health promotion and disease prevention' according to a recent review of the literature.[46] Such a diet is currently not available to everyone, however, and for those without access to dietary alternatives, livestock products may provide an important source of micronutrients. Ensuring the availability and affordability of nutritious plant-based alternatives is therefore imperative to any effort to reduce consumption of meat and dairy.

A final health concern relates to the widespread administration of antibiotics to animals, which has been linked to increased antimicrobial resistance, raising concerns over the future efficacy of those medicines that are also used by humans,[47] and increased potential for zoonotic disease transmission.[48]

Food security

Animal feed constitutes a major and growing share of crop consumption, contributing to higher international food prices with detrimental impacts on the poorest people, who tend to eat diets low in animal products and high in cereals.[49] A quarter of all crops grown is fed to animals, representing half of all protein and over one-third of all calories produced.[50] The use of crops and arable land for livestock production indirectly places rich meat and dairy consumers in competition for calories with poor crop consumers. It also represents a staggeringly inefficient use of resources: meat and dairy products contain only 2.6 per cent of the feed and pasture biomass fed to animals; the remaining 97.4 per cent is lost.[51]

Land-use

Around 75 per cent of the world's agricultural land and 23 per cent of its arable land is used to raise animals, through growing crops for animal feed and through the use of pastures as grazing land.[52] Given the inefficiency of energy transfer in using crops and pasture for meat and dairy production, it would make most sense to grow staple grains and oilseeds for direct human consumption and to restrict feed ingredients to the residues and processing co-products of these crops. However, residues and co-products provide only 14 per cent of livestock feed. In total, only 30 per cent of livestock production might reasonably be considered an efficient use of land.[53]

Without changes in global dietary trends (in which meat and dairy consumption are growing faster than cereal consumption) the share of arable land used for the production of crops destined for animal feed will continue to increase. On current trends, by 2050, more crops could be fed to

[44] The Institute of Medicine recommends 0.8g of protein per kilogramme of body weight per day (Institute of Medicine, 2005), equating to 56g for a 70kg man for example, while the WHO recommends 58g for the same body weight (WHO, 2007). According to the OECD the European average meat consumption during the period 2000–13 was 70 kg/person/year (approximately 190g/day): OECD-FAO Agricultural Outlook 2014; see also Zhai et al. (2009) and Misra et al. (2011).
[45] Larson and Wolk (2006), p. 60.
[46] Katz and Meller (2014).
[47] Rushton et al. (2014).
[48] Slingenbergh (2004).
[49] Rosegrant et al. (2012).
[50] Ravilious (2013).
[51] Bajželj et al. (2014).
[52] Foley et al. (2011).
[53] Either grazing on land unsuitable for crop production or utilizing residues and co-products as feed. See Bajželj et al. (2014).

animals than to humans.[54] This will increase pressure on land, contributing to the expansion of agriculture into forest. Furthermore, while extensive livestock production systems can provide a means of sequestering carbon in certain contexts,[55] the likely impact of the increasing intensification of production is to restrict the availability of land for carbon sequestration activities, such as reforestation and bioenergy with carbon capture and storage (BECCS), that are central to emissions reduction objectives in agriculture and forestry.

Water security

Livestock production also represents an inefficient use of water. For example, global estimates indicate that, on a per kilo basis, production of beef, pork and chicken respectively uses around nine, four and three times as much water as cereals.[56] However, these averages mask important variations according to production system. In particular, intensive livestock systems place a strain on scarce surface and groundwater resources, from irrigation for feed production (which is then converted to animal biomass with significant losses) and withdrawals to water and wash animals. In contrast, pasture-based systems rely mainly on rainwater. A global shift in diets away from livestock products could free significant water resources[57] and reduce pollution from fertilizer run-off.[58]

Biodiversity

As meat and dairy consumption has risen, so too have livestock numbers. The global chicken population is now almost 22 billion, more than three times the human population. Measured in terms of biomass, livestock are among the most preponderant animal species on Earth. The total mass of the global cattle population exceeded 130 million tonnes in 2010, considerably greater than the total human mass of 100 million tonnes.[59] Human consumption of beef and milk means the humble cow is now predominant among animals.

Under certain agro-ecological conditions with well-managed grazing, livestock farming can play an important role in maintaining and improving agricultural land. However, at current levels of consumption, such massive livestock populations have profound consequences for biodiversity. According to one estimate, 30 per cent of global biodiversity loss is linked to livestock production,[60] owing to its contribution to deforestation and land conversion, overgrazing and degradation of grasslands, and desertification.

Avoiding the problem

Despite the necessity of addressing global meat and dairy demand if climate objectives are to be met, and the clear social, economic and environmental co-benefits, no government seems prepared to do so. Administrations the world over have implemented policies and launched communication campaigns to reduce energy demand among motorists, households and industry as part of climate policy-making.

[54] Pradhan et al. (2013).
[55] Conant (2010).
[56] Authors' calculations based on Mekonnen and Hoekstra (2012).
[57] Jalava et al. (2014).
[58] Sutton et al. (2013).
[59] Author's calculation based on cattle population of 1.5 billion head (FAOSTAT 2014) and an average live weight of 499 kg, FAO (1991) and on human population of 7.1 billion and an average weight of 52 kg (adjusted for regional averages, based on estimates in Steinfeld et al. (2010).
[60] Westhoek et al. (2011).

But efforts to moderate meat and dairy consumption are absent from mitigation strategies. The extent of government action is seemingly limited to the inclusion of climate change considerations in the dietary recommendations of a handful of official agencies and advisory bodies.[61]

Campaigns by major environmental groups to raise awareness of meat and dairy's climate footprint or encourage dietary change are scarce and have been relatively muted.[62] In contrast, many global groups have delivered high-profile and effective campaigns on energy, transport and agricultural products such as palm oil and biofuels.

In fact, the received wisdom among governments and campaign groups appears to be that trying to reduce consumer demand for meat and dairy products is at best too complex, and at worst risks backlash. Concerns include the following.

Intrusion: Governments and non-governmental organizations (NGOs) may be concerned about public intolerance of any attempt to interfere in lifestyle decisions, inviting accusations of 'nanny statism' and preaching, and risking alienating voters or supporters.[63] These concerns may be greatest in developed, market-based economies where notions of free choice and individual rights predominate.

Cultural significance: Promoting dietary change would necessarily challenge the cultural significance of meat in many societies around the world, and its aspirational status in many developing countries.

Private-sector resistance: Attempts to reduce meat and dairy consumption would be likely to mobilize resistance from powerful interest groups, including the livestock sector and feed-crop farmers, in much the same way as policies to promote clean energy have encountered resistance from some in the fossil fuel sector.

Public ambivalence regarding climate change: Surveys often demonstrate relatively high levels of public awareness and concern about climate change, yet public engagement remains comparatively low. A lack of belief that individual action will make a difference can translate to low levels of empowerment and minimal changes to individual behaviour. As a result, mitigation strategies focused on individual behaviour change have not been prioritized.

Uncertainty regarding the efficacy or acceptability of policy interventions: Governments may be deterred by a lack of clear evidence as to the efficacy of different interventions to effect dietary changes, ranging from education and information campaigns to taxation and regulation. In particular, a lack of evidence allows opponents of interventions to play up the possibility of unintended consequences and thereby delay action.[64]

However, behind these concerns lie multiple assumptions and generalizations. The belief that in aggregate they represent an insurmountable challenge is untested, and clear examples of behavioural shifts in populations do exist. In reality there is minimal research on how dietary change might best be effected.[65] Ironically, this lack of research may well be symptomatic of the belief that the challenge is insurmountable, suggesting a cycle in which a lack of research allows this belief to remain uncontested, leading in turn to a lack of research. The result of this is the policy vacuum described above.

[61] For example, the Health Council of the Netherlands, the Swedish National Food Agency and the 2012 Nordic Nutrition Recommendations.
[62] Laestadius et al. (2013).
[63] See Laestadius et al. (2014) for a discussion of concerns among environmental NGOs.
[64] Garnett (2014).
[65] Ibid. See also IPCC (2014).

The reality of mitigation policy is that there are very few easy options. Most mitigation opportunities face familiar challenges of vested interests, upfront costs, coordination failures, information gaps and capacity constraints. It is surely questionable whether the challenge of shifting dietary trends is incomparably greater than that of transforming transport or power systems, or for that matter the farming practices of millions of farmers around the world. Yet the absence of effort directed to doing so indicates that many policy-makers and environmental campaigners believe it is.

The Awareness Gap

The marginalization of livestock within mainstream climate policy discourse might reasonably be expected to contribute to low levels of media attention and awareness among publics. Where they exist, national polls and assessments do indicate low levels of coverage[66] and public understanding of the links between meat and dairy consumption and climate change.[67] A multinational survey undertaken in 2014 concluded that 'many consumers, especially those who eat meat more regularly than others, do not think that meat consumption is environmentally detrimental'.[68] This awareness gap inhibits a demand-side response. Understanding of the livestock sector's contribution to climate change is a precondition for voluntary consumer action to reduce emissions from meat and dairy products. It is also necessary to ensure public acceptance of efforts to shift consumer behaviour, whether through public policy or campaigns.

Chatham House survey

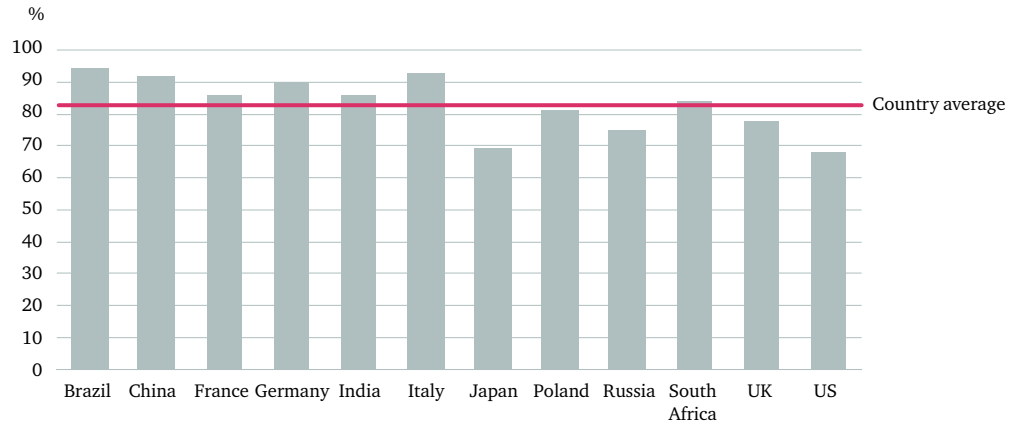
In order to examine the extent and nature of the awareness gap globally, Chatham House and Glasgow University Media Group commissioned Ipsos MORI to undertake the first multi-country, multilingual survey to specifically solicit opinions on the relationship between meat/dairy consumption and climate change. The survey was conducted online in Brazil, China,[69] France, Germany, India, Italy, Japan, Poland, Russia, South Africa, the UK and the US, with a minimum of 1,000 participants in each country. It tested public views on a range of issues including, but not limited to: consumers' motivations for increasing or decreasing their meat and dairy consumption; understanding of the different sources of GHG emissions, including livestock and other sectors; consumers' willingness to alter their behaviour as a means to reduce their environmental footprint; and attitudes towards a range of sources to which the public may turn for information on livestock and climate change. Below we consider some of the key findings from the survey.

Public awareness of anthropogenic climate change is high

Globally, 83 per cent of respondents agreed that human activities contribute to climate change.[70] Agreement was particularly high in some emerging economies such as Brazil and China as well as some countries in the EU (see Figure 6). The lowest levels of agreement occurred in Japan and the US.

[66] Almiron and Zoppeddu (2014); Neff et al. (2009).
[67] See, for example, Friends of the Earth (2013); Cordts et al. (2014); De Boer et al. (2012).
[68] National Geographic (2014).
[69] The survey was undertaken only in mainland China.
[70] It should be noted that the question 'To what extent do you agree or disagree with the following statement: "Human activities contribute to climate change"?' was asked at the end of the survey, following a number of questions which included statements of climate change as fact. One example of such a statement was 'Experts now know that producing animals for meat and dairy products contributes to a number of health and environmental problems, including climate change.'

Figure 6: Percentage of those surveyed agreeing that human activities contributed to climate change



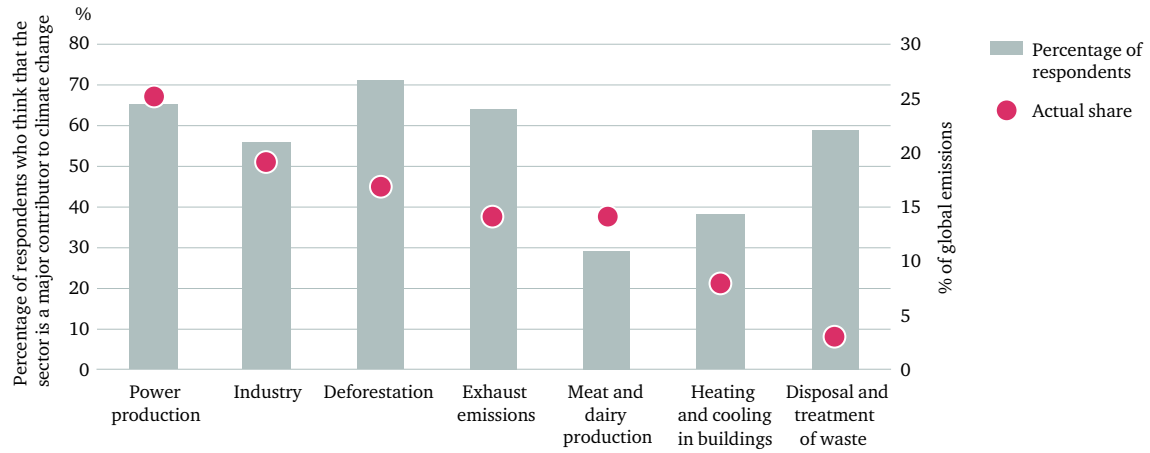
Source: Ipsos MORI/Chatham House (2014).

Those willing to change the amount of meat or dairy products they consume were more likely to agree strongly that human activities contribute to climate change than those who were not willing to do so. This suggests those who would like to change their meat or dairy consumption are more engaged with climate change. Among those willing to change their meat and/or dairy consumption, 61 per cent strongly agreed that human activities contribute to climate change. This compares with 47 per cent of those who were unwilling to change their meat consumption, and 51 per cent of those who were unwilling to change their dairy consumption.

Awareness of livestock as a significant source of emissions is low

Across all the emissions sectors asked about in the survey, recognition of the livestock sector as a contributor to climate change was markedly the lowest. This is illustrated in Figure 7, which shows, for different sectors, the percentage of respondents who believe the sector to be a major source of emissions, alongside the actual share of global emissions for the sector.

Figure 7: Comparison of perceived and actual contribution to climate change*



*Percentage of respondents who, when asked how big a part – if any – different activities play in the human contribution to climate change, stated 'a lot' for each activity.
Sources: Ipsos MORI/Chatham House (2014); IPCC (2007); IPCC (2014).

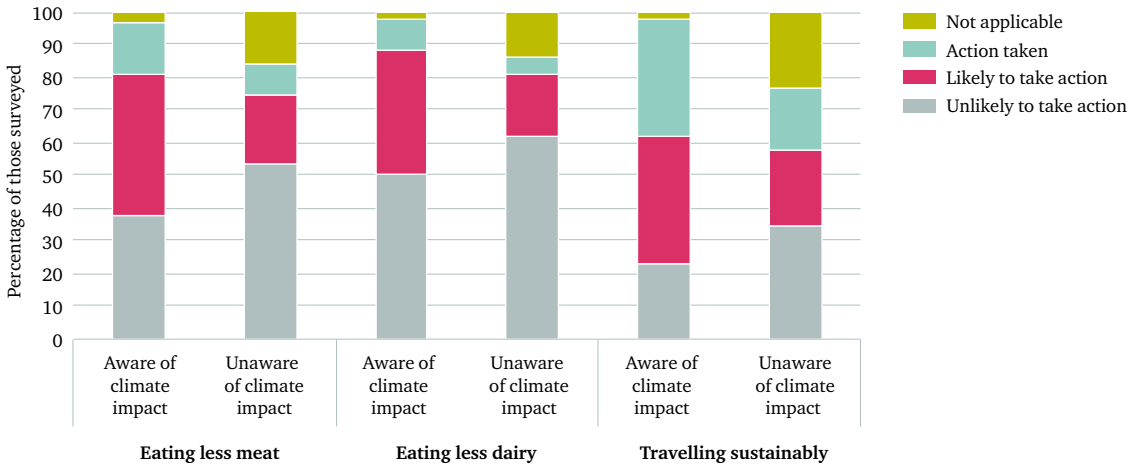
Over twice as many respondents identified direct transport emissions as a major contributor as identified meat and dairy production (64 per cent vs 29 per cent), even though the contribution to overall emissions is almost equal between the two sectors. One-quarter of respondents overall stated that meat and dairy production contributes either little or nothing to climate change. This stands in marked contrast to only 8 per cent who believed direct emissions from transport contribute little or nothing at all.[71]

The awareness gap contributes to indifference

Consumers with low awareness of a sector's contribution to climate change are less likely to indicate willingness to change their behaviour in order to reduce emissions. Compared with other sectors, the awareness gap appears particularly problematic for livestock. For example, just over one-third (35 per cent) of respondents unaware of transport's contribution to climate change stated they were unlikely to change their transport behaviour[72] in order to reduce emissions. In the case of those unaware of the contribution of meat and dairy production to climate change, 54 per cent were unwilling to change their meat consumption, and 62 per cent were unwilling to change their dairy consumption. This difference is highly unlikely to have occurred by chance.[73]

Conversely, closing the awareness gap is likely to increase willingness to act. This is generally true across sectors[74] and is illustrated in Figure 8 for transport, meat and dairy. The chart shows that awareness is associated with a clear increase in the percentage of respondents already taking action or likely to take action.

Figure 8: Comparison of the impact of awareness on willingness to take individual action on transport habits and on meat and dairy consumption



Source: Ipsos MORI/Chatham House (2014).

[71] The rest responded 'a moderate amount' or did not know.
[72] Walking, cycling, or using public transport instead of driving a car or motorbike, within the next year.
[73] These differences are statistically significant at a 5% confidence interval.
[74] Compared with respondents overall (second percentage): manufacturing and industry – those unaware significantly less likely to take action (buy used goods instead of new) 35.6% vs 47.0%; electricity production – those unaware significantly less likely to take action (save energy at home) 40.1% vs 45.1%; waste – those unaware significantly less likely to take action (recycle more) 37.3% vs 47.2%.

Food choices are mainly shaped by immediate concerns

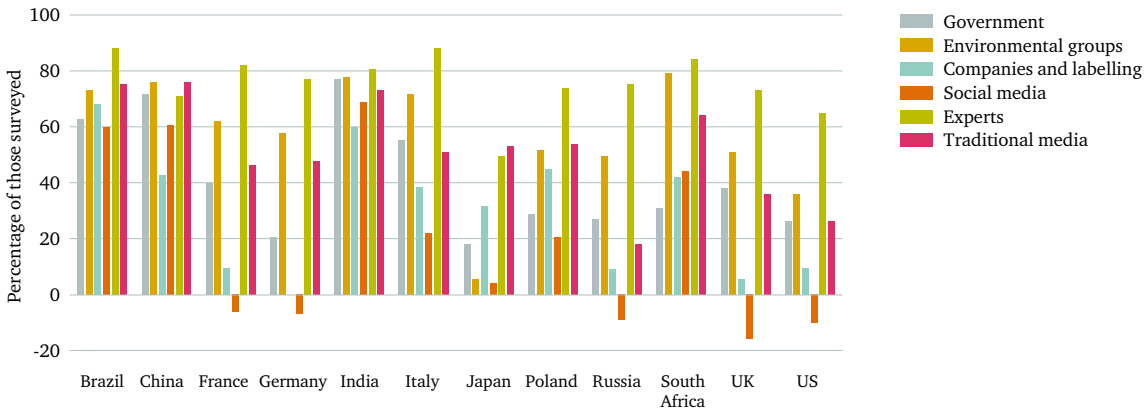
Generally speaking, consumers prioritize factors with direct personal consequence when making food choices. Taste, price and considerations of food safety and health are more formative in shaping consumption decisions than factors with indirect societal consequence such as animal welfare or climate change. Enjoyment of food, healthy eating or trust in food sources were cited by 90 per cent or more of respondents as very or fairly important in influencing their meat consumption, compared with 81 per cent for animal welfare or 67 per cent for climate change.

The importance of climate change as a motivating factor when choosing meat was higher in some countries than in others, however. Respondents in Russia (6 per cent), the United States (26 per cent), Poland (28 per cent) and Japan (39 per cent) were less likely than the average (43 per cent) to consider climate change as 'net important' (the difference between those who found it very or fairly important and those who saw it as not very or not at all important). Respondents in Brazil (65 per cent), South Africa (57 per cent), Italy (59 per cent), India (55 per cent) and France (54 per cent) all viewed climate change as a more 'net important' consideration than the average. There were substantial differences in the results for dairy consumption, with the global average of net importance rising to 51 per cent, while striking national differences were seen in Russia (21 per cent) and Brazil (72 per cent).

Closing the awareness gap: the role of different actors

Closing the awareness gap appears to be an important precondition for behaviour change. An important question, therefore, is who is best placed to inform publics of the links between livestock and climate change. The survey assessed public confidence in a range of sources to which consumers may turn for information about the environmental and health consequences of meat and dairy consumption. Across all countries polled, those labelled 'experts' – with an unidentified field of expertise – were afforded the highest degree of confidence from respondents, a result which is supported by numerous other studies, including the recent Greendex analysis.[75] NGOs and environmental groups ranked second, although there were important differences across countries (see Figure 9).

Figure 9: Actors perceived as helpful sources of information on climate and livestock issues



Source: Ipsos MORI/Chatham House (2014).

[75] National Geographic (2014).

Social media were afforded markedly different degrees of trust across the countries polled: in the UK, France, Germany, Russia and the US, more people thought these sources would be unhelpful than thought they would be helpful, while participants in China, India and Brazil all gave them high helpful scores. Great variation between countries is also seen in attitudes towards industry as a trusted source of information: where Germany, the UK, France, Russia and the US all gave low scores, Brazil, India and Poland ranked industry as considerably more helpful.

Conclusions

The livestock sector is a major emitter of GHGs and its contribution to climate change is set to grow as global demand for animal products rises. Even with ambitious action to reduce the emissions intensity of livestock production, it is unlikely that global temperature rises can be kept below two degrees Celsius in the absence of a radical shift in meat and dairy consumption. Addressing livestock demand is also a highly cost-effective mitigation strategy as it affords more of the global carbon budget to other sectors where emissions reductions may be harder to achieve. Lower consumption of livestock products in high-consuming countries could also yield significant environmental and societal co-benefits for health, global food security, water security and biodiversity.

Despite the clear case for action to tackle demand for meat and dairy products, there is a remarkable lack of policies, initiatives or campaigns to do so. The received wisdom among governments and campaign groups appears to be that trying to reduce consumption of animal products is at best too complex a challenge, and at worst risks backlash. However, this view remains untested and ignores the fact that government interventions and public campaigns in pursuit of societal benefits have successfully shifted consumer behaviour in the past, perhaps most prominently in the case of smoking.

The lack of attention afforded to the issue by governments and environmental groups contributes to a significant lack of understanding about the links between livestock and climate change among publics – an awareness gap. This is a problem in itself, as the multinational survey undertaken for this study indicates that low awareness translates to a lack of willingness to change behaviour in order to reduce emissions. Relative to other sectors, the awareness gap for livestock is particularly large. It also appears to be particularly inhibiting of change: for livestock, unawareness is significantly more likely to be associated with unwillingness to change behaviour than is the case for other sectors.

Closing the awareness gap is likely to be a precondition for voluntary behaviour change to reduce individual emissions, and for societal responsiveness to government interventions or public campaigns to encourage behaviour change. The survey found that consumers with a higher level of understanding of the links between livestock production and climate change are more likely to indicate willingness to reduce their meat and dairy consumption. The survey also revealed that those actors most trusted to inform consumers on the links between livestock and climate change are generally 'experts' and environmental groups, though there are important differences between countries and consequently communication strategies to close the awareness gap should be tailored to national contexts.

However, the challenge is more complex than simply closing the awareness gap. Strategies must be designed to enable willing consumers to change their behaviour. But consumers tend to prioritize factors with an immediate and direct personal impact such as taste, price, health and food safety. Indirect societal concerns such as climate change tend to be secondary. This implies that strategies should avoid compromising primary motivating factors (for example, consumers may be reluctant to compromise on taste or enjoyment of food in order to reduce their emissions). Strategies may be more likely to succeed if they include, or are complementary to, other primary motivating factors (for example, consumers may be more willing to reduce their individual contribution to climate change by reducing meat and dairy consumption if they can also realize health and

economic benefits). Approaches that emphasize multiple benefits may also hold more appeal for governments concerned about the political risks of 'intruding' into people's food choices as part of climate policy.

While it is necessary to exercise caution when extrapolating societal views from an online study, it is encouraging that some of the greatest potential for behaviour change appears to be in countries of most importance to future demand for meat and dairy – Brazil, China and India. Respondents in these countries demonstrated high levels of acceptance of anthropogenic climate change, greater consideration of climate change in their food choices, and a greater willingness to modify their consumption behaviour than the average of the countries assessed.

Finally, in addition to an awareness gap, this paper has also highlighted a research gap. Given the importance of shifting consumption of meat and dairy products to the objective of avoiding dangerous climate change, there is remarkably little research on how best to do so. This paper, and the survey underpinning it, should be considered as a modest contribution to addressing this gap. Much more research on these questions is needed.

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