Blindspot

How lack of action on livestock methane undermines climate targets

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Design: Pietro Bruni - toshi.ltd

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Executive summary

Our planet's precious climate system is on the verge of irreversible disruption. Climate scientists have confirmed that a focus on methane (CH_4) emissions – in addition to measures designed to reduce carbon dioxide (CO_2) emissions – will be crucial in determining whether global heating can be kept below 1.5°C (as per the 2015 Paris Agreement) and whether reaching climate tipping points can be avoided.[1] Although the livestock sector is by far the largest contributor of human-induced methane emissions,[2] our report reveals that both the biggest meat- and dairy-producing countries – with some of the highest methane emissions – and the largest meat and dairy corporations are oblivious to the problem. They are failing to set ambitious targets and implement measures to reduce methane emissions in the livestock sector. Without prompt and radical commitments from key methane emitters, emissions from livestock will put pledges to keep temperature rises below 1.5°C by 2030 in jeopardy.

1.1. The 'methane emergency'

The climate emergency is palpable: we are witnessing increasingly severe extreme weather events such as heatwaves, heavy precipitation, droughts and tropical cyclones which carry heavy costs for human lives and the environment.

Even though methane is not the most abundant greenhouse gas (GHG), it is one of the most powerful,[3] with a global warming potential that is 86 times greater per mass unit than carbon dioxide on a 20-year timescale. Unlike CO_2, however, which stays in the atmosphere for centuries or even millennia,[4] methane has a climate response time of only 12 years. **These unique properties of methane provide an opportunity to use methane emission reductions as a crucial stopgap measure during the longer-term transition to zero emission societies.**

The climate emergency has therefore become the 'methane emergency'.[5] The agriculture sector (which includes agricultural waste) is the largest contributor to global methane emissions,[6] and within the sector, livestock-related emissions linked to the global meat and dairy industries make up the lion's share. Enteric fermentation (where micro-organisms create methane in the stomachs of animals such has cows and sheep) and manure management are believed to be responsible for over 30% of all anthropogenic methane emissions.[7] For this reason, it is vital that governments and companies that are responsible for many of the methane emissions from livestock take urgent and meaningful action to reduce them.

1.2. Methane: climate policy's blind spot

Ahead of the next UN Climate Change Conference (COP26) in November 2021, our report takes stock of the current state of play when it comes to tackling methane emissions. It reveals that both countries and companies that are among the biggest methane emitters ignore the potential of rapidly reducing methane emissions to stay below 1.5°C of global heating. Our analysis looked at the biggest players in the livestock sector and reveals that this is a critical blind spot in climate policies and commitments.

1.2.1. Governments reporting, but not addressing methane emissions

We have analysed the reported methane emissions and related policies in the Nationally Determined Contributions (NDCs) of 18 countries that have the biggest meat and dairy industries, and where action to cut emissions is critical, including the USA, Brazil and countries in Western Europe. The results of the analysis are sobering and demonstrate that governments have yet to grasp the importance of radical methane reduction measures in general and in the meat and dairy industries in particular. Our key findings include:

- In most countries, methane emissions from the livestock sector are relatively stable or even increasing. Even though eight countries reported a decrease in emissions linked to enteric fermentation and manure management in the last five years, none of these reductions was higher than 5%. Over the same five-year period, the Netherlands has reported an increase of 6.5% in livestock-related methane emissions.

- None of the countries assessed has established overall methane reduction targets that are consistent with the 45% reduction in emissions of the gas required by 2030 to keep global warming below 1.5°C. Methane emissions targets for the livestock sector are particularly scarce. Only New Zealand and Uruguay have set methane reduction targets for this sector, but these are weak, with a target of only a 10% reduction in New Zealand, and limited to emission intensity reduction targets in Uruguay. Recently announced schemes, like the Global Methane Pledge and the EU Methane Strategy, also ignore the potential to reduce methane emissions by addressing people's overconsumption of meat and dairy – where some of the biggest cuts in emissions can be achieved.

- Finally, although the vast majority of countries cover agriculture in their NDCs, they lack concrete measures and action plans to transform the way they produce and consume food, which could include shifts to healthier and more sustainable diets incorporating less and better meat and dairy.

Blindspot: How lack of action on livestock methane undermines climate targets

Box E.S.1: **Addressing the gap in the Global Methane Pledge**

COP26 in November 2021 offers a real opportunity to establish strong commitments to reduce methane emissions. Ahead of the conference, the EU and the US released the Global Methane Pledge, with the goal of 'reducing global methane emissions by at least 30% from 2020 levels by 2030 and moving towards using best available inventory methodologies to quantify methane emissions'.[8] Although the pledge does mention agriculture and livestock, disappointingly it focuses only on technical measures and incentives to encourage individual farmers to reduce their methane emissions, instead of aiming for the much more significant reductions that could be achieved by reducing livestock numbers through a systemic transition to healthier diets with less and better meat and dairy.

Nor is the pledge aligned with the *Global methane assessment*[9] report, which calls for a 45% reduction in methane emissions from all sectors by 2030. The report concluded that targeted technical measures, which are already available, could reduce methane emissions in the ruminal livestock sector by around 30 million tons per year by 2030. However, behavioural and policy measures to reduce food loss and waste, improve livestock management and implement a shift to healthier diets could reduce emissions by a further 65–80 million tons over the next few decades. This is almost half of the 180 million tons of annual reductions required to avoid 0.3°C of global heating by the 2040s, contributing significantly to global efforts to limit any temperature rise to 1.5°C.[10]

Implementing policies that drive reductions in demand for meat and dairy products through the adoption of healthier diets is therefore critical in bridging the gap in the Global Methane Pledge and bringing emissions into line with scientific recommendations for keeping any global temperature rise below 1.5°C.

1.2.2. Meat and dairy giants ignoring the methane issue

Most of the largest corporate emitters of methane are also oblivious to the problem and their responsibility to address it. To measure the extent to which industry is committed to reducing GHG emissions in general and methane emissions in particular, we focused on ten of the largest global meat companies and ten of their largest dairy counterparts. We analysed and scored their climate policies and actions against 11 indicators, with a particular focus on methane. The overall analysis showed a clear lack of leadership and commitment when it comes to reducing methane emissions and contributing to global efforts to avoid the worst impacts of climate change. Our key findings include:

- All the companies scored poorly. Of those we assessed, Nestlé was the highest-scoring company, with a mediocre score of 34.6%. Danone came second, scoring slightly over 30%, while all other firms scored less than 20%. Groupe Bigard, the largest European beef processor, came bottom with a total score of 0%.

- None of the 20 companies report methane emissions separately, and none of them have meaningful and concrete targets or action plans to specifically reduce methane emissions in their operations and value chains.

- Only seven of the 20 companies have set science-based targets (i.e. in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement) to reduce their overall GHG emissions.

- Only three companies (Nestlé, Danone and Dairy Farmers of America) set targets that include scope 3 emissions. Crucially, these include emissions from supply chains, for example farms that are owned by suppliers but from which companies buy milk or meat for processing.

- Although 18 of the 20 companies were found to have made at least some investment in plant-based and cultured meat alternatives, only Danone reports sales of its combined portfolio of such alternatives.
- Just over half of the companies assessed are meaningfully investing in methane abatement research, but none of them disclose the level of funding they are providing to such research efforts.

1.3. The way forward

Livestock, which is by far the largest contributor to human-induced methane emissions, should be at the heart of action plans designed to reduce such emissions. Our report reveals that, in spite of the livestock sector's major contribution to global methane emissions, neither governments nor the industry itself are taking the sector's methane emissions seriously. While the Global Methane Pledge (see Box E.S.1) is a step in the right direction and sets a framework for the introduction of both supply and demand side measures, it should be made legally binding, and foreground methane reductions that can be made by decreasing demand for animal products. In particular, countries where the average consumption of meat and dairy is above recommended intake should rapidly develop national action plans with binding policies for consumption reduction. These should focus on a shift to a diet containing less and better meat and dairy, with the promotion of alternative and plant-based protein. On the industry side, there should be specific regulations requiring companies to set science-based targets to cut their carbon and methane emissions, both by using technical measures and reducing livestock production.

Further recommendations for governments, companies and consumers can be found at the end of this report.

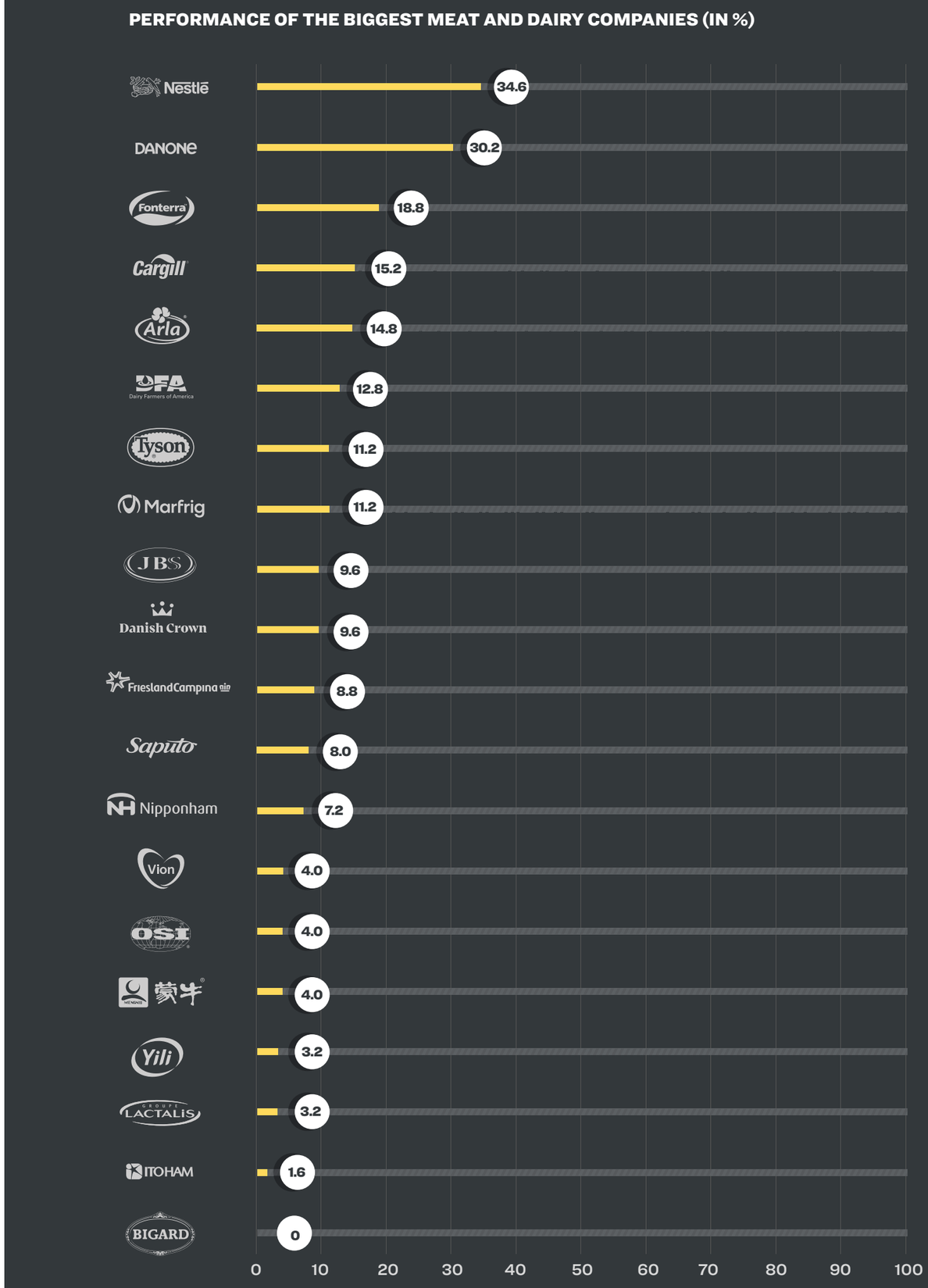


Figure E.S.1: Summary of scoring (%) for the 20 largest meat and dairy companies assessed on their commitments to reducing GHG and methane emissions

1. Introduction: Living in a climate emergency

The northern hemisphere summer of 2021 has given the world a taste of what life might be like on a planet where human-induced climate change has not been addressed. Extreme and apocalyptic weather events have had devastating impacts in many countries, and temperature records have been broken across continents, impacting on the lives of millions in a world that was already struggling with the Covid-19 pandemic.

A new European temperature record of 48.8°C was logged in Italy on 11 August 2021, while destructive forest fires ravaged millions of hectares of land across the continent, killing dozens of people.[11] Only two months earlier, numerous people in various parts of the world had lost their lives and thousands their homes during catastrophic floods caused by record rainfall that was unprecedented in its scale and intensity. Parts of Germany that usually see about 80 litres of rain per square metre in the month of July were inundated with 148 litres of rain within 48 hours.[12] Similar record levels of rainfall and the resulting floods in the Chinese province of Henan led to more than 300 deaths[13] and the displacement of more than a million people.[14] This happened in parallel with a deadly heatwave in North America,[15] where the village of Lytton in British Columbia recorded a temperature of 49.6°C – the highest ever measured in the country.[16] Less than a week later, Lytton was erased from the map by wildfire.[17] Air temperatures of nearly 32°C were recorded in the Arctic Circle,[18] and surface temperatures even reached 48°C in Siberia during a heatwave there.[19]

Even climate scientists were surprised by the frequency and intensity of such extreme weather events, warning that climate models have underestimated the impacts of climate change in causing such unprecedented heat-waves.[20] 2020 was the second hottest year on record, and the five hottest years on record have all occurred since 2015.[21] It is now 'unequivocal'[22] that the climate emergency has been caused by humanity, and we have a very limited window of opportunity to manage this problem.

The Working Group I contribution to the *Sixth assessment report of the Intergovernmental Panel on Climate Change* (IPCC) was released in August 2021 and showed that human-induced climate change is already contributing to many extreme weather and climate events in every region across the globe, including heatwaves, heavy precipitation, droughts and tropical cyclones.[23] According to the IPCC, many of the changes observed in the climate have had no precedent for thousands, if not hundreds of thousands, of years, and there is no way to reverse some of the changes already set in motion within hundreds or even thousands of years.[24]

While many public debates and policy actions concentrate on reducing carbon dioxide, the rapidly shrinking time frames for action mean that we also must focus intensely on methane, which is a more potent GHG over the short term. A rapid reduction in methane emissions may provide opportunities to slow the rate of warming, allowing a window for more fundamental changes in society to take place. The IPCC report indicates that the scale of any reduction in global methane emissions could decide whether global warming can be kept below 1.5°C and whether tipping points will be reached that would accelerate irreversible climate change. In 2018, the IPCC said the world only had until 2030 to achieve the 1.5°C goal.[25] The unique characteristics and properties of methane combined with the availability of methane mitigation measures could provide a pathway to staying below 1.5°C. However, the world has no time to waste, so these critical measures must be implemented during the present decade.

> *Methane mitigation is one of the most significant climate actions the world can take in this decade. In the near term, it is really the best thing we could possibly do.*
>
> Drew Shindell, Professor of Earth Science, Nicholas School of the Environment, Duke University [26]

According to the recently published *Global methane assessment* report by the United Nations Environment Programme (UNEP), the agriculture sector (including agricultural waste) is the largest contributor to global methane emissions. Within the sector, livestock-related emissions from enteric fermentation and manure management linked to the global meat and dairy industries make up the lion's share of emissions.[27] For this reason, it is vital that governments and the companies responsible for many of the methane emissions from livestock take urgent and meaningful action to reduce them.

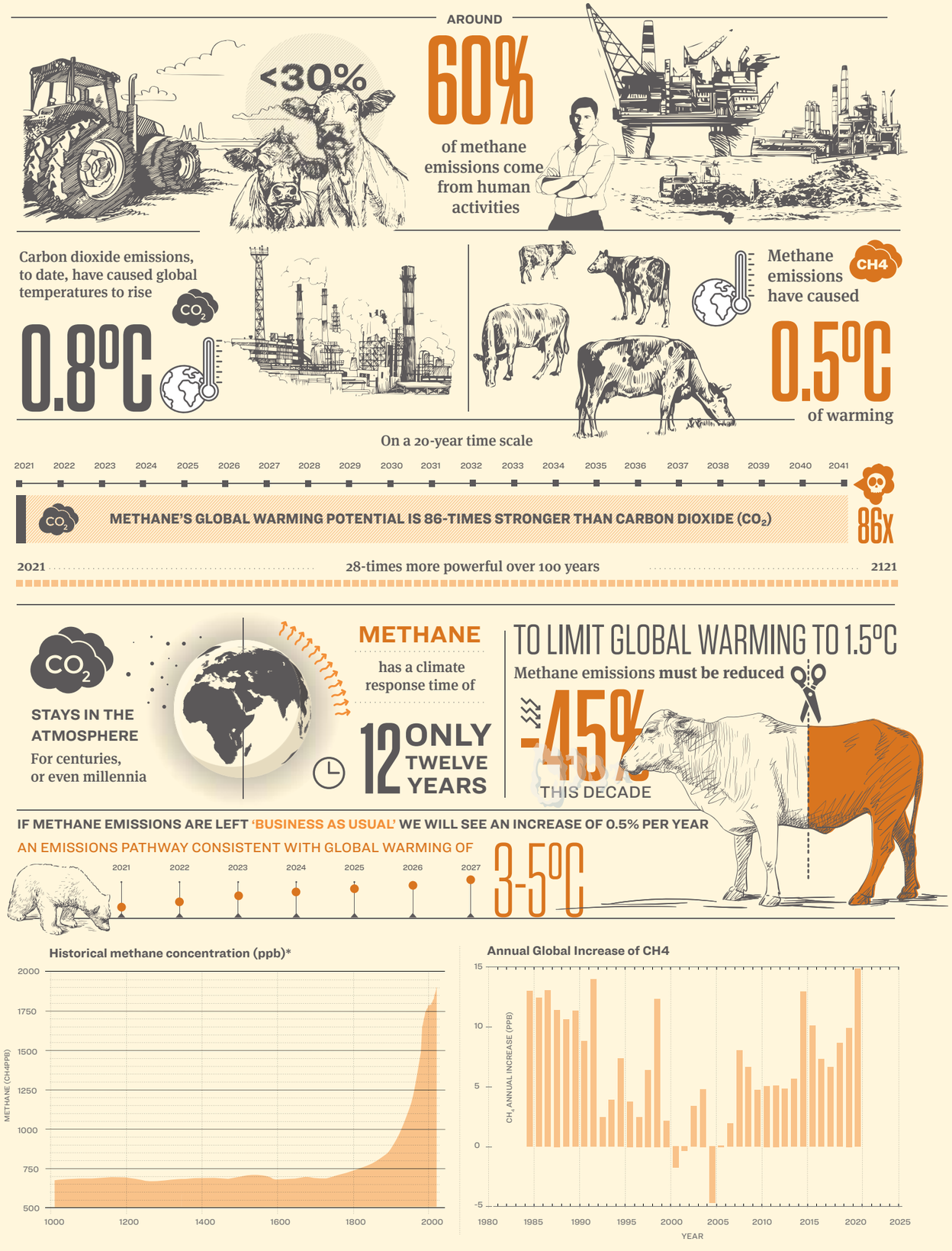
2. Why we need to rapidly reduce methane emissions: The science

2.1. Methane: A potent greenhouse gas

Methane is a colourless, odourless and highly flammable gas consisting of one carbon and four hydrogen atoms (CH_4). It is also a major contributor to global warming. While carbon dioxide emissions, to date, have caused global temperatures to rise 0.8°C, methane emissions have caused 0.5°C of warming.[28] Methane is emitted into the atmosphere from natural sources, such as wetlands, rivers, volcanoes or the seafloor, but around 60% of methane emissions come from human activities, such as the extraction of fossil fuels, leakage from landfills, sewage treatment plants and rice paddies.[29] The digestive tracts of ruminant animals, such as cows, sheep and goats, and the use of manure to fertilise fields produce particularly large amounts of anthropogenic methane emissions, making livestock agriculture the largest methane-emitting sector.[30]

Even though methane is not the most abundant GHG, it is one of the most powerful.[31] Methane's global warming potential is 86 times stronger per mass unit than carbon dioxide (CO_2) on a 20-year timescale, and 28 times more powerful over 100 years.[32] Equally important is the time methane persists once released into the atmosphere. Unlike CO_2, which stays in the atmosphere for centuries or even millennia,[33] methane has a climate response time of only about 12 years,[34] after which it degrades to CO_2 and water vapour. Therefore, methane's unique characteristics provide an opportunity to use methane emission reductions as a crucial stopgap measure during the longer-term transition to zero emission societies.

Critically, the rapid effects of methane emission reductions on reducing warming rates could also mean that climate tipping points and their effects on the planet could be delayed or avoided altogether.[35] Climate tipping points are critical thresholds in the biosphere that, if breached, will result in abrupt, irreversible, uncontrollable and potentially catastrophic change, and evidence suggests that we are approaching, or in some cases may already have reached, these points.[36, 37] Evidence of tipping points being reached that is already being observed include the collapse of ice sheets and weakening of the Gulf Stream. Scientists argue that this evidence alone suggests that we are in a state of planetary emergency.[38] A recent study also showed that exceeding tipping points would lead to a significant increase in the economic impacts of climate change.[39]



*2 Degrees Institute. 2021.Global CH4 Levels. [Online] https://www.methanelevels.org/

NOAA Global Monitoring Laboratory. (2021) https://gml.noaa.gov/ccgg/trends_ch4/

Scientists use the term 'positive feedback loops' to describe series of events caused or exacerbated by anthropogenic climate change that lead to the release of additional emissions. For example, permafrost soil stores large amounts of methane and carbon dioxide; as the earth warms, the soil thaws and releases these greenhouse gases into the atmosphere. The positive feedback loop in permafrost soil above sea level may already have been activated. In the decade between 2007 and 2016, permafrost temperatures increased by 0.29°C, but in some regions, such as north-western Siberia, temperatures have continued to increase by as much as 0.9°C since 2008–2009.[40] In the Canadian High Arctic, the thawing of permafrost is being observed at depths exceeding those that were forecast to take place only in 2090.[41] While it had been previously estimated that tundra ecosystems would shift to being a net GHG source in the mid-2020s,[42] permafrost regions may already be releasing up to 0.6 billion tons of carbon per year.[43]

Concentrations of carbon dioxide, methane and nitrous oxide in the atmosphere all set new year-to-date records in both 2020 and 2021.[44] Measurements show that methane levels reached 1891.6 parts per billion (ppb) in May 2021. This means that, at the time of writing, 2021 has thus far seen the largest recorded increase in methane levels in the atmosphere since measurements began in 1983.[45] Considering that the Covid-19 pandemic significantly slowed global economic activities, the sharp increase in methane concentrations is particularly surprising and a cause for concern.[46]

Overall, methane emissions have risen more than 150% from pre-industrial levels in 1750.[47] In comparison, CO_2 concentration levels have increased by around 50%.[48] Moreover, the increase in atmospheric methane tracks close to the warmest possible scenario assessed by the IPCC in its fifth assessment report.[49] To limit global warming to 1.5°C, human-induced methane emissions must be reduced by 45% this decade.[50] This is in stark contrast to the current path, which shows an increase of 0.5% per year - an emissions pathways consistent with global warming of 3–5°C.[51] Such a scenario will likely lead to the Arctic Ocean being ice-free during the summer months, and an 85% reduction in glaciers by the year 2100. Changes in temperature and humidity will also compromise humans' ability to grow food, inevitably affecting global food security.[52]

> *Meeting the Paris Climate Goals will need every climate action trick in the book. Cutting methane emissions should be on page 1.*
>
> Professor Dave Reay, Executive Director, Edinburgh Climate Change Institute, University of Edinburgh.[53]

It is important to recognise that the negative impacts of methane emissions are not limited to its role as a GHG. Methane is also linked to the formation of ground-level ozone, which has severe impacts on both human health and plant growth. Without significant reductions in methane, ozone-related health impacts could result in up to 90,000 premature deaths by 2050.[54] Reducing human-driven methane emissions could also prevent 26 million tons of staple crop losses.[55]

2.2. Hitting the limits of the methane budget

A number of organisations and experts have developed projections of current and future methane emissions. The Global Carbon Project has combined them to produce the most detailed and widely accepted methane budget calculations and projections. Its most recent estimates were published in 2020 and include methane budget estimates for the time period from 2000 to 2017. Total emissions of methane from both anthropogenic and natural origins reached nearly 600 million tons per year, and recent emissions were mostly caused by human-driven activities.[56] More than 60% of all emissions in 2017 had anthropogenic origins, and the largest contributor to these human-induced emissions was the agricultural sector, including agricultural waste, which alone was responsible for around 38% of the total.[57]

GLOBAL METHANE BUDGET 2017

TOTAL EMISSIONS

596
(572-614)

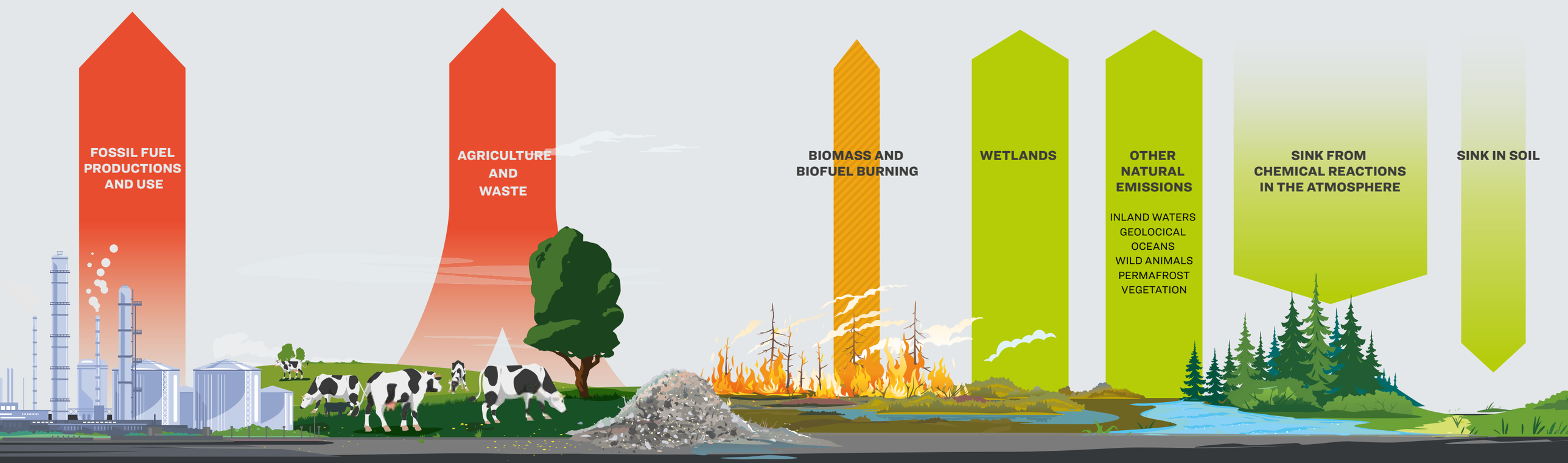
ATMOSPHERIC CH_4 GROWTH RATE

+16.8*

TOTAL SINKS

571
(540-585)

FOSSIL FUEL PRODUCTIONS AND USE	AGRICULTURE AND WASTE	BIOMASS AND BIOFUEL BURNING	WETLANDS	OTHER NATURAL EMISSIONS	SINK FROM CHEMICAL REACTIONS IN THE ATMOSPHERE	SINK IN SOIL
108 (91-121)	**227** (205-246)	**28** (25-32)	**194** (155-217)	**39** (21-50)	**531** (502-540)	**40** (37-47)



EMISSIONS AND SINKS

In teragrams of CH_4 per Year ($TgCH_4/yr$), for year 2017, from top-down approaches

*This shows the observed atmoshperic growth rate. Budget imbalance of a few tg CH_4/yr effects uncertainties of models in capturing the observed growth rate.

ANTHROPOGENIC FLUXES

NATURAL FLUXES

NATURAL AND ANTHROPOGENIC FLUXES

Based on the Global Carbon Project, 2020

There are, nevertheless, still significant uncertainties in methane budget calculations, partly because running methane models requires more time than CO_2 models, and partly because, compared to carbon dioxide, tracking methane budgets is a relatively new discipline.[58]

In order to reduce the contribution of methane to global warming, it is important not only to stabilise the global methane budget, but to store significantly more methane than is being emitted. Therefore, the various sectors that produce anthropogenic methane emissions and the extent to which such emissions can be reduced become critically important. **In order to avoid catastrophic climate change, methane emission reductions of 45% are necessary by 2030.**[59]

> *Cutting methane is the strongest lever we have to slow climate change over the next 25 years and complements necessary efforts to reduce carbon dioxide. The benefits to society, economies, and the environment are numerous and far outweigh the cost. We need international cooperation to urgently reduce methane emissions as much as possible this decade.*
>
> Inger Andersen, Executive Director of UNEP[60]

2.3. Methane emissions by sector

As shown in Figure 2.1, the single largest contributor to anthropogenic methane emissions is the livestock sector. More than 30% of all human-induced methane emissions are estimated to originate from enteric fermentation and manure management.

In comparison, oil and gas production account for 22%, landfills and waste for 18%, and 12% of all non-natural methane emissions are attributed to coal mining.[61] The largest contributor within the oil and gas sector is onshore conventional oil production, which contributed 27% of the total in 2020. Onshore conventional gas and downstream gas were each responsible for another 21% of methane emissions within the oil and gas sector.[62]

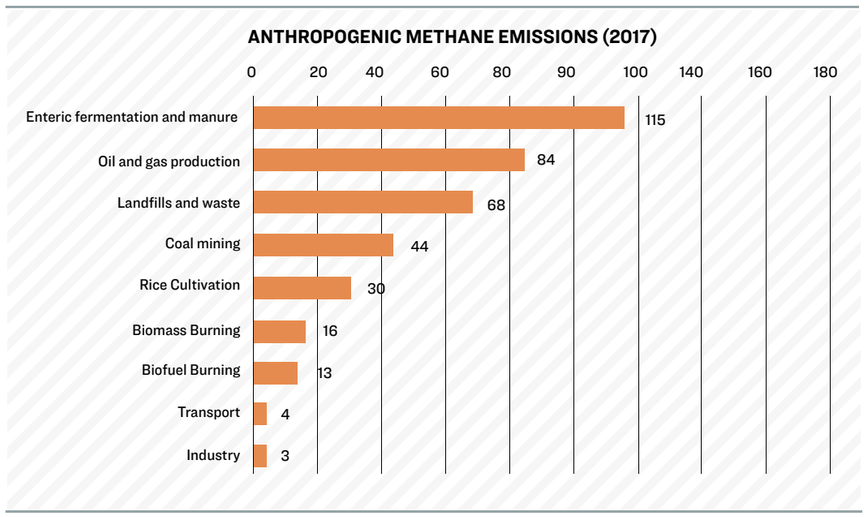


Figure 2.1: Natural and anthropogenic methane emissions (million tons, bottom-up approach)

Source: *Jackson, R. B., Saunois, M., Bousquet, P., Canadell, J. G., Poulter, B., Stavert, A. R., Bergamaschi, P., Niwa, Y., Segers, A. and Tsuruta, A. (2020) Increasing anthropogenic methane emissions arise equally from agricultural and fossil fuel sources. Environmental Research Letters, 15(7): 071002. [ONLINE] Available at https://iopscience.iop.org/article/10.1088/1748-9326/ab9ed2*

The waste sector is the third largest contributor to anthropogenic methane emissions, being responsible for approximately 18% of the world's total. This translates to as much as 4% of global GHG emissions.[63, 64] The largest contributor to emissions within the waste sector is solid waste in landfills: 50% of waste-related methane emissions are associated with municipal solid waste.[65]

2.4. Geographical distribution of methane emissions

The country with the largest anthropogenic methane emissions overall is China, where coal mining alone emits around 24 million tons of methane every year. This amounts to more than half of the annual global methane emissions associated with coal mining. China is also one of the largest emitters of methane from the livestock sector, with more than 11 million tons per year.[66]

Unsurprisingly, most methane emissions from oil and gas production, which constitutes the second-largest contributing sector, occur in major fossil fuel production regions. The Middle East, Russia and the US – with respective emissions of 18.1, 14.6 and 11.7 million tons of methane in 2017 – dominate this sector with more than 50% of total emissions.[67]

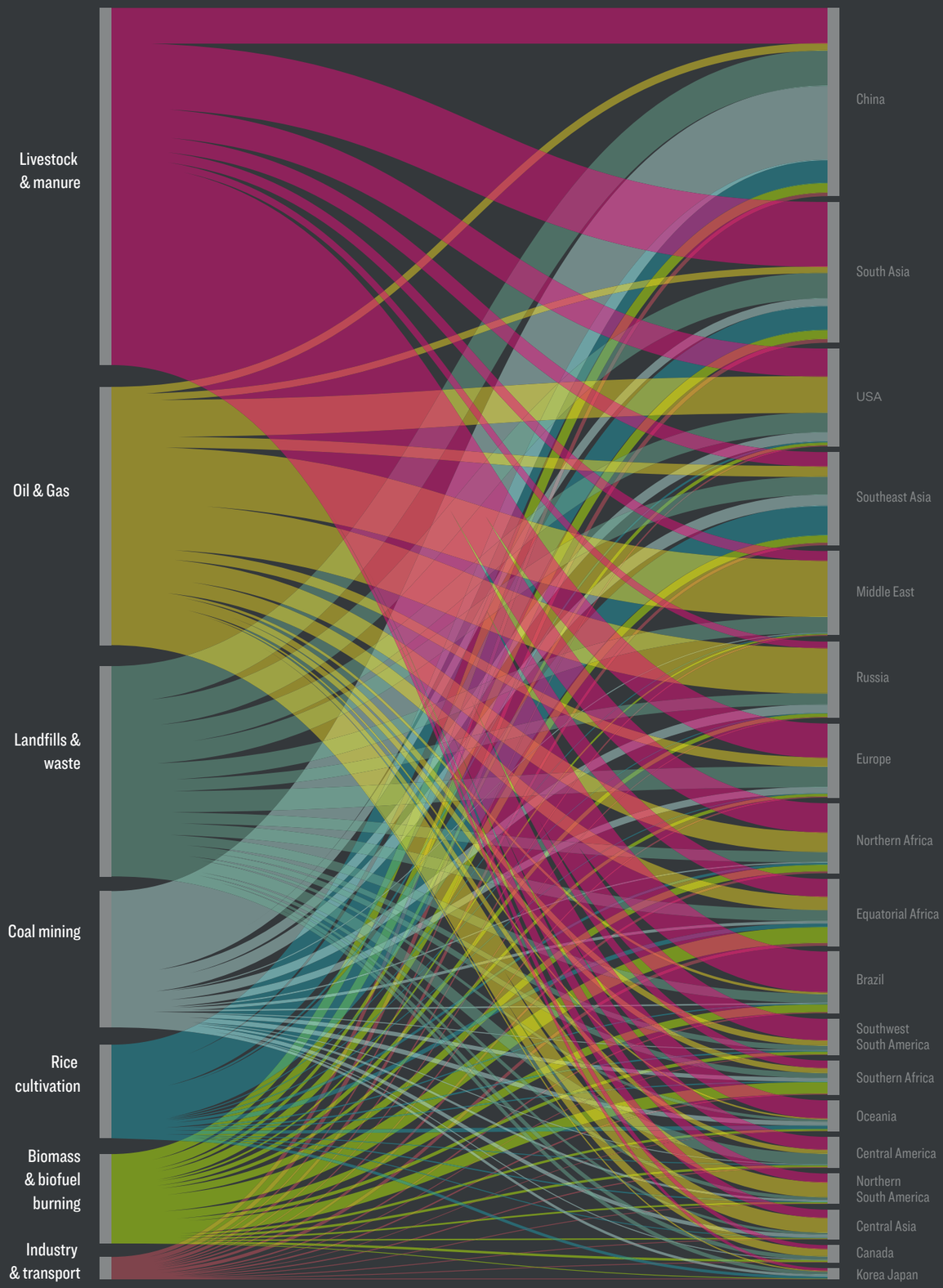
Emissions from the landfill and waste sector appear to have a more even geographical distribution and broadly correlate with population sizes. Around 80% of all emissions associated with rice cultivation originate in Asia.[68]

In the livestock sector, more than 20.8 million tons – of a total of 115 million tons – are generated in Southeast Asia, while Brazil (13.0 million tons), China (11.3 million tons) and Europe (10.9 million tons) are also significant contributors. Together, these regions account for nearly 50% of global livestock-related methane emissions. However, it is important to also consider the political dimension of livestock emissions. For example, the Institute for Agriculture & Trade Policy (IATP) reports that the EU, US and New Zealand alone account for 46% of global dairy production and that companies headquartered in the Global North account for the lion's share of global emissions related to dairy, making these governments best placed to drive transition.[69]

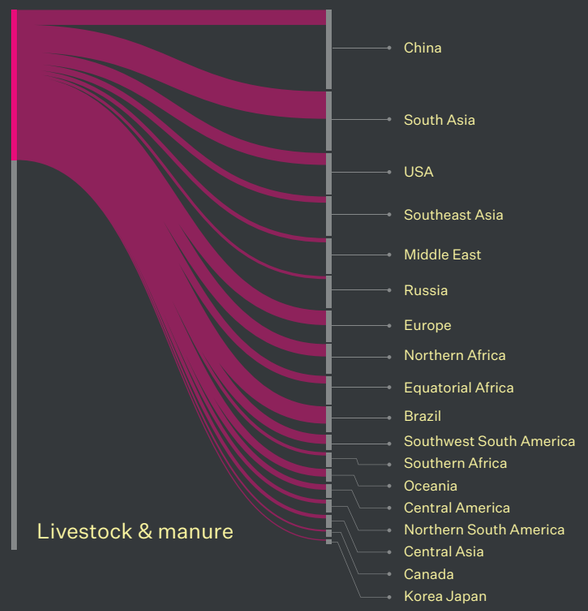
2.5. Methane mitigation options

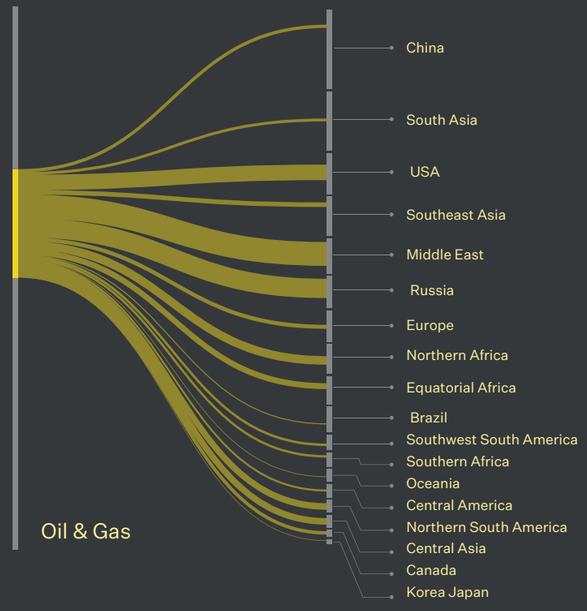
Scientists believe that in order to meet the targets of the Paris Agreement and keep global warming below 1.5°C, it is necessary to reduce human-caused methane emissions by 45%, which translates to a reduction of 180 million tons a year. This will result in avoiding nearly 0.3°C of warming by the 2040s and represents a significant contribution to efforts to avert catastrophic climate change.[70] In what is the most detailed report to date on methane mitigation opportunities, the *Global methane assessment* estimates that two-thirds of the necessary methane reductions could be achieved using readily available measures. Importantly, 60% of these targeted measures are low cost, and 50% of those have negative costs. Nevertheless, extra measures and policies relating to behaviours and taxation systems will be needed in addition to technical solutions in order to bring methane emissions in line with the targets of the Paris Agreement.[71]

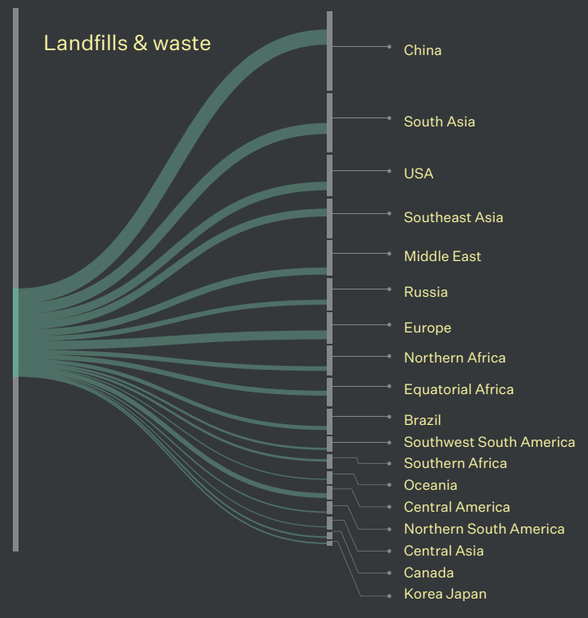
GEOGRAPHICAL DISTRIBUTION OF METHANE EMISSIONS BY SECTOR

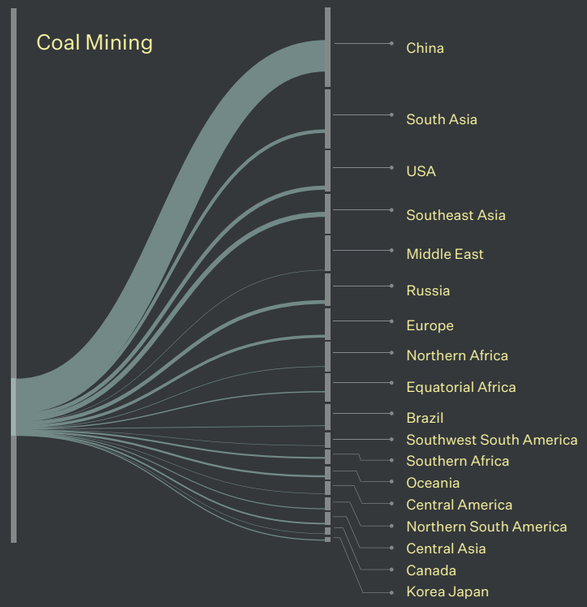


Source: Calculated from Integrated Carbon Observation System (ICOS) (2021) Supplemental data to global methane budget 2000-2017. [ONLINE] Available at: https://www.icos-cp.eu/GCP-CH4/2019









Geographical zones of methane emissions

BOX 2.1: Methane mitigation options, according to the *Global methane assessment*

The table below summarises the technical and behavioural measures that could be implemented to facilitate methane emission mitigation. While some of the abatement measures focus entirely on methane reduction (such as controls on landfills, anaerobic digestion for manure, and improved irrigation practices for rice cultivation), many others will also result in the reduction of other GHGs. For instance, moving away from coal will reduce CO_2 emissions, as will a move away from a meat-based diet and a resulting reduction in deforestation rates,[72] and the release of land to grow food directly for increasing populations or for climate-positive activities such as reforestation.[73]

Technical measures		
Agriculture	**Fossil fuels**	**Waste**
Enteric fermentation in cattle, sheep and other ruminants: feed changes and supplements; breeding to improve productivity and animal health/fertility	Oil and gas: upstream and downstream leak detection and repair (LDAR)	Municipal solid waste: source separation with recycling/reuse; no landfill of organic waste; treatment with energy recovery or collection and flaring of landfill gas
Manure management for ruminants and pigs: treatment in biogas digesters; decreased manure storage times; improved manure storage coverings; improved housing systems and bedding; manure acidification	Oil and gas: blowdown capture; recovery and utilisation of vented gas with vapour recovery units and well plungers; installation of flares	Industrial solid waste: recycling or treatment with energy recovery; no landfill of organic waste
Rice cultivation: improved water management or alternate flooding/drainage wetland rice; direct wet seeding; phosphogypsum and sulphate addition to inhibit methanogenesis; composting of rice straw; use of alternative hybrids	Existing oil and gas devices: replacement of pressurised gas pumps and controllers with electric or air systems; replacement of gas-powered pneumatic devices and petrol or diesel engines with electric motors; early replacement of devices with lower-release versions; replacement of compressor seals or rods; capping of unused wells	Residential wastewater: upgrade of primary treatment to secondary/ tertiary anaerobic treatment with biogas recovery and utilisation; replacement of latrines and disposal with wastewater treatment plants
Agricultural waste burning: introduction of ban; enforcement of existing bans	Coal mining: pre-mining degasification; air methane oxidation with improved ventilation	Industrial wastewater: upgrade of treatment to two-stage treatment, i.e. anaerobic treatment with biogas recovery followed by aerobic treatment
	Coal mining: flooding of abandoned mines	
Behavioural measures		
Agriculture	**Fossil fuels**	**Waste**
Reduced food waste	Switching from fossil fuels to renewables/ nuclear	
Dietary change	Energy demand management	
	Energy efficiency improvement	
Emissions pricing	Emissions pricing	Emissions pricing

Table 1: Summary of methane mitigation measures – technical and behavioural

Source: *UNEP and Climate and Clean Air Coalition (2021) Global methane assessment: Benefits and costs of mitigating methane emissions. [ONLINE] Available at: https://www.ccacoalition.org/sites/default/files/resources/2021_Global-Methane_Assessment_full_0.pdf*

2.6. Livestock methane emissions and impacts

The ruminant livestock and manure sub-sector is the single largest contributor to anthropogenic methane emissions, generating more than 30% of all methane emissions linked to human activities. Even though governments and some large corporate emitters have made promises to significantly reduce CO_2 emissions, this has not yet occurred in the livestock sector, as will be shown in subsequent chapters, and there have been no efforts to establish specific measures to mitigate methane emissions.

The vast majority of emissions within the livestock sector originate from enteric fermentation – the process in the digestive system of ruminant animals whereby bacteria produce methane in the rumen (fore-stomach) as a by-product of the fermentation of plant materials. Enteric methane production is directly related to the amount, type and quality of feed. The amount of energy consumed, animal size, growth rate, level of production, and environmental temperature also play important roles. In total, 77% of global enteric methane is generated by cattle, 13% by buffalo and the rest by small ruminants such as sheep and goats.[74]

In addition to enteric methane, large manure tanks in industrial farming operations that use animal manure as fertiliser are also a significant source of methane linked to livestock, particularly in pig farming.

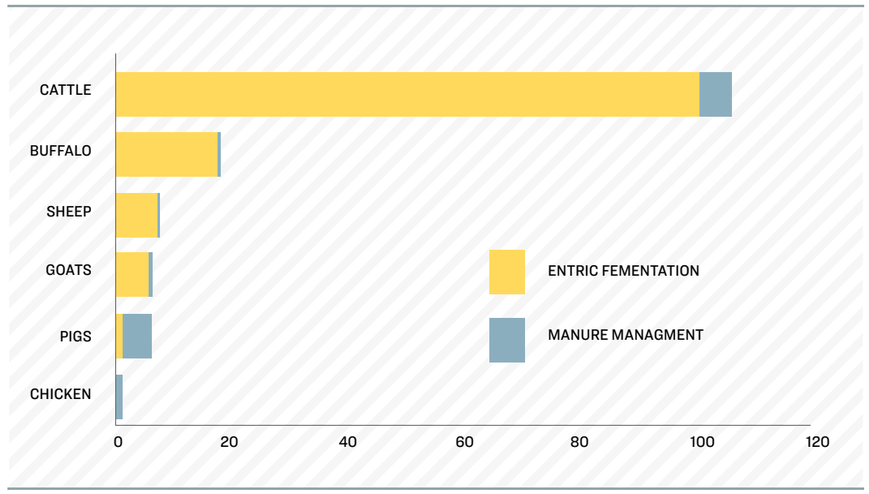


Figure 2.2: Annual methane emissions related to livestock (million tons)

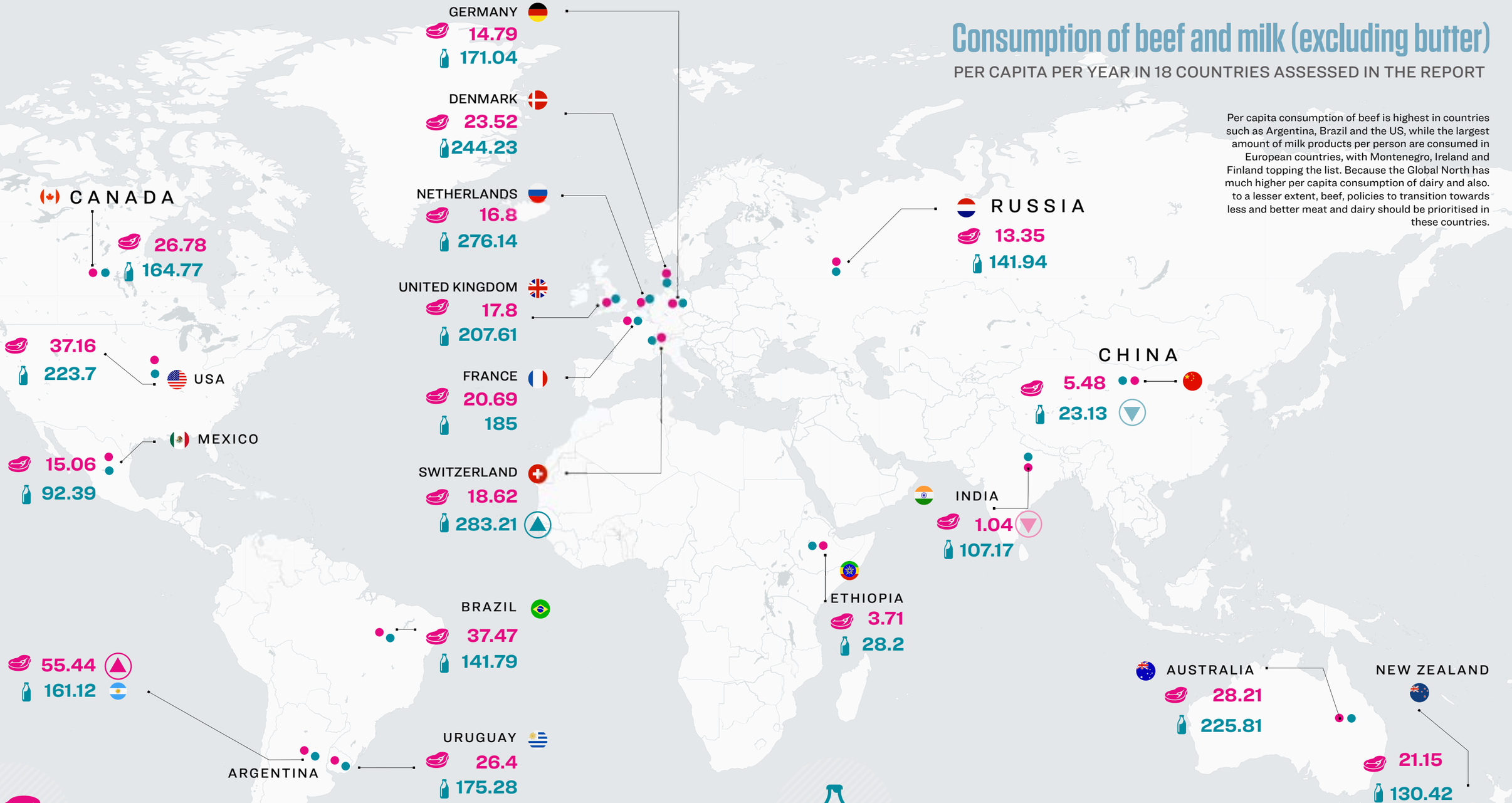
Source: UNEP and Climate and Clean Air Coalition (2021) Global methane assessment: Benefits and costs of mitigating methane emissions. [ONLINE] Available at: https://www.ccacoalition.org/sites/default/files/resources/2021_Global-Methane_Assessment_full_0.pdf

Beef and dairy production also represent a highly inefficient protein production system, as only 3.8% of animal feed protein input is effectively converted into final animal product for beef and 24% for whole milk.[75] Beef is also one of the most carbon-intensive food products, generating almost 60kg of CO_2 per kg of product.[76] One-third of all croplands are currently occupied by crops whose sole purpose is to feed livestock.[77] While it is true that native grazing land has few alternative uses and should therefore, at least to some extent, remain in use for a smaller

Consumption of beef and milk (excluding butter)

PER CAPITA PER YEAR IN 18 COUNTRIES ASSESSED IN THE REPORT

Per capita consumption of beef is highest in countries such as Argentina, Brazil and the US, while the largest amount of milk products per person are consumed in European countries, with Montenegro, Ireland and Finland topping the list. Because the Global North has much higher per capita consumption of dairy and also. to a lesser extent, beef, policies to transition towards less and better meat and dairy should be prioritised in these countries.



BEEF CONSUMPTION RANKING

KG PER CAPITA PER YEAR

ARGENTINA	55.44	DENMARK	23.52	MEXICO	15.06		
BRAZIL	37.47	NEW ZEALAND	21.15	GERMANY	14.79		
USA	37.16	FRANCE	20.69	RUSSIA	13.35		
AUSTRALIA	28.21	SWITZERLAND	18.62	CHINA	5.48		
CANADA	26.78	UNITED KINGDOM	17.8	ETHIOPIA	3.71		
URUGUAY	26.4	NETHERLANDS	16.8	INDIA	1.04		

MILK CONSUMPTION RANKING

LITRE PER CAPITA PER YEAR

SWITZERLAND	283.21	FRANCE	185	BRAZIL	141.79		
NETHERLANDS	276.14	URUGUAY	175.28	NEW ZEALAND	130.42		
DENMARK	244.23	GERMANY	171.04	INDIA	107.17		
AUSTRALIA	225.81	CANADA	164.77	MEXICO	92.39		
USA	223.7	ARGENTINA	161.12	ETHIOPIA	28.2		
UNITED KINGDOM	207.61	RUSSIA	141.94	CHINA	23.13		

number of animals, reductions in beef and dairy consumption could free up lands currently used to grow feed. These could then be used to grow crops for direct human consumption or for other climate-positive purposes, such as rewilding or regrowing forests.[78]

Livestock farming also has negative impacts on biodiversity and water, and produces significant CO_2 emissions. Beef production is the most important driver of tropical deforestation. Between 2001 and 2015, cattle pasture replaced about 45 million hectares of forested land (an area roughly the size of Sweden). This is nearly twice the deforestation caused by the next six largest agricultural commodities combined. Cattle production also indirectly drives deforestation. Much of the world's soy production is used in animal feed, and between 2001 and 2015, the establishment of soy farms was linked to 8.2 million hectares of additional forest loss.[79]

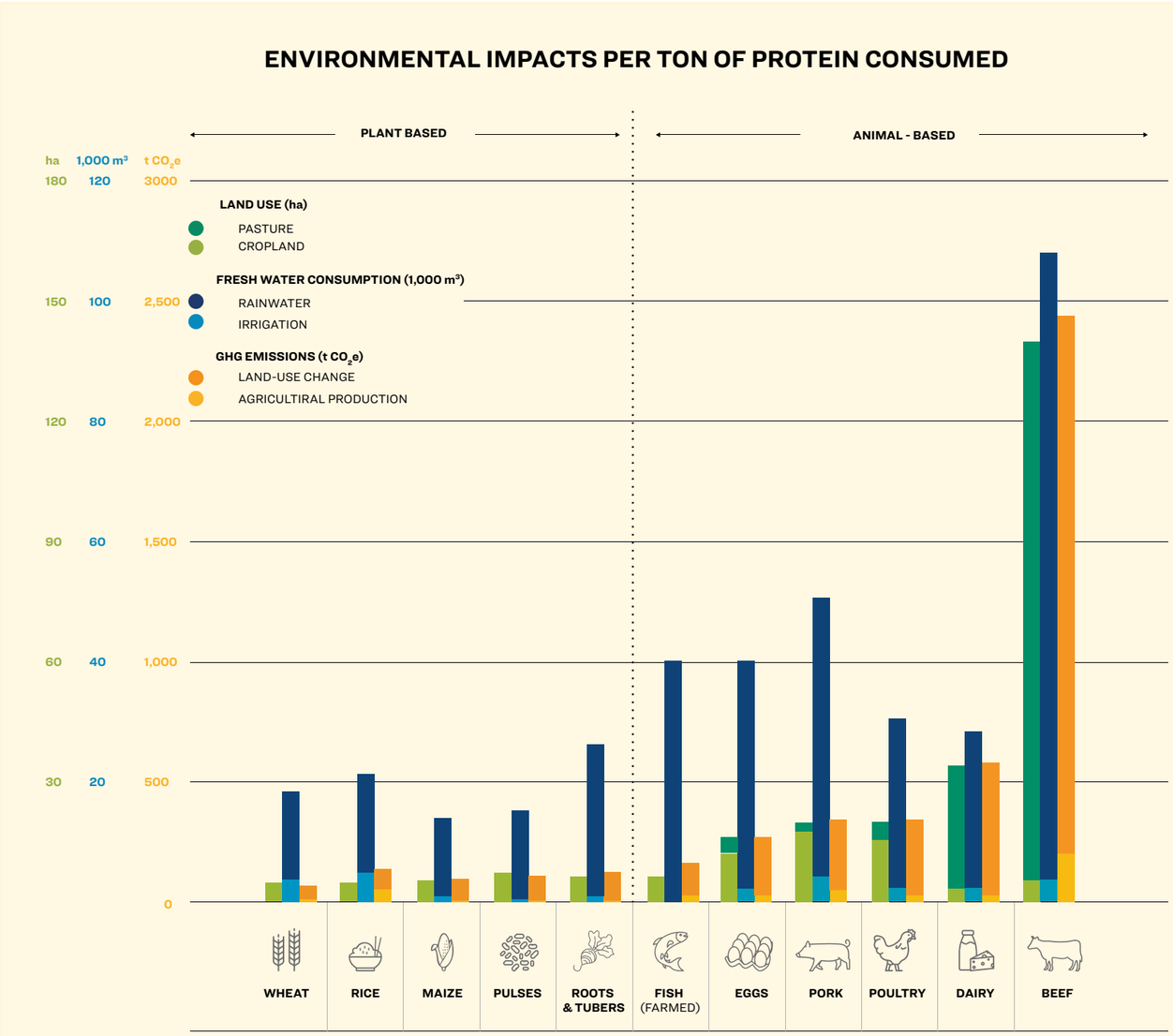


Figure 2.3: Environmental impacts per ton of protein

Source: World Resources Institute (2016) Animal-based foods are more resource-intensive than plant-based Foods. [ONLINE] Available at: https://www.wri.org/data/animal-based-foods-are-more-resource-intensive-plant-based-foods

Blindspot: How lack of action on livestock methane undermines climate targets

Ruminants also have large impacts on water scarcity and pollution. Agriculture accounts for 92% of the global freshwater footprint, and animal products are responsible for one-third of this. Moreover, animal products use much more water per calorie than plant-based proteins.[80] A 2010 study found that 15,400m^3 of water are necessary to produce a ton of beef compared to 4,000m^3 for a ton of pulses. For each gram of protein produced, bovine meat required 112 litres of water, milk 31 litres and pulses 19 litres.[81]

The *Global methane assessment* report states, that by 2050, emissions from enteric fermentation, especially from cattle, will be the dominant remaining source of methane emissions in scenarios that keep any temperature rise under 2°C.[82] Harmsen et al. also argue that enteric fermentation in ruminants is by far the largest obstacle to achieving the methane reduction necessary by the end of the century.[83] In order to reduce methane emissions from the livestock sector, the *Global methane assessment* report says it will be necessary to apply a mix of technical and behavioural abatement measures. Because technical solutions in agriculture and livestock are less advanced and available than in other major methane-emitting sectors, the introduction of behavioural measures and policies, such as the adoption of plant-based diets, becomes particularly important. The *Global methane assessment* report predicts that targeted technical measures could reduce methane emissions in the ruminal livestock sector by around 30 million tons per year by 2030, but behavioural and policy measures to reduce food loss and waste, improve livestock management and foster healthier diets would still be needed to reduce emissions by a further 65–80 million tons.[84]

Mitigation activities fall into two categories. Targeted technical solutions are already available and could be applied quickly, while policies that drive behavioural change, such as shifts towards plant-based and flexitarian diets, could have higher mitigation potential, but might take more time and political will to implement. In addition to these, significant innovation in the alternative protein market, with new types of plant-based and cultured meat products, is on the way, which might disrupt traditional food-production systems. We discuss technical mitigation options in Box 5.1, and policy options to reduce meat and dairy consumption in Chapter 5, where we also investigate in box 5.2 some market trends and dietary shifts that are already on the way.

credit: *We Animals Media*

3. Lack of action among major methane-emitting countries

3.1. What actions are countries taking on methane emissions?

In order to assess current and historical methane emissions and key policies that have been developed by countries crucial to the debate around reducing emissions from the livestock industry, Changing Markets has analysed data submitted by 18 countries to the United Nations Framework Convention on Climate Change (UNFCCC). In particular, we scrutinised the nationally determined contributions (NDCs) and biennial reports (BRs) that are periodically provided to the UNFCCC. NDCs report the efforts by each country to reduce national emissions and adapt to the impacts of climate change following the establishment of the Paris Agreement.[85] While they are supposed to be submitted every four years, countries often also submit updates and addendums at various times, in particular after new climate change regulation has been passed. BRs include, among other subjects, updates on recent GHG inventories.

Countries were chosen based on an analysis of international statistics on meat and dairy production and exports, as well as information on cattle herds and the location of the largest meat and dairy companies' headquarters. The data submitted by governments to the UNFCCC was then analysed against criteria such as whether and when emissions specific to enteric fermentation and manure management have been reported, and whether GHG inventories show short-term and long-term decreases in methane emissions. Countries were also assessed on the strength of any livestock-specific methane reduction polices they may have adopted. Finally, we also investigated whether governments have developed detailed action plans to achieve any reduction targets they have committed to.

The results of the analyses are sobering and show that governments have not yet realised the importance of significant methane reduction measures in general and for the livestock sector in particular. The reported data shows that in most countries methane emissions are relatively stable or even increasing. In the absence of general methane reduction targets, it is not surprising that very few countries have policies that will reduce emissions from their livestock sectors, even if such action is essential to meet emission reductions in line with scenarios that keep global warming below 1.5°C and to meet other biodiversity and sustainability targets.

3.1.1. *Reporting and methane emission reductions*

The main positive takeaway is that almost all countries analysed report livestock-specific emissions from enteric fermentation and manure management. Yet (partly due to the biennial submission cycle of BRs) the latest year any country is reporting for is 2017. Moreover, a number of countries only submit older data, such as China for 2014 and the US for 2013 – the latter due to the fact that it had temporarily left the Paris Agreement under the Trump presidency.

Disappointingly, most countries included in the analysis have not achieved any meaningful methane emission reductions for enteric fermentation and manure management since 1990. The lack of such reductions is especially noticeable in the last five years of reporting for livestock-related emissions. Even though eight countries reported a decrease in emissions linked to enteric fermentation and manure management in the last five years when applying the calculations outlined in the methodology for this assessment, none of these reductions was higher than 5%. Australia reported the largest decrease, with 3.1% in five years. At the other end of the spectrum, the Netherlands reported an increase of 6.5% in livestock-related methane emissions over the same period.

Two countries reported very significant methane emission reductions in the livestock sector since 1990. Germany decreased emissions by nearly 27% between 1990 and 2017, while Russia claims a reduction of more than 60%. These figures are plausible considering that, according to the Food and Agriculture Organization (FAO), Germany reduced its cattle herd by close to 40% during this period, and Russia's herd declined by two-thirds between 1992 and 2017.[86] Other countries reported a long-term increase in livestock related methane emissions such as Brazil (44% increase), Canada (13.2% increase), as well as the USA (12.2% increase) and Uruguay (9% increase).

3.1.2. *Livestock methane emissions and targets*

The issue of most concern in this analysis is that none of the countries assessed have communicated overall methane reduction targets to the UNFCCC for all sectors, let alone targets that are consistent with the 45% reduction in methane emissions specified by the latest science as necessary to keep global warming below 1.5°C. While many of the countries included in the analysis will have overall reduction targets for emissions that include methane by extension (as CO_2 equivalent), given how differently methane reacts in the atmosphere and the significant opportunity to delay global warming through the abatement of such a short-lived greenhouse gas, separate strong methane targets are rapidly becoming a necessity.

The lack of adequate targets among the key countries that produce beef and dairy products is particularly concerning considering that the presidents of the US, Russia and France all called for methane reductions at the Leaders' Summit on Climate in April 2021.[87]

Only two of the countries assessed have committed to specific targets for livestock-related methane emissions according to their submissions to the UNFCCC. New Zealand has set a goal of reducing biogenic methane emissions (those from agriculture and waste) to 10% below 2017 levels by 2030 (see Box 3.1 on New Zealand), but this falls well short of what is required to avoid catastrophic climate change. Moreover, neither its historical methane emissions from 1990 (7.5% lower than the current level) nor its very small methane reduction of 1.9% in the last five reported years provides confidence that New Zealand will be able to reach its already low target, particularly in light of the local meat and dairy industries' reluctance to act. While New Zealand should be given some credit as one of the few countries that has set such targets at all, and for updating its NDC once the legislation was passed, the country has not provided a detailed action plan on how it intends to make sure that the target is reached.[88] Furthermore, there are no enforcement mechanisms associated with the target that would ensure major emitters are held accountable if it is not met.

Uruguay, a country where methane makes up a particularly high percentage of total GHG emissions, has also set a specific target that covers livestock. The country has committed to an unconditional goal of reducing the methane emission intensity per kg of beef cattle measured in live weight by 32% by 2025 compared to its 1990 level.[89] Considering that the country's cattle herd has increased by nearly one-third since 1990,[90] it is questionable whether this goal will result in any absolute reduction in methane emissions in Uruguay. Even though intensity-based targets are a good indicator of production efficiency and, in this case, will likely require the implementation of successful methane abatement solutions, only an absolute reduction in methane emissions and other GHGs will ensure the world avoids the impacts of catastrophic global warming. Increasing cattle herds while reducing methane intensity is unlikely to result in the necessary overall emissions reductions. In addition to its livestock targets, Uruguay has also set wider (but also intensity-based) goals for its total methane emissions of a '57% reduction in CH_4 emissions intensity per GDP unit' by 2025. This applies to the sectors of energy, agriculture (including cattle), waste and industrial processes.[91]

Finally, while Ethiopia does not report detailed methane figures, the country, which has the largest cattle herd in Africa, has committed to a climate policy intervention that replaces beef (but not dairy) cattle with chickens to induce a demand shift. Although this should result in a decrease in methane emissions, the country has provided no calculations, milestones or action plans to quantify any emission reductions associated with the policy.[92]

Overview of countries' methane reporting and methane reduction plans

Table 2: Overview of country reporting and methane reduction plans

COUNTRIES	LINKS TO METHANE EMISSIONS FROM LIVESTOCK IN 2019 *FAO (2021) Crops and livestock products. [ONLINE] Available at: http://www.fao.org/faostat/en/#data/QCL* *Comtrade (2021) UN Comtrade Database. [ONLINE] Available at: https://comtrade.un.org/*	Country reports methane emissions publicly for all key sectors including agriculture (not in CO_2 equivalent)	Country reports recent methane emissions for enteric fermentation and manure management	Country has demonstrated at least 15% reduction of absolute methane emissions from enteric fermentation and manure management in the last five years most recently reported	Country has demonstrated at least 25% reduction in methane emissions from livestock between 1990 and the latest reported year	Overall methane emission reduction target, including agriculture, in line with global requirements of at least 45% by 2030 compared to 2020 level	Methane reduction targets include cut to emissions from livestock of at least one-third by 2030 compared to 2020 level	Country has submitted methane-specific action plan for agricultural emissions including measurable milestones towards its target
ARGENTINA	4TH LARGEST BEEF PRODUCER 6TH LARGEST CATTLE HERD 7TH LARGEST BEEF EXPORTER	ALL SECTORS	2016	+3.9%*	-6.5%*	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
AUSTRALIA	3RD LARGEST BEEF PRODUCER	ALL SECTORS	2017	-3.1%	-18.8%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
BRAZIL	LARGEST BEEF EXPORTER LARGEST CATTLE HERD	ALL SECTORS	2016	+4.7%	+44.0%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
CANADA	9TH LARGEST BEEF PRODUCER & EXPORTER	ALL SECTORS	2017	-0.6%	+13.2%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
CHINA	3RD LARGEST BEEF PRODUCER 4TH LARGEST CATTLE HERD 5TH LARGEST MILK PRODUCER	ALL SECTORS	2014	-0.2%	INSUFFICIENT REPORTING	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
DENMARK	HQ OF MAJOR PRODUCERS ARLA AND DANISH CROWN	ALL SECTORS	2017	-0.2%	-0.7%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
ETHIOPIA	5TH LARGEST CATTLE HERD / LARGEST CATTLE HERD IN AFRICA	NOT REPORTED	NOT REPORTED	INSUFFICIENT REPORTING	INSUFFICIENT REPORTING	NO METHANE TARGETS	PROMOTES POULTRY OVER BEEF PRODUCTION BUT NO EMISSION TARGET	NO DETAILED ACTION PLANS
FRANCE	8TH LARGEST BEEF PRODUCER LARGEST CATTLE HERD (IN THE EU) 4TH LARGEST MILK PRODUCTS EXPORTER	ALL SECTORS	2017	+0.5%	-8.9%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
GERMANY	4TH LARGEST MILK PRODUCER LARGEST MILK PRODUCT EXPORTER	ALL SECTORS	2017	-1.4%	-26.8%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
INDIA	2ND LARGEST MILK PRODUCER 2ND LARGEST CATTLE HERD	REPORTS MOSTLY CO_2 EQUIVALENT	2016	+0.3%	INSUFFICIENT REPORTING	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
MEXICO	6TH LARGEST BEEF PRODUCER 8TH LARGEST CATTLE HERD	REPORTS MOSTLY CO_2 EQUIVALENT	2015	+5.7%	+3.7%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
NETHERLANDS	3RD LARGEST MILK PRODUCT EXPORTER 6TH LARGEST BEEF EXPORTER HQ OF MAJOR PRODUCERS FRIESLAND CAMPINA AND VION	ALL SECTORS	2017	+6.5%	-14.6%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
NEW ZEALAND	8TH LARGEST MILK PRODUCER 2ND LARGEST MILK PRODUCT EXPORTER HQ OF MAJOR PRODUCER OF FONTERRA	ALL SECTORS	2017	-1.9%	+7.5%	NO METHANE TARGETS	10% BELOW 2017 LEVEL FOR BIOGENIC METHANE	NO DETAILED ACTION PLANS
RUSSIA	6TH LARGEST MILK PRODUCER 7TH LARGEST BEEF PRODUCER	ALL SECTORS	2017	+1.4%	-60.3%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
SWITZERLAND	HQ OF MAJOR PRODUCER, NESTLÉ	ALL SECTORS	2017	-1.4%	-9.3%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
UK	3RD LARGEST MILK PRODUCER (IN EUROPE) 3RD LARGEST BEEF PRODUCER (IN EUROPE) 8TH LARGEST MILK PRODUCT EXPORTER	ALL SECTORS	2017	+2.7%	-14.7%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS
URUGUAY	ONE OF THE HIGHEST LIVESTOCK METHANE EMISSION PERCENTAGES	ONLY MANURE MANAGEMENT IN CH4	2017	+4.8%	+9.0%	57% REDUCTION PER GDP UNIT BY 2025 ON 1990 INTENSITY LEVEL	32% REDUCTION PER KG OF BEEF BY 2025 ON 1990 INTENSITY PER LEVEL	NO DETAILED ACTION PLANS
USA	LARGEST MILK & BEEF PRODUCER 2ND LARGEST BEEF EXPORTER 3RD LARGEST CATTLE HERD	ALL SECTORS	2013	-2.8%	+12.2%	NO METHANE TARGETS	NO LIVESTOCK TARGETS	NO DETAILED ACTION PLANS

* While most other countries reported figures for enteric fermentation and manure management, Argentina's historical emission figures are combined across the livestock sector.

BOX 3.1: The case of livestock in New Zealand

New Zealand, which is in the top 30 countries for gross domestic product (GDP) per capita,[93] serves as an example of the lack of progress in achieving methane emission reduction in the livestock sector. More than 95% of the 21 billion litres of milk produced in New Zealand is exported worldwide[94, 95] and one in every three dollars the country earns from goods exports is in the dairy sector.[96] New Zealand is home to Fonterra, the sixth largest dairy company in the world,[97] which handles more than 90% of New Zealand's milk production, equivalent to 7% of the country's GDP.[98]

As a result, the percentage of GHG emissions that originate from methane in the livestock sector is unusually high in New Zealand compared to many other countries. According to the latest reported data for New Zealand, a staggering 42% of emissions (expressed in CO_2 equivalent) come from methane.[99] These methane emissions are mainly produced by livestock (86%), in particular by enteric fermentation in cattle and sheep,[100] and in 2018, these emissions were 8% higher than in 1990.[101] Overall, enteric fermentation and manure management are linked to 38% of New Zealand's gross emissions in CO_2 equivalent,[102] and this has been one of the key drivers of a 26% increase in emissions between 1990 and 2019.[103]

Despite this situation, the country has not implemented effective policies and legislation to reduce methane emissions. In fact, to date, the agricultural sector and the meat and dairy industries in particular have been successful in derailing such efforts.

In 2003, the government proposed the introduction of a moderate tax on all livestock for their methane emissions. It was estimated that this would cost the average farmer about NZ$300 a year (US$175 at the time), and the money was to fund research into methane reduction methods.[104] The farming industry vehemently opposed the idea, and the proposal was subsequently withdrawn.[105]

The New Zealand Emissions Trading Scheme (ETS) began operating in 2008,[106] but the farming sector successfully lobbied to be exempted until 2015. In 2013, another lobbying effort resulted in agriculture being exempted indefinitely.[107] A new Labour government vowed to bring farmers into the ETS by 2025 if the industry has not made sufficient progress by 2022.[108] New Zealand also passed legislation to reduce net emissions of all GHGs to zero by 2050 and reduce biogenic methane emissions to 24–47% below 2017 levels by the same year, with an interim target of 10% below 2017 levels by 2030.[109] This is clearly not in line with the reductions that are required globally by 2030. The act passed with the support of nearly all members of parliament from across different parties.[110] However, it has been criticised for being toothless because it does not include any enforcement mechanisms that would hold anyone to account for not meeting the targets. [111]

New Zealand's dairy industry body, DairyNZ, cautiously supported the bill, stating that the (insufficient) 10% reduction in methane by 2030 'will be very challenging for farmers' but 'is possible to achieve with the right support'. DairyNZ prefers a 2050 target of only 'up to 24%'.[112] DairyNZ argues that options for mitigation include reducing supplementary feed, adjusting stocking rates and using low-protein supplementary feeds. The organisation also highlights potential future technical solutions, such as feed additives, vaccines or genetically selected cows. DairyNZ does not consider voluntary reductions until methane reduction technology matures to be currently feasible, though it does admit that the government's methane reduction requirements could make earlier action inevitable.[113]

Even though Fonterra has dropped a controversial target of doubling its milk production output to 30 billion litres by 2025,[114] it has no plans to reduce production in response to climate change.[115] The company argues that the emission intensity of New Zealand's dairy production is about one-third of the global average.[116] However, it does concede that dairy production accounts for approximately 25% of the country's GHG emissions and that the company must play a leadership role in helping to find methane mitigation solutions.[117] Yet, in its submission on the recent legislative changes, the company 'accepts' only a 10% reduction in biogenic methane in New Zealand by 2030 (compared to the 2017 level), and for 2050, it advocates a target of 'up to 24% less than 2017 emissions'.[118] Fonterra does not commit to any detailed plans or milestones for meeting even the least ambitious targets, let alone to achieve the necessary global methane reduction of 45%.[119] Overall, Fonterra and the wider New Zealand dairy and meat sectors are woefully resistant to taking responsibility for their methane emissions and their abatement.

3.1.3. Upcoming policies

There are, however, some existing or planned policies and targets that are not yet reflected in the NDCs and BRs submitted by national governments to the UNFCCC. For instance, the Netherlands is considering plans that could reduce livestock numbers by 30%. This follows the ruling by a Dutch court that the government was breaking EU law by not doing enough to reduce excess nitrogen emissions from livestock manure and urine in vulnerable natural areas. To ensure compliance with the law, ministers are now considering forcing farmers to sell emissions rights or even their land to the state.[120]

Most recently, in the run-up to COP 26 in November 2021 in Glasgow, the EU and the US released the Global Methane Pledge, which has a goal of 'reducing global methane emissions by at least 30 percent from 2020 levels by 2030 and moving towards using best available inventory methodologies to quantify methane emissions'. Although the pledge does specifically mention agriculture and livestock, its focus seems to be on technical measures and incentives to farmers to reduce methane emissions,[121] rather than the significant reductions that could be achieved through a cut in livestock numbers by switching to healthier, more plant-based diets. Although at the time of writing over 30 countries have expressed support for the pledge, it still lacks specific targets, action plans and milestones. Furthermore, even though the countries that support the pledge have all committed to achieving the goals of the Paris Agreement, the latest scientific assessments call for methane emission reductions of 45%[122] to meet the Paris goals, rather than the 30% specified in the pledge.[A]

BOX 3.2: The EU Methane Strategy

The lack of concrete targets and action plans addressing livestock in the EU's strategy to reduce methane emissions (published in October 2020) represents another missed opportunity.[123] The EU acknowledges that agriculture is a sector with the potential to make significant contributions to reducing methane emissions. Methane emissions in the EU from agriculture have increased in the last five years, and 80.7% of methane emissions originate from enteric fermentation, with 17.4% from manure management and 1.2% from rice production.[124] However, the proposed measures fall short of a concrete methane reduction target for agriculture. In fact, they constitute nothing more than improvements in companies' measurement and reporting of their methane emissions, and accelerated development of the biogas market (involving manure and organic waste). The EU Methane Strategy also claims that the methane emission intensity of meat and dairy has decreased as a result of changes to production methods. The European Commission has promised to develop an inventory of best practices and available technologies to explore and promote wider uptake of innovative mitigating actions in 2021. However, beyond technical approaches, it stops short of proposing any concrete measures to reduce production of and demand for meat and dairy, merely acknowledging 'an expected societal shift to more balanced diets, with less red and processed meat, more fruits, vegetables and plant-based protein sources, in line with the EU Farm to Fork Strategy'.[125] In addition to its weak strategy, the EU is still spending significant amounts of money on promoting meat and dairy, undermining its own rhetoric on cutting emissions. According to a group of NGOs, 'between 2016 and 2020, the European Commission spent 32% of its €776.7-million farm-product promotion budget on advertising campaigns for meat and dairy and 28% on the promotion of mixed "baskets" of products, almost all of which included meat and dairy products'.[126] What is worse, according to Greenpeace calculations, between 18 and 20% of the EU's total annual budget is used to support animal agriculture.[127]

A Our understanding of the Global Methane Pledge is that it translates to a 35% reduction compared to the Global methane assessment's business as usual scenario, thus falling at least 10% short of what is needed to stay within a 1.5°C temperature increase.

3.2. Most NDCs lack concrete measures to drive healthier diets and better food-production systems

FAO analysis from 2016 shows that close to 80% of countries (148 out of 189) that have submitted NDCs include agriculture sectors (crops and livestock) in their national mitigation and adaptation goals.[128] Countries that include agriculture collectively account for 92% of global agricultural GHG emissions. However, countries rarely include quantified sector-specific targets, and lack specific policies and measures both for reducing emissions from farming, and for dealing with other elements of the food system – such as adopting more sustainable diets – which could have a significant impact on CO_2 and methane emissions. Countries also often refer to agricultural sectors in terms of adaptation: 97% of the 131 countries that include agriculture in their adaptation strategies refer to crops and livestock, 88% refer to forests, and 64% refer to fisheries and aquaculture.[129]

Countries could be doing much more with their agricultural industries in terms of mitigation and adaptation to climate change. According to a WWF, UNEP and EAT report, changes to food systems offer great potential to reduce GHG emissions as such systems contribute between 21 and 37% of total anthropogenic emissions annually.[130] Different countries could adopt different strategies to deliver on the 1.5°C target, and developed countries could set ambitious emission reduction targets. On the demand side, the US, EU, China, Brazil, Argentina and Russia have the highest potential for shifting diets, while North America, China and the EU have significant potential to cut food waste. The highest potential to reduce emissions from land use exists in Brazil, China, Indonesia, the EU, India, Russia, Mexico, the US, Australia and Colombia.[131] Current systems are also under significant pressure due to more frequent extreme weather events and other climate change impacts, which also have massive implications for food security and efforts to alleviate poverty (see Box 3.3).

> *Activities such as supporting nature-based solutions, agroecological approaches, including climate-smart, regenerative, conservation agriculture, organic and others, diversifying the food system and adopting healthy and sustainable diets, not only offer potential to reduce emissions but also contribute to food system resilience.*
>
> **WWF, UNEP and EAT**

There are several policies that governments could adopt on both the supply and demand sides to reduce emissions from agriculture. These range from reducing food waste, which is responsible for 8% of current global GHG emissions, to adopting more diversified crop systems and better cropland management techniques.[132] For example, the UK National Food Strategy recommends cutting meat consumption by 30% over the next decade.[133] However, there are currently no policies to drive such consumer behaviour, and according to the Social Market Foundation, per capita meat consumption in the UK has decreased by only 6% since 1974,[134] although a more recent study recorded a decrease of about 17% over the past decade.[135] For the UK to reach its net zero commitment, meat consumption will have to decrease more rapidly over the coming decades, and the government will need to take a more active role to drive this decrease. Chapter 5 outlines the policies that governments should adopt to reduce excessive meat and dairy consumption as part of a general shift towards healthier diets and better food-production systems. As Box 3.3 shows, such a transition is inevitable, as food-production systems are already hitting various environmental constraints, exacerbated by worsening climate change, which are harming the productivity and viability of animal agriculture.

BOX 3.3: Climate change, food security and animal agriculture

According to the IPCC, climate change is already affecting food security through increasing temperatures, changing precipitation patterns and more frequent extreme weather events. Yields of some crops such as maize and wheat in many lower-latitude regions have already suffered reductions, with significantly lower yields in parts of the Mediterranean due to warmer and drier conditions. There have been impacts on food security in drylands, particularly in Africa and high mountain regions of Asia and South America.[136]

Conflict, climate extremes and economic downturns – exacerbated by the Covid-19 pandemic – are now major drivers of food insecurity and malnutrition in the developing world. All of these factors continue to increase in both frequency and intensity, and are occurring more frequently in combination.[137] A set of storms in 2019 affected more than two million people in Zimbabwe and Mozambique. Among those forced to migrate to different regions were farmers who had already abandoned their original lands a decade earlier to try to start new farms in more fertile areas, only to find themselves facing extreme weather events of another kind.[138]

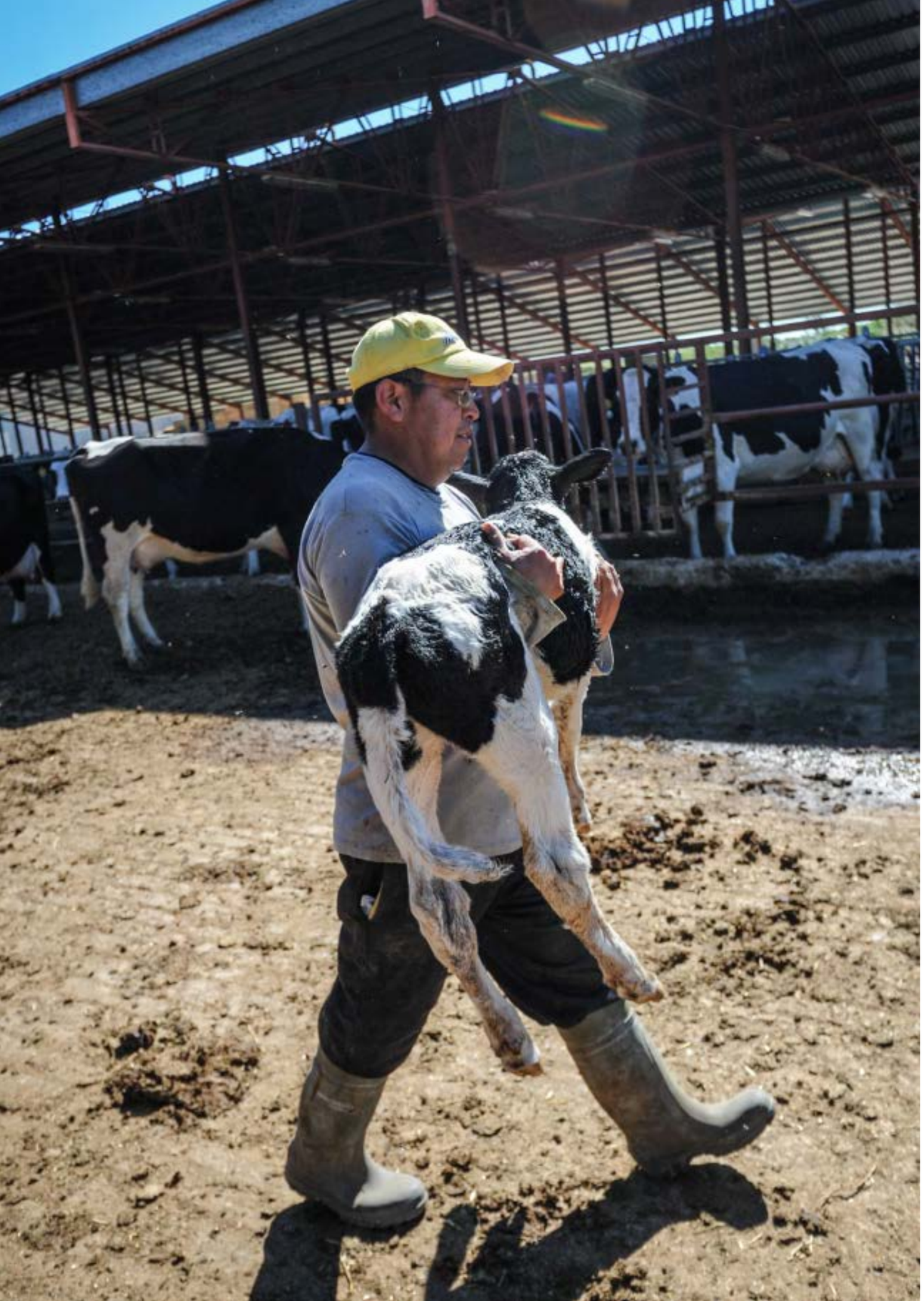
In fact, these issues are starting to have a dramatic impact on farmers everywhere – even in the developed countries of the Global North. Due to drought conditions in 2021, there were reports of farmers in North America having to cull their animals, or sell them off at low prices much earlier than they normally would, after being left unable to feed them.[139] Droughts have hit Californian beef and dairy farmers especially hard. The profitability of their industries – worth US$10 billion a year – was wiped out by steep increases in the cost of feed and the depletion of water sources, and this will likely lead to higher prices for meat and dairy products for consumers.[140] Research has shown that many UK farmers are concerned about the impacts of extreme weather events on their production, but are unable to invest in adapting to the worsening climate crisis because they have to focus on short-term profitability and the survival of their business.[141]

Against this backdrop, three UN agencies – the FAO, United Nations Development Programme (UNDP) and UNEP – issued a report in September 2021 calling for reform of the $540 billion of taxpayer-funded subsidies given to agricultural producers worldwide every year. While these were originally devised to support food security, most of the subsidies – around 87% according to the report – now entail measures that can distort prices and be harmful to nature and health.[142]

Other state subsidies are regularly given to farmers in the EU to compensate for periods of drought. In 2020, partly as a result of the Covid-19 pandemic but also because of prolonged drought – particularly in Romania and Poland where the warmest winter in half a century was followed by the lowest spring rainfall in 30 years – the European Parliament approved support of up to €7,000 per farm. [143] Such ad hoc measures are inevitably short-term solutions that do not address the root of the problem.

According to the authors of the UN report on subsidies, support schemes should be repurposed to influence decisions about what crops to grow and what livestock to raise, based on expected climate impacts, and to improve climate resilience.[144] The report calls for a 'paradigm shift' in these subsidies, arguing that they could improve the economic resilience of farmers if they were 'underpinned by stronger and more effective action on climate change mitigation' as well as on adaptation and ecosystem restoration.

In Germany, a Commission on the Future of Agriculture was created following a series of protests by farmers against environmental measures. It brought together 31 representatives of farmers and consumers plus research institutions and environmentalists, and was compared to a similar 2019 coal commission (on plans for a coal exit). The commission brought about consensus[145] that major changes are necessary because the current food system is not sustainable either economically or ecologically. Commission president Peter Strohschneider said that state subsidies in the agriculture sector would have to become outcome-oriented in order to be properly aligned with societal goals, which would eventually result in a complete phase-out of direct payments to farmers based on land area.



4. The biggest meat and dairy companies' lack of action on methane emissions

The global meat and dairy sectors are big business and, in many cases, vertically integrated and highly concentrated. The worldwide dairy market was estimated to be worth more than US$720 billion in 2020,[146] while the value of the global meat market was assessed as around US$1 trillion in the same year,[147, 148] with the beef market alone valued at US$310 billion.[149] While the level of industrial concentration varies from region to region, the industries tend to be especially concentrated in the Global North. In the US, four large conglomerates control the majority of the beef, pork and poultry markets,[150] while in major dairy-producing countries such as Denmark, the Netherlands and New Zealand, individual 'super co-ops' control the majority of the dairy market.[151] For instance, Danish company Arla alone processes more than 90% of the Danish milk pool and two-thirds of its Swedish equivalent.[152] As market concertation increases, so does the responsibility of the major industry players to address the GHG emissions associated with their supply chains.

To measure the extent to which these industries are committed to reducing GHG emissions in general and methane emissions in particular, Changing Markets analysed and scored the climate policies and actions of ten of the largest meat companies in the world and ten of their largest counterparts in the dairy sector. The ten largest dairy companies were selected using Rabobank rankings.[153] The meat companies were selected from *Food Engineering Magazine*'s *Top 100 food and beverage companies*[154] and other sources that estimate emissions from beef companies specifically.[155] The combined revenue of these corporations amounts to US$520 billion – more than the GDP of countries such as Denmark, Argentina and Singapore.[156]

To carry out this analysis, we developed 11 indicators to score companies out of a maximum of 100 available points across the following categories:

- the existence and the level of ambition of their overall GHG emission targets, including reporting;
- the existence and ambition of specific methane targets, including the reporting of methane emissions, and investments in technology and other measures to reduce them;
- investments in research into abatement options to reduce methane emissions, and research into and commercialisation of plant-based or cultured meat alternatives;

- companies' support for policy measures such as a methane tax and methane reduction measures, and support for policies designed to reduce meat and dairy consumption;
- their zero deforestation commitments.

The available scores for each of the indicators were banded into high, medium and low categories, with the maximum available points adjusted accordingly. The full scoring methodology can be found in the Appendix. Companies were independently assessed by different researchers using publicly available information. The companies have not been contacted for comment, but we encourage them to engage with us, if they believe we have missed anything in the assessment.

4.1. Overall results

The analysis shows a lack of leadership and commitment on the part of the world's largest dairy and meat companies when it comes to reducing methane emissions and contributing to global efforts to avoid the worst impacts of climate change. While some companies have general GHG reduction targets, these mostly do not cover scope 3 emissions and do not specifically account for methane. Furthermore, none of the companies analysed has strong measures in place to specifically address methane emissions and report on the impact of such measures. Nestlé is the only company that provides figures for the predicted impact of its planned methane-cutting activities, but it reports these only as carbon dioxide emissions equivalent, rather than as methane itself. Not measuring and reporting methane emissions specifically could undermine the significant opportunity presented by the short-lived nature of methane as a GHG because companies will not then prioritise methane abatement strategies. In addition, the lack of measurement and reporting of methane emission reductions may leave companies with little understanding of the impact of mitigation efforts and strategies.

Of the companies assessed, Nestlé was the highest-scoring firm, but with an underwhelming total of 34.6%. The only other company that scored slightly above 30% was Danone, while all others scored less than 20% of the available points. Dairy companies performed better than their counterparts from the meat industry. The average score of the ten companies that focus predominantly on dairy products was 13.5%, while meat processors scored an average of 7.4%. Cargill was the highest-scoring meat company, with 15.2%. Companies that are headquartered in Europe outscored those that are located in other regions. The eight European companies included in the analysis averaged 13.2%, the two South American companies 10.4%, the five North American companies 10.2% and the four Asian companies 4.0%. Fonterra was the only company from the Pacific region included – it scored 18.8%. Despite European companies' better overall performance, the only company that did not score any points was the French firm Groupe Bigard, Europe's largest beef processor.[157]

4.2. Overall greenhouse gas emission reporting

Seven of the 20 companies have set science-based targets (i.e. in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement) to reduce emissions.

Blindspot: How lack of action on livestock methane undermines climate targets

To be able to score companies against this indicator, we consulted analysis by the Science Based Target Initiative (SBTI).[158] Nestlé is the only company that has adopted a target consistent with keeping global warming at or below 1.5°C. Fonterra and Dairy Farmers of America have targets classified as 'well below 2°C'. The science-based targets of Arla, Danone, Cargill and Tyson are in line with global warming of 2°C. JBS has made a commitment to science-based targets but has not yet disclosed any more details according to SBTI; therefore no points were awarded.

When it comes to the setting and reporting of targets for emission reductions overall (usually in CO_2 equivalent), it is important that companies include not only direct emissions from owned or controlled sources (scope 1) and those associated with energy purchased (scope 2), but also indirect emissions that occur along their value chains (scope 3). The latter include, for instance, emissions that occur on farms that are owned by independent suppliers but from which companies buy milk or meat for processing. Companies that were found to include scope 3 emissions across all their operations in their reporting and targets include Nestlé, Danone and Dairy Farmers of America.

BOX 4.1: Spotlight on meat and dairy company emissions

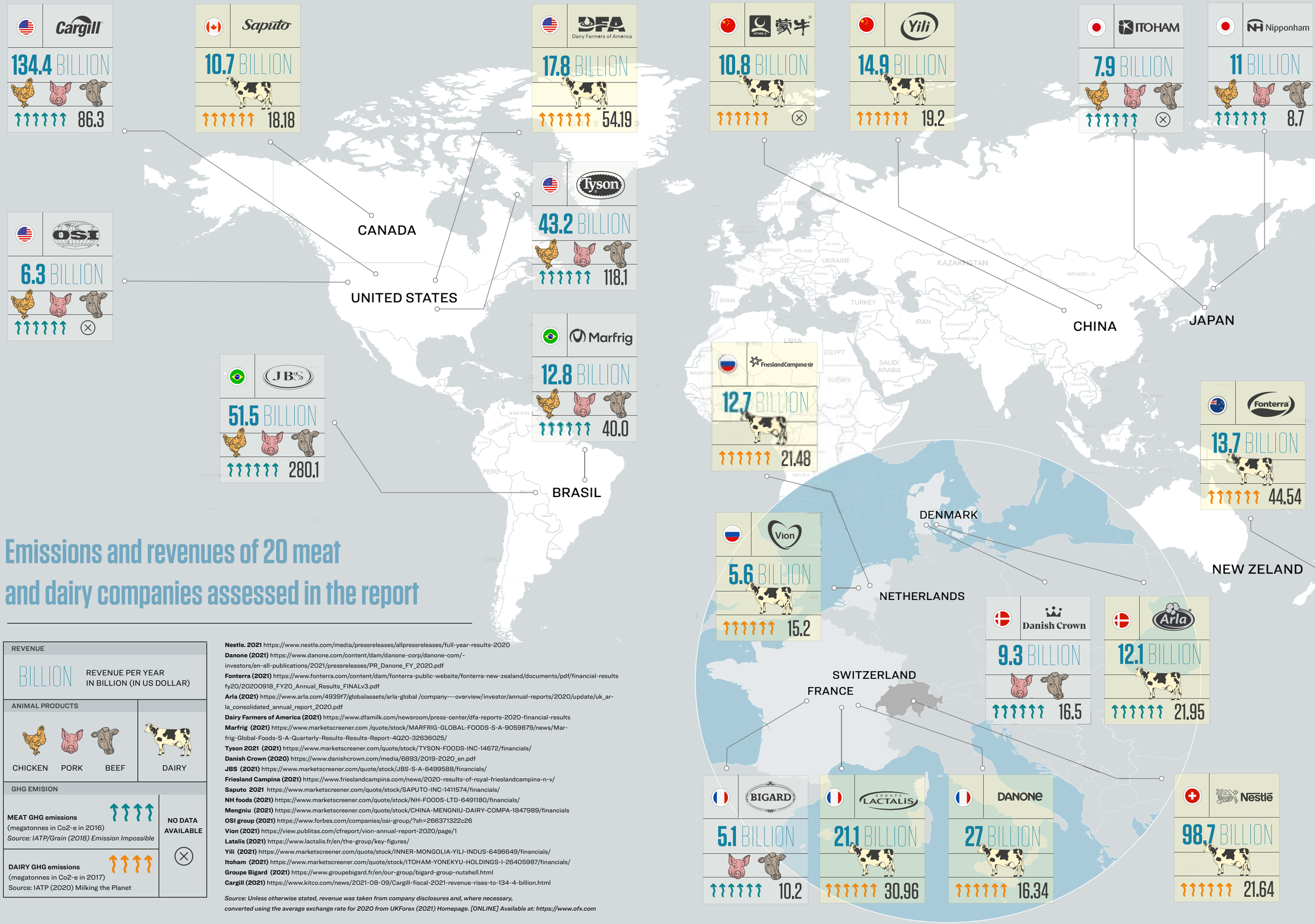
Despite the fact that livestock production is responsible for about 15% of global GHG emissions,[159] companies active in this sector are not receiving as much attention or public scrutiny of their role as any fossil fuel companies. Yet a 2020 report found that 13 of the world's largest dairy corporations emit more GHGs than major polluters such as BHP, the Australia-based mining, oil and gas giant, or ConocoPhillips, the US-based oil company.[160] A previous landmark report from GRAIN and the IATP found that the five biggest meat and dairy producers (JBS, Tyson, Cargill, Dairy Farmers of American and Fonterra) emit more climate-damaging GHGs than oil giants like Exxon or Shell.[161]

The figures become even more striking if the emissions of meat and dairy companies are compared to those of the countries where they are headquartered. Their emissions are so large that they would represent – in several countries – a large percentage of their home country's NDCs if extraterritorial emissions were applied to headquarter countries.

For example, if accounted for this way, both Fonterra in New Zealand and Nestlé in Switzerland would exceed their home country's total emissions target for the coming decade. Similarly, in Denmark, the combined global emissions of Arla and Danish Crown would exceed the country's emissions target.[162] In the Netherlands, just two meat and dairy companies would represent 31% of the country's NDCs. In France, three companies would make up 19%; while four Brazilian companies would represent 26% of their country's emissions.[163]

In spite of meat producers' gigantic emissions footprint, not a single government requires these companies to document their emissions. The sector relies solely on self-reporting.[164] In 2018, GRAIN and IATP concluded that only four companies – NH Foods (Japan), Nestlé (Switzerland), FrieslandCampina (the Netherlands) and Danone (France) – provided complete and credible emissions estimates. All other companies, including major meat processors JBS and Tyson, were found to either make incomplete reports or, in the majority of cases, no reports at all.[165]

This trend to underreport is widespread among food companies: Ceres's 2021 *Food emissions 50 company benchmark*,'[166] which assesses the 50 largest North American food companies, found that only 19 of them disclose scope 3 emissions, and even fewer record agriculture and land use change. This worrying trend is also confirmed by our report.



Emissions and revenues of 20 meat and dairy companies assessed in the report

REVENUE

BILLION — REVENUE PER YEAR IN BILLION (IN US DOLLAR)

ANIMAL PRODUCTS

CHICKEN | PORK | BEEF | DAIRY

GHG EMISION

MEAT GHG emissions
(megatonnes in Co2-e in 2016)
Source: IATP/Grain (2018) Emission Impossible

DAIRY GHG emissions
(megatonnes in Co2-e in 2017)
Source: IATP (2020) Milking the Planet

NO DATA AVAILABLE

Nestle. 2021 https://www.nestle.com/media/pressreleases/allpressreleases/full-year-results-2020
Danone (2021) https://www.danone.com/content/dam/danone-corp/danone-com/-investors/en-all-publications/2021/pressreleases/PR_Danone_FY_2020.pdf
Fonterra (2021) https://www.fonterra.com/content/dam/fonterra-public-website/fonterra-new-zealand/documents/pdf/financial-results fy20/20200918_FY20_Annual_Results_FINALv3.pdf
Arla (2021) https://www.arla.com/4939f7/globalassets/arla-global /company---overview/investor/annual-reports/2020/update/uk_arla_consolidated_annual_report_2020.pdf
Dairy Farmers of America (2021) https://www.dfamilk.com/newsroom/press-center/dfa-reports-2020-financial-results
Marfrig (2021) https://www.marketscreener.com /quote/stock/MARFRIG-GLOBAL-FOODS-S-A-9059879/news/Marfrig-Global-Foods-S-A-Quarterly-Results-Results-Report-4Q20-32636025/
Tyson 2021 (2021) https://www.marketscreener.com/quote/stock/TYSON-FOODS-INC-14672/financials/
Danish Crown (2020) https://www.danishcrown.com/media/6893/2019-2020_en.pdf
JBS (2021) https://www.marketscreener.com/quote/stock/JBS-S-A-6499588/financials/
Friesland Campina (2021) https://www.frieslandcampina.com/news/2020-results-of-royal-frieslandcampina-n-v/
Saputo 2021 https://www.marketscreener.com/quote/stock/SAPUTO-INC-1411574/financials/
NH foods (2021) https://www.marketscreener.com/quote/stock/NH-FOODS-LTD-6491180/financials/
Mengniu (2021) https://www.marketscreener.com/quote/stock/CHINA-MENGNIU-DAIRY-COMPA-1847989/financials
OSI group (2021) https://www.forbes.com/companies/osi-group/?sh=266371322c26
Vion (2021) https://view.publitas.com/cfreport/vion-annual-report-2020/page/1
Latalis (2021) https://www.lactalis.fr/en/the-group/key-figures/
Yili (2021) https://www.marketscreener.com/quote/stock/INNER-MONGOLIA-YILI-INDUS-6496649/financials/
Itoham (2021) https://www.marketscreener.com/quote/stock/ITOHAM-YONEKYU-HOLDINGS-I-26405987/financials/
Groupe Bigard (2021) https://www.groupebigard.fr/en/our-group/bigard-group-nutshell.html
Cargill (2021) https://www.kitco.com/news/2021-08-09/Cargill-fiscal-2021-revenue-rises-to-134-4-billion.html

Source: Unless otherwise stated, revenue was taken from company disclosures and, where necessary, converted using the average exchange rate for 2020 from UKForex (2021) Homepage. [ONLINE] Available at: https://www.ofx.com

4.3. Methane emission targets and reporting

While some of the companies assessed report emissions as CO_2 equivalent and include methane emissions along their supply chain within that, none of the 20 companies provide specific figures for methane emissions. Furthermore, none of the ten largest meat producers and processors or their ten largest counterparts in the dairy sector have meaningful and concrete targets or actions plans to specifically reduce methane emissions in their operations and value chains.

The company that is closest to developing commitments that resemble a methane action plan is Nestlé. Even though the dairy giant does not report methane emissions from enteric fermentation or manure management, under its *Net zero roadmap*, the company predicts that, by 2030, it will reduce overall emissions by 3.2 million tons of CO_2 equivalent by cutting the methane produced by animals during digestion through nutritional change.[167] Yet, although Nestlé says that it will achieve this by supporting 'innovation in rumen modification that reduces emissions, mainly through the inclusion of feed additives and dietary supplements, with the help of dedicated research and development (R&D) support',[168] this does not constitute a detailed action plan or include any milestones or key performance indicators.[169] Even though Nestlé might be slightly ahead of other companies, an action plan that relies on future, not yet commercial methane abatement technologies does not address the urgent need to reduce methane emissions from dairy production and their impact on global heating.

4.4. Support for policy measures and legislation

In addition to the lack of action in their own operations and value chains, none of the companies included in the analysis are publicly supportive of a methane tax on the livestock sector or other public policies to reduce methane emissions. Danone is the only company assessed that indirectly recognises the debate on the issue of herd sizes and production, and that a shift to more sustainable, plant-based diets may be necessary. However, it does not go as far as committing itself to reduce its output of animal products or calling for policies to address these issues.

There is a substantial catalogue of scientific publications that show that a significant reduction in the production and consumption of meat and dairy products is one of the most important measures to keep global heating within acceptable limits. However, none of the companies publicly acknowledge that they will have to transition away from meat and dairy. On the contrary, the livestock industry has actively resisted efforts to introduce new measures designed to reduce meat and dairy consumption (such as efforts to introduce methane tax) in New Zealand, the US and Denmark where some of the largest companies are headquartered.[170, 171]

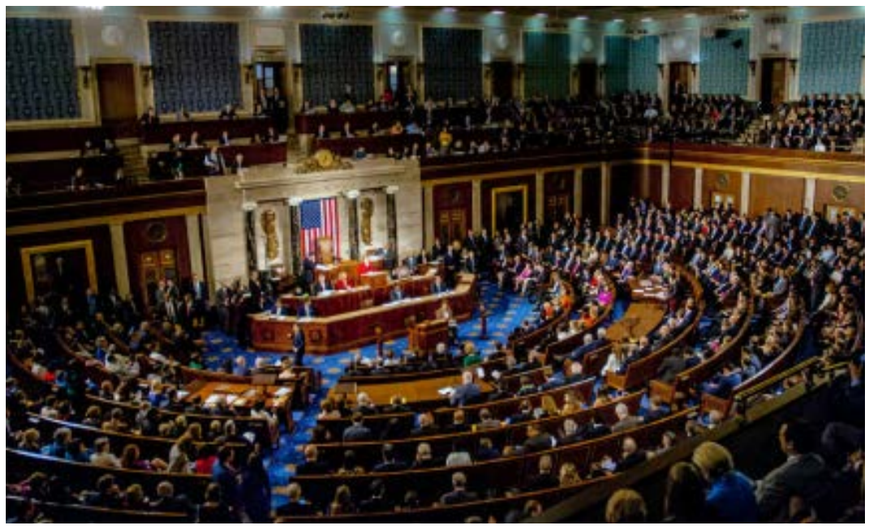


Photo: Washington, DC., USA, January 3, 2017 Members of the 115th congress

Credit: *Shutterstock*

BOX 4.2: Murky tactics to undermine legislation

A recent article by Greenpeace's Unearthed investigations unit found that several meat industry associations – representing leading corporations that account for much of the global meat supply chain – have been pushing for the 2021 UN Food Systems Summit to promote increased meat consumption and intensive livestock farming as a way to 'contribute to the preservation of planetary resources'.[172] This runs counter to the IPCC's findings and its call for a reduction in meat consumption in rich countries.[173]

This comes in the aftermath of a five-month investigation by *DeSmog*, a news site specialising in uncovering climate change disinformation, which has drawn parallels between the tactics of meat and dairy companies and those applied for decades by fossil fuel companies to undermine scientific findings, policies and government legislation to reduce carbon emissions.[174] *DeSmog* found the meat industry appears to be 'nervous about its role in a carbon-constrained future' and that there is mounting evidence of both the climate impacts attributable to the industry's activities and rapid growth in the market share of meat alternatives. Against this background, the sector has instituted a comprehensive PR strategy that seeks to portray itself instead as a climate leader. For example, four companies analysed by *DeSmog* (JBS, Tyson, Vion and Danish Crown) claim to be contributing to the UN's Sustainable Development Goal of achieving zero hunger by 2030.

Such PR campaigns are even more damaging when funded and supported by governments. In 2020, the European Commission faced a backlash from Members of the European Parliament and environmental organisations after it was found that the EU spent €2.4 million to fund the beef lobby group Provacuno's campaign 'Become a beefatarian'.[175] The campaign, which promoted beef consumption, suggested eating beef can contribute to sustainable development.

However, the tide is turning, and campaign groups are increasingly calling out such greenwashing tactics. In June 2021, a group of three non-profit organisations filed a lawsuit against Danish Crown, Europe's biggest pork producer, for misrepresenting its climate footprint in a marketing campaign that claims pork production is 'climate controlled' and the meat is 'more climate friendly than you think'.[176]

4.5. Research into and promotion of alternatives

The assessment area where most companies received some points is their funding of research into methane abatement and investment in alternatives to meat and dairy products.

4.5.1. Investments in meat alternatives

Eighteen of the 20 companies were found to have at least limited investments in plant-based and cultured meat alternatives, although Danone is the only company that includes detailed financial reporting of its combined portfolio of such alternatives. Around 10% of Danone's sales are now generated from plant-based products under brands such as Alpro and WhiteWave.[177] Nestlé owns Europe's second-largest vegetarian brand, Garden Gourmet, and in the US, it owns Sweet Earth Food, which launched the plant-based Awesome Burger.[178] Major meat companies are also investing in plant-based and cultured meat alternatives. OSI Group, a major supplier of beef patties to the global fast-food industry, launched a co-manufacturing partnership with Impossible Foods in 2019.[179] Tyson initially had a stake in Beyond Meat (a plant-based meat company); after selling it, Tyson launched its own plant-based brand, Raised & Rooted.[180] The company is also investing in two lab-based meat companies - Upside Foods (formerly known as Memphis Meats) and Future Meat Technologies.[181] More recently, JBS acquired Dutch plant-based meat company Vivera in April 2021.[182] Finally, Cargill has invested in multiple cell-culture companies including Upside Foods and Aleph Farm.[183]

Company	Investments
Nestlé	Owner of Garden Gourmet and Sweet Earth Foods,[184] investor in Future Meat[185]
DANONE	Owns Alpro, Silk, So Delicious and Follow Your Heart[186]
Cargill	Invested in cultured protein companies Upside Foods (Memphis Meats) and Aleph Farms,[187] and plant-based start-up Bflike[188]
Fonterra	Investment in Motif FoodWorks (ingredients for plant-based meat and dairy products) [189]
Tyson	Investor in Upside Foods and Future Meat Technologies,[190] and owns plant-based Raised & Rooted brand[191]
Marfrig	Owns PlantPlus Foods, a joint venture with ADM[192]
Nipponham	Early investor in IntegriCulture, a Japanese firm developing cell-based foods[193]
Saputo	Owns vegan cheese company Bute Island Foods[194]
Yili	Corporate partner in investment fund and accelerator supporting plant-based start-ups in China[195]
OSI	Involved in co-manufacturing partnership with plant-based protein company Impossible Foods[196]

Table 3: Examples of meat and dairy companies with investments in plant-based or cell-cultured alternatives (non-exhaustive list)

4.5.2. Investments in methane abatement research

Just over half of the companies assessed are meaningfully investing in methane abatement research, but none of them disclose the level of funding they are providing to such research efforts. This lack of reporting makes it difficult to assess the extent of their commitment to funding research that could result in breakthroughs in methane reduction technologies for livestock. Fonterra is investigating the potential of seaweed as a feed additive that could lower methane emissions from enteric fermentation, and the company has trademarked the term Kowbucha after trials using probiotics to reduce methane production in cows showed promising results.[197] Danish Crown is involved in the Future Beef project, which is trying to identify beef cattle bulls that produce cross-breed calves that utilise feed more efficiently, yield more meat and emit less methane.[198] It remains unclear how close these technical measures are to being widely commercially available and scalable, or what impacts they will have on methane emissions when widely applied outside of the lab.

BOX 4.3: 'It's all relative': Spotlight on the Pathways to Dairy Net Zero emissions initiative

The Global Dairy Platform is an interest group representing the dairy sector. The group states that its membership includes '95 leading corporations, companies, associations, scientific bodies and other partners' and corporate members that produce around one-third of the world's milk.[199] The Pathways to Dairy Net Zero initiative was first announced in July 2021, and officially launched in September 2021 at the UN Food Systems Summit and Climate Week.

While it is claimed that six principles underpin the initiative, including greenhouse gas removal, avoidance and adaptation, and measurement and monitoring,[200] the launch documents lack specific reduction targets and action plans. Crucially, the 'mitigation measures' section only refers to reductions in 'emissions intensity' rather than 'absolute emissions.[201] Emission intensity is the level of GHG emissions per unit of economic activity. In livestock production, reducing emission intensity relies on further intensification of production by generating more meat or dairy per animal or using less feed per animal without necessarily reducing the number of animals produced. However, this means that if production grows then so too do total emissions. Agricultural scientists and various NGOs argue that reducing the production and consumption of animal products is key to climate protection[202] and advocate for a reduction in 'absolute' or total emissions across the sector. [203]

This difference is fundamental in the dairy sector where overall milk production is on the rise, growing by 30% between 2005 and 2015, and the global dairy herd has increased by 11% during the same period.[204] The emission intensity reduction pledges made by the Global Dairy Platform are misleading because companies can highlight emissions reductions per litre of milk even if their total emissions continue to rise as a result of increases in milk production and more animals in supply chains.[205] In a joint study with the FAO,[206] the Global Dairy Platform reports that the industry reduced emission intensity by 11% between 2005 and 2015. However, its overall emissions increased by 18% over the same period – as despite reduced emissions per litre of milk produced, companies dramatically increased their production and the number of animals in their supply chains.[207] In the study itself, the Global Dairy Platform acknowledges that 'increased production efficiency is typically associated with a higher level of absolute emissions (unless animal numbers are decreasing)'. The study also recognises that 'absolute emissions reduction will become an imperative as the world moves towards carbon neutrality by 2050', but argues that 'the mitigation potential of the sector is limited because, as a biological process, emissions will always be generated' and concludes that the sector will need to focus on carbon capture and storage instead.[208]

Instead of tackling the growth in emissions from the global dairy sector head-on through concrete targets, timelines and action plans, the initiative only commits 'to create methodologies and tools and pathways for practical action and to highlight progress'.[209] It also says that it will release a study led by Scotland's Rural College and the New Zealand Agricultural Greenhouse Gas Research Centre that will guide the creation of such tools and pathways, but sets no release date for the study.[210]

Even though this initiative is an acknowledgement by the industry that immediate methane emission reductions could hold the key to delaying climate change impacts, its vague language and lack of concrete commitments reveal that this is merely another of the industry's delaying tactics.

METHANE POLICY AND ACTIONS-ASSESSMENT OF 20 TOP DAIRY AND MEAT COMPANIES

(SCORE OUT OF 100)

Company	Science-based targets	CO2 emission cope 3 targets and reporting	Methane reduction target of at least 45% by 2030	Methane emission reduction reporting	Fermentation and manure management targets & reporting	Methane emission action plans	Methane reduction technology investment and research	Investments in plant-based and/or cell culture-based alternatives to meat or dairy	Support for consumption reduction	Support for methane tax	Zero deforestation commitments	TOTAL (0 ⟷ 100)
Nestlé	8	8	—	—	—	5	1.6	4	—	—	8	34.6
DANONE	1.6	8	—	—	—	—	1.6	8	5	2	4	30.2
Fonterra	3.2	4	—	—	—	—	4	4	—	2	1.6	18.8
Cargill	1.6	1.6	—	—	—	—	4	4	—	—	4	15.2
Arla	1.6	4	—	—	—	—	1.6	1.6	2	—	4	14.8
DFA Dairy Farmers of America	3.2	8	—	—	—	—	1.6	—	—	—	—	12.8
Marfrig	—	4	—	—	—	—	1.6	4	—	—	1.6	11.2
Tyson	1.6	4	—	—	—	—	—	4	—	—	1.6	11.2
Danish Crown	—	—	—	—	—	—	4	1.6	—	—	4	9.6
JBS	—	4	—	—	—	—	—	4	—	—	1.6	9.6
FrieslandCampina	—	4	—	—	—	—	1.6	1.6	—	—	1.6	8.8
Saputo	—	4	—	—	—	—	—	4	—	—	—	8.0
Nipponham	—	1.6	—	—	—	—	1.6	4	—	—	—	7.2
蒙牛	—	—	—	—	—	—	—	4	—	—	—	4.0
OSI	—	—	—	—	—	—	—	4	—	—	—	4.0
Vion	—	—	—	—	—	—	—	4	—	—	—	4.0
Groupe Lactalis	—	—	—	—	—	—	1.6	1.6	—	—	—	3.2
Yili	—	1.6	—	—	—	—	—	1.6	—	—	—	3.2
Itoham	—	—	—	—	—	—	—	1.6	—	—	—	1.6
Bigard	—	—	—	—	—	—	—	—	—	—	—	0.0

LEGEND

HIGH

MEDIUM

MEDIUM - LOW

LOW

NONE

Table 4: Methane reporting and action assessment of 20 top dairy and meat processors (total scores out of 100)

credit: *We Animals Media*

5. Conclusions and recommendations

Ensuring that a growing population has access to nutritious and sufficient food – on a planet already affected by rising temperatures and higher incidences of extreme weather events – will require urgent and significant reforms to the way we produce and consume food. The climate emergency requires rapid political action by governments, companies and investors, and the case for change is so compelling on environmental, climate and health grounds that the question is not whether such action will happen, but how quickly and in what way. If we fail to act now, runaway climate change will force us to adapt our eating habits because of collapsing food-production systems, increasing poverty and inequality. If we act quickly, we can manage the transition to healthier and more nature- and climate-friendly diets that are more just and equitable. This is where our choices and opportunities lie.

As this report shows, a rapid reduction in methane emissions is a key opportunity to stay below 1.5°C of global heating and to avoid reaching tipping points in the climate system. Methane is a potent but short-lived gas, and livestock agriculture is the single largest contributor to anthropogenic methane emissions. Political action on methane emissions must thus address this source.

However, our research demonstrates that this is not happening. Our analysis of the climate commitments of the biggest meat- and dairy-producing nations shows that although these countries generally report livestock methane emissions, none have measures in place to reduce them. This is why methane emissions have remained steady or even increased in most countries over recent years. Similarly, although a vast majority of countries include agriculture in their NDCs, they lack concrete measures to transform the way their citizens produce and consume food, such as shifts to healthier and more sustainable diets with less and better meat and dairy. Countries in the Global North, where average meat and dairy consumption significantly exceeds dietary health recommendations, should drive this transition and adopt policies to cut methane emissions, which should be centred around accelerating societal shifts towards healthier and plant-rich diets.

Governments can close the current gap in the Global Methane Pledge, which commits its signatories to a 30% reduction by 2030, by addressing emissions from livestock agriculture through transitions to healthier diets and the promotion of alternative proteins. According to the IPCC and *Global methane assessment* reports, we need at least a 45% reduction by 2030 to stay below 1.5°C of global heating and avoid tipping points. Ahead of COP26, the pledge must be made legally binding and increase in ambition, which must include the full potential methane emissions reductions from agriculture, including through the transition to healthier diets with less and better

meat and dairy, as well as better agricultural production practices. The biggest methane emitters should take the lead and introduce concrete targets and policies in their NDCs to facilitate rapid cuts in methane emissions from livestock agriculture.

Our report also shows that corporations are largely ignoring the problem of methane. While some of the biggest meat and dairy companies make general climate commitments, their lack of action on methane is very concerning. They do not even report methane emissions and lack any concrete measures to reduce them. As meat and dairy are highly concentrated industries with significant proportions of production in the hands of a few multi-billion-dollar corporations, these companies have a huge responsibility to act. But our investigation shows that even the highest-scoring company, Nestlé, falls far short of having a concrete plan to reduce its climate impacts, let alone specifically targeting methane emissions. Companies should adopt action plans that include specific commitments to invest in proven methane mitigation measures, and actively work to substitute their meat and dairy products with plant-based alternatives or reformulate their products to provide healthier options with less meat and dairy.

The main overarching conclusion is that not enough action is being taken, and we need rapid moves by governments and corporations to cut methane emissions as part of a wider shift towards healthier and more sustainable diets and better agricultural production systems. This chapter outlines the main recommendations for policymakers, companies and consumers to embark on this transition. Cutting methane emissions, in line with what the science recommends, must become a central part of our fight against climate change.

5.1. Recommendations for governments

Most governments are already leading the transition to low-carbon energy and transport systems through a variety of policy interventions. They should adopt similar strategies for a transition to *less and better meat and dairy production and consumption*, with specific time-bound targets. Such strategies and targets should be underpinned by broader reform of agricultural subsidies and support measures. According to a recent UN report, 87% of the US$540 billion in total annual agricultural subsidies consist of measures that damage people's health, degrade the environment and drive inequality.[211] In rich countries, most subsidies support unsustainable meat and dairy industries. For example, a 2019 Greenpeace report showed that between 69% (€28.5 billion) and 79% (€32.6 billion) of the EU's Common Agricultural Policy spending went to livestock farms or farms producing fodder for livestock, representing between 18 and 20% of the EU's total annual budget in 2017.[212] The specific design of these subsidies is also driving intensification and the disappearance of smaller farms. Radical reform and repurposing of subsidy structures could become a key driver of more sustainable farming practices, supporting a just transition to agriculture with lower climate impacts, while also ensuring fair income for farmers, especially smallholders.

This rest of this section explores some broad measures that governments should take to drive the transition to less and better meat and dairy.

5.1.1. Supply side measures

In addition to reducing meat and dairy consumption, it is vital to change how meat and dairy products are produced in order to keep global temperatures below 1.5°C.[213] Broadly characterised as 'better meat and dairy',[214] this approach requires livestock systems that are higher welfare, contribute to local ecosystems and biodiversity, reduce damaging inputs such as nitrate fertilisers or purpose-grown feed, and change feeding methods to reduce livestock emissions and land use demands.

5.1.1.1. Drive the reduction of herd sizes, as this is critical to reduce land use change and absolute agricultural emissions

A reduction in the number of animals is of paramount importance for the reduction of livestock emissions in the transition to better meat and dairy. This has recently been recognised by the Dutch government as a means to reduce the emissions of another very potent GHG – nitrogen oxide. The Netherlands, which has one of Europe's largest livestock industries and is one of the biggest meat and dairy exporters, is considering a plan to reduce livestock numbers by 30%.[215] Various organisations recommend a reduction in livestock numbers across the EU as a key component of efforts to fulfil climate targets and other environmental policies.[216, 217]

5.1.1.2. Switch to agroecology, permaculture and other regenerative agricultural practices

Agroecology embraces organic, permaculture and other cultivation techniques, while promoting the preservation of biodiversity and provision of habitats for local wildlife. Transformative agroecology is gaining traction, and a number of studies confirm its benefits. For example, comprehensive modelling by the Institute for Sustainable Development and International Relations (IDDRI) in 2018 assumed widespread adoption of agroecology in Europe, based on a general transition to healthier diets with fewer animal products and more legumes, fruit and vegetables.[218] In this modelling, assumptions included the phase-out of pesticides and synthetic fertilisers, and regeneration of natural grasslands and other habitats, while assumed yields were analogous to the current yields of organic farming. Despite a 35% reduction in production, the study shows that it is possible to provide healthy and diverse food for Europeans, while maintaining export capacity and reducing GHG emissions from the agricultural sector by 40% by 2050.[219] Although reductions in methane emissions were not modelled, keeping livestock within reduced and more sustainable production systems should be treated as a priority by governments as it is also consistent with maintaining food security and even increasing access to healthier and more nutritious foods.

5.1.1.3. Regulate meat and dairy companies to ensure they reduce and report their emissions

Meat and dairy production are highly concentrated industries where a handful of companies make up the vast majority of the markets and produce the most emissions. Governments can drive the necessary transition by obligating meat and dairy companies headquartered within their jurisdictions to establish science-based climate targets, which include scope 3 emissions, and concrete action plans to meet these targets. Such action plans should include concrete measures to reduce livestock production and specific methane emission mitigation measures.

5.1.1.4. Adopt technical methane abatement measures, such as better manure management

The Climate and Clean Air Coalition cites different integrative practices that can reduce methane emissions released from manure including 'excretion, collection, housing and storage, anaerobic digestion, treatment, transport, application, and losses and discharge at any stage along the "manure chain"'.[220] This is discussed further, alongside other production measures, in Box 5.1 below on technological methane abatement strategies. It is important to highlight that according to leaked documents, the Global Methane Pledge includes 'abatement of agricultural emissions through technology innovation as well as incentives and partnerships with farmers'.[221] Some of these strategies are more mature than others, and governments should ensure that they are not relying on unproven or unfeasible solutions and that their chosen measures are in line with broader environmental, health and animal welfare considerations.

BOX 5.1: Technological methane abatement strategies

Currently, technical methane abatement activities in the livestock sector predominantly focus on three areas: feed, animal health and husbandry, and improved manure management. However, there is significant variation in estimates of how much mitigation can be achieved through currently available and developed methods, and also of the associated costs. Different scientific models estimate the methane abatement potential as anything between 4 million tons of methane per year and nearly 42 million tons per year, with associated implementation costs of between US$400 per ton and US$1,000 per ton.[222]

Feed quality, additives and supplements

Methane-reducing feed additives and supplements reduce enteric methane emissions by inhibiting the bacteria in the rumen. It has been shown that changing the fermentation pattern is one of the most effective ways to reduce methane from livestock and can not only reduce GHG emissions but also increase production.[223] However, it must be noted that many of these methods are only in the early stages of development. One study found that the addition of a methane inhibitor to the feed of dairy cows resulted in a 30% reduction in methane emissions without affecting feed intake or milk production.[224] Recent studies have even indicated that certain kinds of algae (Asparagopsis) have the potential to reduce ruminant enteric methane by up to 99% in the laboratory.[225] In 2019, a trial with dairy cows whose feed was supplemented with the algae showed a 67% reduction in methane.[226] When used with steers for meat production, the supplements resulted in methane reductions of up to 80%. The conversion of feed to body weight also increased, and consumers did not notice a difference in the quality of the meat.[227] Farms that grow and harvest Asparagopsis are already being developed on the coasts of Australia, Hawaii and North America.[228]

In September 2021, Dutch company Royal DSM received regulatory approval in Brazil and Chile for the commercialisation of a feed additive that the company claims can reduce enteric methane emissions from dairy cows by 30% and from beef cows by up to 90%.[229] Each cow requires about one-quarter of a teaspoon daily. The additive has been in development for more than ten years, and the company is also working to obtain approval in other jurisdictions.[230]

Among the more unusual and publicly debated proposed solutions that are in development is a mask developed by UK start-up Zelp that claims to be able to reduce methane emissions by more than 50% by capturing and oxidising emissions into CO_2 before they are released into the atmosphere. Part of the funding for this project comes from the global commodity trader and beef processor Cargill.[231] It expects to make such masks available to European farmers as of 2022 through an annual subscription, which has not yet been decided, but could be around US$80.[232] The technology has yet to be independently tested for its effectiveness and impact on animal behaviour.[233]

A certain amount of methane abatement can be achieved through low-tech solutions such as improved grazing management and changing forage, for instance to corn and legumes.[234] Less novel or technological solutions, such as tannins in white clover, can also reduce methane emissions but at a relatively low rate of around 12%.[235]

Improving animal health and husbandry

Improvements in animal health and associated increases in productivity have also been identified as a way to reduce methane emissions. Such approaches could include education, the use of veterinary services, proactive herd health planning, and the availability of efficient animal health diagnostic tools and therapeutics. However, access to such tools and services varies across major beef and dairy production areas and indeed the world.[236] There is also evidence that crossbreeding can reduce dairy-related methane emissions by up to 6%. Much of this is achieved by breeding cows to live longer, resulting in fewer animals being required for production.[237]

Improving manure management

Reducing methane from manure is another area that is comparatively advanced. Current best practices include covering outdoor slurry storage facilities, shortening indoor storage times, frequent and complete removal of slurry from buildings, lowering the slurry temperature, and filtration of the air from livestock sheds and storage facilities.[238] Experimental research also suggests that additives that make stored manure more acidic can, in theory, lead to methane reductions of more than 85%.[239] The use of anaerobic digesters can break down organic wastes using bacteria, and the methane produced can be collected and combusted to generate electricity.

5.1.2. Demand side measures

While technological solutions to combatting methane emissions in the livestock industry, such as novel animal feed additives, are welcome, the ambitious methane reductions necessary to meet the Paris Agreement targets cannot be achieved without scaling down production.[240] Between 2013 and 2018, there was an 8% increase in the total volume of meat sold globally.[241] Global meat consumption is predicted to rise by more than 1% again this year,[242] and on the current trajectory, associated livestock production may take 49% of the GHG emissions budget by 2030 allowable under the 1.5°C target.[243, 244] For this reason, it is crucial to focus attention on meat and dairy consumption reduction initiatives.[245, 246]

As in other sectors where a transition to low-carbon options is under way, it is vital that policymakers support the creation of a sustainable market for alternatives. According to the Social Market Foundation, 'changing the "choice architecture" for consumers' is an area that governments should address by supporting the alternative protein sector.[247] At the heart of the government strategies shaping food environments should be desired outcomes to make healthier and plant-rich foods more accessible, affordable and convenient – with special attention on access for more vulnerable groups. Governments should adopt national strategies and education campaigns in combination with other measures, outlined below.

5.1.2.1. Incorporate sustainability and promoting transition to diets aligned with national dietary health guidelines

Several countries around the world have started to incorporate elements of sustainability into their dietary health guidelines. Sweden and the Netherlands both recommend limiting overall meat consumption to 500g per week. Sweden, the Netherlands and Germany also provide quantified guidance on dairy products.[248] Denmark serves as an interesting example, as the government guidelines published in 2021 emphasise climate-friendly eating, recommending the consumption of plant-rich food with less meat and more vegetables and legumes, including meat-free days.[249] Dietary guidelines have significant potential 'to guide institutions, both public and private, in setting the parameters for food environments, which in turn influence what food we buy and eat'.[250] However, a significant discrepancy exists between what such guidelines usually recommend and what people actually eat – especially when it comes to recommended meat intake. For this to change, countries must adopt strategies to ensure the implementation of these guidelines.

5.1.2.2. Create positive knock-on effects through public procurement aligned with healthy and sustainable dietary guidelines

Public procurement can be instrumental in shaping demand and demonstrating government leadership on food system emissions. The most effective immediate action on sustainable diets should include legally binding standards for public food procurement across all public institutions. This will require duly weighted consideration of requirements including nutritional content, environmental sustainability and animal welfare criteria, and enforcement of these standards. Procurement has a huge role to play in normalising plant-rich food,[251] which is an important component of strategies to decrease meat consumption. Schools, hospitals, prisons and public canteens can choose between meat-free days (as in 40% of Swedish municipalities),[252] increasing vegetable portions in recipes, adding more plant-based options or offering a plant-based meal as a daily special, all of which would help to normalise plant-rich options, highlight the shift in eating habits and increase support for further policy measures.

5.1.2.3. Impose national targets for reductions in meat sales in supermarkets

In many countries, retailers and food service companies are the gatekeepers for the consumption and promotion of meat and dairy products. For example, the UK National Food Strategy published in July 2021 namechecks supermarkets and fast-food chains as the key actors.[253] National targets for reductions in meat sales would incentivise supermarkets to normalise and promote plant-based diets, and reduce meat consumption, without waiting for individuals to change their own consumption habits. These targets could be supported by mandatory reporting for large food businesses on sales of protein by type and origin.[254] The effects of such measures would also trickle down to food producers, who would be encouraged to offer more plant-based products, healthier types of protein and reformulated products.

5.1.2.4. Promote R&D of plant-based foods and other meat analogues

According to the Social Market Foundation, '[p]ublic investment can help ensure industry advances – from cell biology research through to scaling up production and infrastructure – are shared widely amongst a range of firms'.[255] To achieve this, the foundation recommends the publicly funded creation of research clusters and innovation programmes. Ownership of technologies and patents is key to creating a competitive alternative protein market, can accelerate commercialisation, and could potentially also help with public acceptance. In the Danish government's recently adopted climate agreement for food and agriculture, DKK1.25 billion (€168 million) in funding is dedicated to advancing plant-based foods, and the government has also committed to creating a national action plan with clear targets for production and sales.[256]

BOX 5.2: The growth of plant-based alternatives and other meat analogues

According to Euromonitor, the global meat substitutes sector was worth $20.7 billion in 2020 and is expected to rise to $23.2 billion by 2024.[257] Alternatives to meat can broadly be categorised into plant-based (products derived from plant protein, such as peas), fermented (products derived from fermentation) and cultured (products grown from animal cells). The plant-based food sector is experiencing rapid expansion, with retail sales of plant-based meat alternatives reaching $7 billion in 2020 — an increase of 27% from 2019.[258] By contrast, the cultivated meat market is still in its early stages, with the first lab-grown meat sold in a Singapore restaurant in December 2020: a trio of sample chicken dishes costing US$23.[259] Innovation in meat alternatives is increasingly driven by the power of cutting-edge computing and biotechnology, which – applied to food technology – could lead to a rapid increase in product quality and a faster-than-expected fall in product prices.[260]

Market trends also show that there is a huge appetite for plant-based foods. In 2019, 21% of people globally were trying to limit their meat intake, while 3% were vegan and 6% vegetarian.[261] Some of these trends have been accelerated by the global pandemic and are also being driven by more general health and environmental concerns.[262] While such diets still represent a niche in a global context, compared to the overall growth in meat consumption, it is nonetheless an important market that could be rapidly grown through innovation, leading to increasingly competitive pricing and wider availability of alternative protein products. What is more, these trends could be accelerated through support from public policies that address climate, environmental and health concerns.

5.1.3. Fiscal measures

Fiscal measures are widely used by governments to drive transitions towards environmentally-friendlier and healthier options.[263] These range from sugar, alcohol and fuel taxes to tax exemptions for environmentally beneficial measures (such as insulation of houses, or greener products). Governments should consider introducing fiscal measures to drive down their citizens' consumption of meat and dairy products. These measures should combine financial disincentives (such as taxes on specific products) with fiscal incentives (rewards with a monetary value, such as subsidies or vouchers) to ensure that lower-income households do not suffer disproportionately negative impacts. Governments could phase in such measures, and/or adopt a 'worse-first' approach,[264] for example introducing taxes on products deriving from high methane emitters as a priority (either methane-specific or a wider carbon tax). Such measures would normally need to be part of a broader range of policies that aim to reduce overall consumption,[265] including public education campaigns and public procurement policies. In addition, governments could use any tax revenues generated to offset effects[266] (e.g. redirecting revenues to farmers to support necessary transitions in agriculture) or boost alternatives (e.g. making nutritious plant-based food more widely available and affordable). Producing more leguminous crops, especially as part of a solid crop rotation, can contribute to climate mitigation and adaptation by reducing water and fertiliser use, and increasing soil fertility and yield. Legumes are also a very healthy source of protein and could be promoted as the core of a healthy diet.

5.2. Recommendations for companies

Our report shows that responsibility for the lion's share of methane emissions is not in the hands of individual farmers, but ultimately lands at the door of a small number of multinational mega-corporations. These vast organisations certainly have the resources to drive the transition towards less and better meat and dairy, including significant measures to reduce emissions. The analysis shows that these companies have not yet embarked on this journey, and as time is running out, they need to expedite their actions. As in other sectors, it is unlikely that voluntary action will be sufficient; therefore it is important that governments take the lead through regulations to create a level playing field, as suggested in the previous section.

5.2.1. Company actions

5.2.1.1. Set science-based emissions reduction targets in line with 1.5°C of global heating, which should include scope 3 emissions from their suppliers

As demonstrated, most companies assessed in this report do not have emissions targets or reporting in place. As a priority, companies should set such science-based targets in line with a 1.5°C scenario, and develop concrete action plans to reduce emissions from their operations and supply chains. Implementation should include separate reporting requirements for CO_2 and methane emissions, including scope 3 emissions.

5.2.1.2. Establish separate methane reduction targets and concrete action plans to meet them

Companies should set specific methane reduction targets with concrete action plans to achieve them. They should concentrate on reducing their absolute emissions, rather than emission intensity, which will involve drastic cuts to their production and the number of animals in their supply chains. As part of this transition, companies should provide support to farmers and be realistic about the viability, effectiveness and commercial availability of the various proposed remedies – to prevent greenwashing and overreliance on unproven technologies or unfeasible solutions. For transparency, companies should also report how much they are investing in R&D and pilot projects for methane and CO_2 abatement. They should pay special attention to the wider sustainability and animal welfare considerations associated with potential solutions in order to prevent negative impacts.

5.2.1.3. Invest in alternative protein production and establish a specific plan to reduce sales of conventional meat and dairy

Our analysis shows that most companies have some investments in plant-based or cultured alternatives to meat and dairy. However, it is unclear whether these are intended only to diversify sales or are part of a proper climate strategy and a wider shift away from animal proteins. To maximise the environmental and health benefits, companies should develop concrete plans and milestones to increase sales of their healthy alternative protein products.

5.2.1.4. Support progressive climate, environmental and health policies

Meat and dairy giants and other food corporations, such as retailers, are politically powerful actors that often play a negative role in public debates on environmental and health reforms. It is of crucial importance that these companies – and the professional associations that represent them – express public support for policies that will drive a shift to healthier and more environmentally sustainable diets, rather than lobby against the implementation of such initiatives. It is also important that these companies stand behind proposed efforts to regulate methane emissions, i.e. methane taxes and methane reduction targets. Proposed reductions should be ambitious and in line with what the climate science says is necessary.

BOX 5.3: Who is funding industrial agriculture?[B]

Between 2015 and 2020, global meat and dairy companies received over $478 billion in backing from over 2,500 investment firms, banks and pension funds headquartered around the globe. High street banks such as Barclays and HSBC provide billions in loans to firms selling chlorinated chicken. Pension, savings and investment companies such as Prudential, Standard Life Aberdeen and Legal & General invest in companies such as JBS and Marfrig, linked again and again to deforestation.[267]

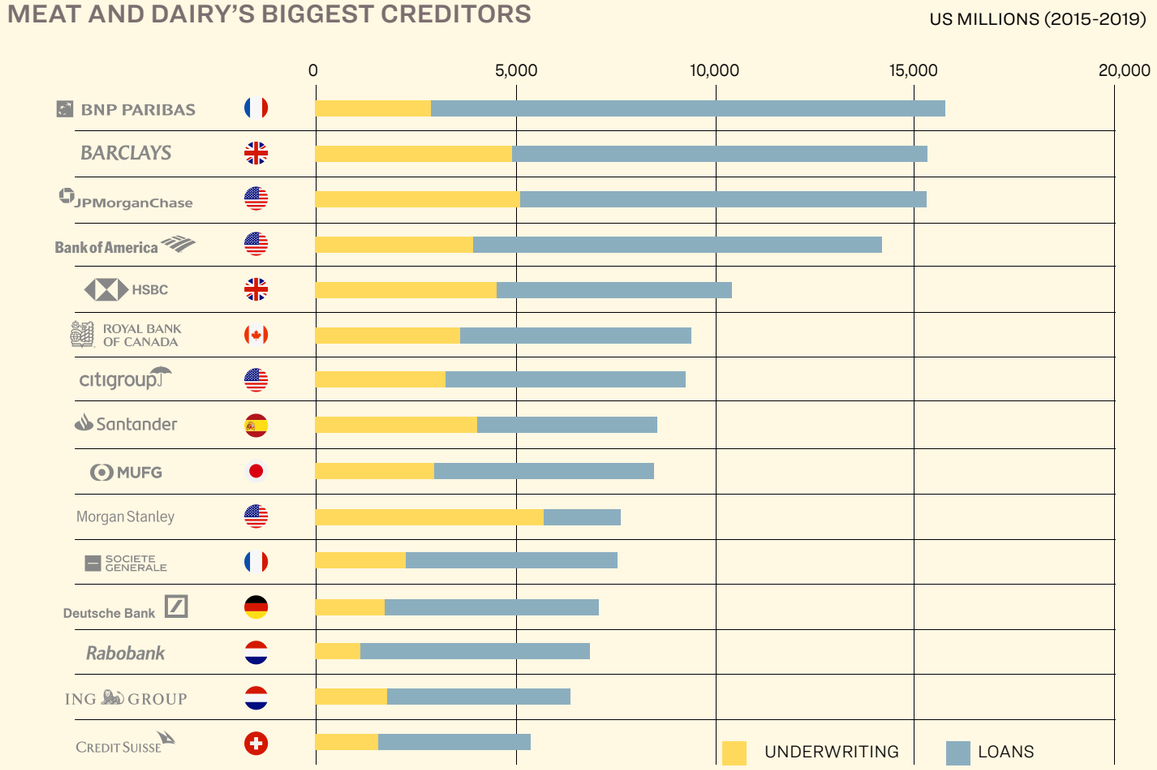
From farm to fork, the food system generates 25–30% of global GHG emissions,[268] but while capital markets are starting to wake up to the risks of climate change and taking steps to tackle emissions from fossil fuels, emissions from food and agriculture remain largely unaddressed.

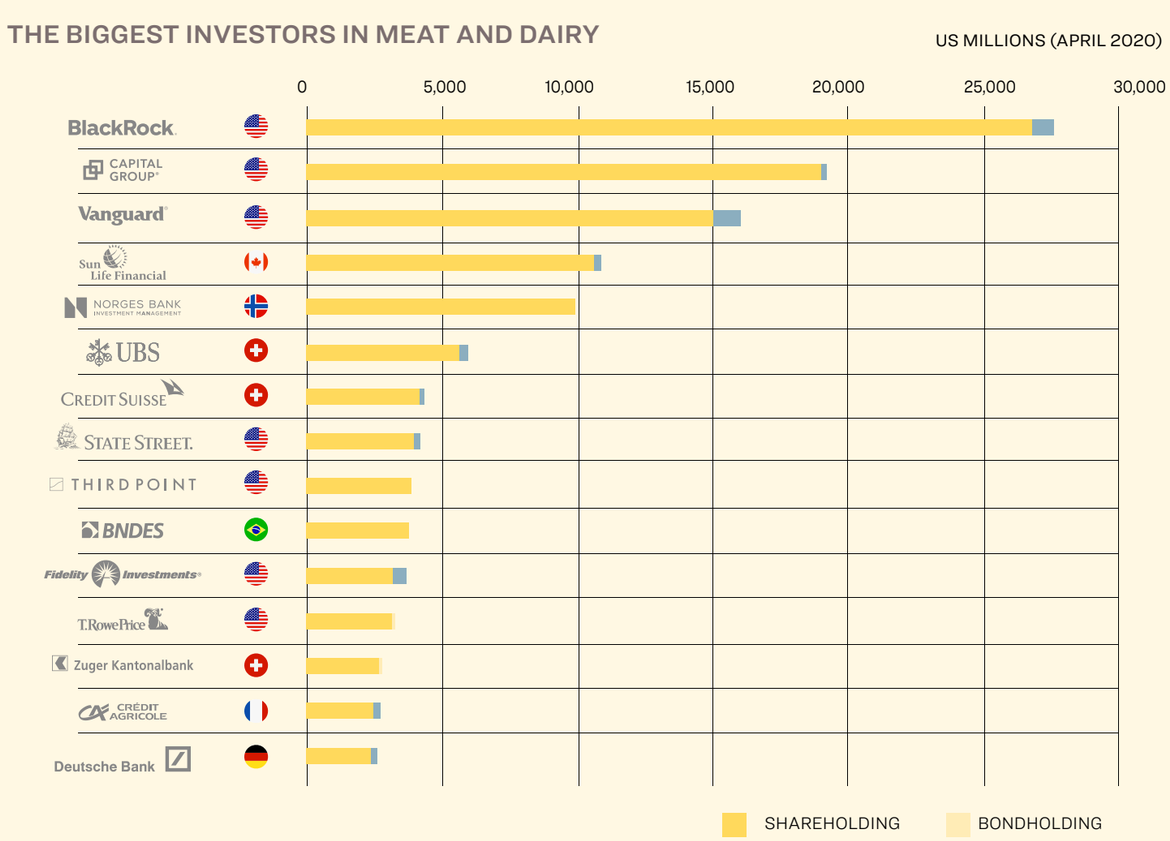
Feedback's research shows that in April 2020, 3,000 investors backed the world's 35 largest meat and dairy corporations (which together emit more than economies like Germany, Canada or the UK) to the tune of $228 billion, including $167 billion from over 200 banks.[269] Banks headquartered in the US, France and the UK provide over half (51%) of the credit used by these meat and dairy giants, totalling $91.8 billion in loans and $45.9 billion in underwriting over the past five years, with BNP Paribas, Barclays and JP Morgan Chase the largest creditors.

Banks and investors that promote their sustainability policies, proudly advertising their commitments to end deforestation and combat climate change, are deeply implicated in the financial support underpinning the global livestock industry. The most common request among investors when 'engaging with companies' is not for concrete emission reductions or to stop driving deforestation but for 'more reporting'.[270]

Occasionally, the hypocrisy is even more blatant – banks such as HSBC appear to be funding Brazilian beef production, linked to deforestation and forest fires, despite their own ethical investment policies forbidding them to do so. The investment firm Marshall Wace, which highlights its support for local communities during the Covid-19 pandemic on the front page of its website, continues to invest in Tyson Foods, a company that has come under particular scrutiny for its conduct during the crisis.[271, 272] Meanwhile, over the past five years, Rabobank – which 'focuses explicitly on sustainability in livestock farming' – has loaned $5.7 billion to meat and dairy companies with a combined emissions footprint of 727 million tons of CO_2 equivalent per year, including WH Group, which scored 0 out of 100 on Global Canopy's influential Forest 500 sustainability ranking.[273]

B This research was first published in Feedback (2020) Butchering the planet: The big-name financiers bankrolling livestock corporations and climate change. [ONLINE] Available at: https://feedbackglobal.org/wp-content/uploads/2020/07/FeedbackReport-ButcheringPlanet-Jul20-HighRes.pdf. Feedback takes the greatest possible care in collecting information and drafting publications but cannot guarantee that this report is complete. It relies heavily on secondary sources reproduced here in good faith. Feedback assumes no responsibility for errors in the sources used and makes no claim that any named financial institution knowingly finances any wrongdoing or is guilty of any breach in policy, or that any named business committed any wrongdoing.





5.3. Recommendations for consumers

In terms of individual actions, reducing one's consumption of meat and dairy is one of the more effective climate decisions one can make. Going vegan for two-thirds of meals cuts emissions by 60%, while absolute veganism cuts emissions by 85%.[274] However, even reducing meat consumption in line with dietary health guidelines will bring major health and environmental benefits and, if many consumers adopt such behaviour, can send an important signal to governments to adopt progressive food and farming policies. Recommended actions for consumers include:

- Reduce personal consumption of meat and dairy products, shifting to consume less and better, i.e. products that meet higher environmental and animal welfare standards;
- Put pressure on retailers and consumer goods companies to offer more plant-based options and to reduce sales of meat and dairy;
- Support small agroecological farms through veg box schemes as these are associated with increased vegetable consumption, higher productivity, lower waste, and reduced emissions and environmental impact.

6. Annex: Company assessment methodology

Indicator	Guidance	Max. points
1. Company has adopted a science-based target for GHG emission reductions and is being monitored on https://sciencebasedtargets.org/	**HIGH:** Company has adopted 1.5°C target **MEDIUM-HIGH**: Company has adopted 1.5°C to well below 2°C target **MEDIUM-LOW:** Company has adopteyd well below 2°C target **LOW:** Company has adopted 2°C target **NONE:** Company has not adopted a science-based target	**8**
2. Company targets and reporting include CO_2 emission equivalent, including scope 3 emissions, across all operations	**HIGH:** Company includes GHG scope 3 emissions in targets and reporting, and across all company activities and suppliers **MEDIUM**: Company includes scope 3 emissions in either targets or reporting, but only for some of its business operations **LOW:** Company reports some scope 3 emissions but has set no targets **NONE:** Company does not have targets and reporting for scope 3 emissions	**8**
3. Company has a specific methane reduction target of at least 45% by 2030	**HIGH:** Company has at least a 45% reduction target (absolute figures) by 2030 **MEDIUM-HIGH:** Company has an absolute target of at least 30% and less than 45% by 2030 **MEDIUM-LOW:** Company has an absolute target of at least 15% and less than 30% by 2030 **LOW:** Company has an intensity or absolute target of at least 5% and less than 15% by 2030 **NONE:** Company has no target or target of less than 5% reduction in methane by 2030	**10**
4. Company reports progress publicly and annually on methane emissions or reductions achieved for both intensity and absolute emissions (specifically for methane rather than just CO_2 equivalent)	**HIGH**: Company reports annually on methane reduction in absolute figures **MEDIUM:** Company reports absolute methane reduction figures less than annually **LOW**: Company reports methane emissions only in intensity figures **NONE**: Company does not report methane emissions	**10**
5. Methane-specific commitments and reporting include specific targets for methane emissions from enteric fermentation and manure management (absolute reduction rather than intensity reduction)	**HIGH:** Company has methane-specific targets for enteric fermentation (including, for instance, feed quality and herd health management) and manure management, including for suppliers (scope 3) **MEDIUM**: Company has methane-specific targets only for enteric fermentation or enteric fermentation and manure management, but not for its supplier herd (scope 3); or company has targets in key sectors, but they relate to CO_2 equivalent rather than methane specifically **LOW:** Company has specific methane reduction targets only for manure management **NONE:** Company has no specific methane reduction targets	**10**
6. Company has a detailed action plan for meeting its methane reduction targets, based on currently available and implementable technology; the plan describes a clear path for achieving its reduction commitment according to defined milestones	**HIGH:** Company has an action plan that details methane emission reduction with reference to specific activities **MEDIUM**: Company has an action plan that includes at least some at-market solutions **LOW:** Company has an action plan and targets but relies entirely on solutions not yet commercialised **NONE**: Company does not have a detailed action plan or has not set methane reduction target	**10**
7. Company sponsors research into technical solutions for methane abatement, and reports on its investments in these or is actively involved in the application of methane reduction activities (excluding biogas production)	**HIGH**: Company sponsors research and reports the value of its investments in technical solutions and/or R&D as a revenue percentage or absolute figures; or company is involved in significant methane abatement projects and provides figures for these **MEDIUM:** Company is involved in significant research or projects in methane abatement solutions but does not report the value of the investments; or company is applying methane reduction strategies **LOW:** Company investments in research appear minor (i.e. only one or two minor projects are reported) and no R&D values are reported **NONE:** Company is not involved in funding methane abatement projects	**8**
8. Company is involved in projects or investments that focus on plant-based and/or cell-culture-based alternatives to meat or dairy products	**HIGH:** Company has significant investments or is involved in plant-based projects and reports the value of the investments or the sales generated (investments or sales amount to at least 5% of turnover/sales that year, or projects and research amount to more than 10% of reported R&D budget) **MEDIUM:** Company has significant investments or is involved in plant-based or cell-culture projects but does not report the value of the investments or the sales generated, or investments or R&D figures are below those indicated in the category above **LOW:** Company has small investments in plant-based or cell-culture alternatives such as converting specific products of a brand only **NONE:** Company is not involved in plant-based or cell-culture alternatives	**8**
9. Company publicly supports the reduction of meat and/or dairy consumption	**HIGH:** Company recognises that a reduction in meat production and consumption is necessary to meet GHG reduction targets **MEDIUM:** Company has made statements indirectly supporting production reduction **LOW:** Company publicly recognises that there is a debate about the reduction in herd numbers or meat and dairy production volumes related to global warming **NONE:** Company has not made statements supporting consumption reduction	**10**
10. Company supports a methane tax that includes the livestock sector or supports broad government policies to regulate methane reduction	**HIGH:** Company supports a methane tax for the livestock industry without delay **MEDIUM:** Company only supports a methane tax for the livestock industry after 2025 or specifies no date **LOW:** Company only supports broad policies or legislation for methane reduction in the livestock sector **NONE:** Company does not support specific methane reduction policies affecting the corporate sector in the livestock industry	**10**
11. Company has a zero deforestation commitment that includes the feed used in its supply chain, and has action plans and independent verification of its deforestation-free supply chains	**HIGH:** Company has a gross zero deforestation policy (i.e. it does not rely on offsetting) that includes all-natural forests and all of its suppliers and can demonstrate that this is on a pathway to successful implementation (e.g. through monitoring reports or full traceability to production unit) and is third-party verified **MEDIUM:** Company has a gross zero deforestation policy that includes all-natural forests and all of its suppliers but is not monitored or verified; or company has a fully implemented net zero deforestation policy **LOW:** Company has a net zero deforestation policy that is not monitored or third-party verified, or the commitment does not include all-natural forests, or company has commodity-based policies for at least soy or palm oil; or company has a history of repeatedly not meeting commitments **NONE:** Company does not have a zero deforestation policy	**8**

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Changing Markets
FOUNDATION
FEED BACK
From 2025
Feedback is
FOODRISE
This document uses
our old branding
MIGHTY
EARTH