A sugarcane plantation in Mato Grosso do Sul, Brazil, 2013. Photo: Tatiana Cardeal/Oxfam

FEEDING CLIMATE CHANGE

What the Paris Agreement means for food and beverage companies

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The Paris Agreement marked a major breakthrough in support for climate action from many parts of the business community, including from key actors in the food and beverage sector. But despite significant progress, much work remains both to cut greenhouse gas emissions and to support the millions of people already hit by climate change.

As one of the sectors that is at highest risk of being affected by climate change, responsible for a giant emissions footprint and reliant on millions of small-scale farmers and agricultural workers in the regions most vulnerable to climate change, the food and beverage sector should lead the next generation of post-Paris corporate climate commitments.

This paper presents new data commissioned from the research consultancy CE Delft on the greenhouse gas emissions footprints and water scarcity footprints of major food commodities. The data demonstrate the vital role the food and beverage industry can and must play in turning the Paris Agreement into a springboard for the stronger climate action needed.

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INTRODUCTION

The Paris Agreement marked a major breakthrough in support for climate action from many parts of the business community. Hundreds of CEOs pledged to reduce their carbon footprint – 115 companies committed to aligning their targets to keep the global temperature increase below 2°C, and 52 companies promised to strive for 100 percent renewable energy.[1]

For the first time, the food and beverage industry collectively added its support. The CEOs of 14 leading companies – including Ben & Jerry's, Coca-Cola, Dannon USA, General Mills, Kellogg, Mars, Nestlé USA, PepsiCo and Unilever – signed an open letter in *The Washington Post* and the *Financial Times* ahead of the Paris conference, pledging to accelerate business action on climate change and urging governments to do the same by forging a robust international agreement.[2]

Undoubtedly, this shift in private sector positioning helped open new political space for governments to strike a deal in Paris. But what does the resulting agreement mean for the private sector, not least the food and beverage industry, which rightly spoke out about the 'climate challenges that face our businesses'?[3]

'Climate change is bad for farmers and for agriculture. Drought, flooding and hotter growing conditions threaten the world's food supply and contribute to food insecurity… Now is the time to meaningfully address the reality of climate change ... We are ready to meet the climate challenges that face our businesses.'

Open letter from CEOs of 14 food and beverage companies ahead of the Paris climate change conference

What does the Paris Agreement on mitigation mean for food and beverage companies?

On mitigation, the collective efforts announced by companies combined with the plans submitted by governments – Intended Nationally Determined Contributions (INDCs), 80 percent of which address agricultural mitigation[4] – are unprecedented in scope and scale, covering 189 countries and 98.8 percent of global emissions.[5] But the pledges are still nowhere near enough to avoid disastrous climate change.

Even with full implementation, the planet is still headed for warming of 2.7°C to 3°C and the food system will see some of the most significant shocks. Food and beverage company supply chains will be disrupted, hitting their consumers and threatening the livelihoods of millions of people in developing countries who produce their raw ingredients.

Central to the Paris legacy is the strengthened temperature target in the new agreement – to keep warming 'well below 2°C, and to pursue efforts to limit the temperature increase to 1.5°C'[6] – but this will only remain within reach with significant additional emissions cuts over the next decade. Significant reductions will be needed from the global food system, which accounts for around 25 percent of global emissions.[7]

For the food and beverage industry, this means planning for deeper emissions cuts, especially in the agricultural supply chains that are responsible for the bulk of their greenhouse gas (GHG) emissions.

In 2014, Oxfam exposed the significant emissions generated by the operations and supply chains of the 10 biggest food and beverage companies (the 'Big 10'), which equal the annual emissions of all Scandinavian countries combined.[8] Moreover, many of these emissions

can be attributed to highly potent 'super pollutants' like methane, which accelerate the severity of climate change in the short term.

New research presented in this paper – commissioned by Oxfam and prepared by CE Delft[9] – uncovers the sheer scale of the GHG emissions footprint of key food commodities. If the top five highest-emitting food commodities (rice, soy bean, maize, palm oil and wheat) were a country, they would be the third highest emitter on the planet – only surpassed by China and the USA.[10]

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In recent years, a number of food and beverage companies have made important strides in seeking to eliminate deforestation from their palm oil supply chains. One of the clear messages from this research is that the sector must redouble efforts to reduce supply chain emissions from palm oil, but also pay far greater attention to tackling the huge emissions associated with other commodities that they source.

As the data in this paper makes clear, rice, soybean, maize and wheat all have higher GHG footprints in absolute terms than palm oil. While crops like rice, maize and wheat are staples that underpin the food security of millions of people, options exist to reduce their emissions footprints while supporting the livelihoods of small-scale producers. The food and beverage sector should now play a leading role in seeing those emissions fairly but significantly reduced, including through setting science-based emission reduction targets for their full supply chains.

What does the Paris deal on adaptation mean for food and beverage companies?

On adaptation, the Paris Agreement established a new long-term goal of 'enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change,' recognizing adaptation as 'a global challenge faced by all'[11] and placing it on an equal footing with the status of the agreement's provisions on mitigation. All countries have committed to developing national adaptation plans and communicating them periodically.

While the agreement calls for an urgent increase in funds for adaptation it does not establish a concrete target, even though developing countries are set to face adaptation costs of at least $520bn a year by 2050.[12] Oxfam projects that the pledges of increased climate finance made by several governments ahead of and during the Paris meeting will mean dedicated adaptation finance of just $6–9bn per year delivered by developed countries to developing countries by 2020 – this leaves a perilous adaptation gap.[13]

Developing countries face adaptation costs of at least $520bn per year by 2050, while just $6-9bn per year will flow from developed countries for adaptation by 2020, leaving a perilous adaptation gap.

For food and beverage companies, the Paris provisions on adaptation should mean a rapid assessment of responsibilities towards enhancing the adaptive capacity, strengthening resilience and reducing vulnerability of small-scale farmers and others working in or affected by their supply chains. The sector should lead the way in defining a post-Paris agenda on corporate climate resilience.

To give a sense of the responsibilities of the sector in this regard, new research presented in this paper demonstrates the major contribution of key food commodities not only to GHG emissions but also to water

scarcity in a warming world. This has significant implications for the adaptive capacity of local communities, notably in the highly water-scarce region of Asia and Oceania.

While many companies have introduced targeted initiatives to support farmers or workers in parts of their supply chains to adapt to the changing climate, a much more comprehensive approach is required post-Paris.

This means ensuring targeted adaptation interventions tailored to the needs of small-scale farmers and workers, especially women, throughout their global supply chains. But ultimately, the Paris long-term adaptation goal should mean companies addressing their contributions to the fundamental socio-economic drivers of vulnerability to climate change. For example, companies should ensure the right of farmers and workers to organize to press for improved conditions, provide fair and stable contracts and sourcing arrangements, and ultimately ensure workers receive a living wage and farmers are able to achieve a living income so that they can be more resilient to climate-related shocks when they occur.

Setting the post-Paris agenda for corporate climate action

The Paris Agreement is a historic milestone in the fight against climate change, and the food and beverage industry made an important contribution to it. But the fight is far from over. As one of the sectors facing the gravest climate risk and responsible for a major share of global emissions, the food sector should lead the next generation of corporate climate commitments.

On mitigation, food and beverage companies must work with small-scale producers to drive down the often hidden emissions in their supply chains from commodities such as rice, soy, wheat and maize, including by setting science-based mitigation targets for their full operations and supply chains. On adaptation, they must put small-scale farmers' and agricultural workers' resilience to climate change at the heart of their business models, ensuring that the risks their suppliers face in a changing climate are fairly shared.

As one of the sectors facing the gravest climate risk and with a clear business imperative for strong climate action, the food sector should lead the next generation of post-Paris corporate climate commitments.

The first section of this paper provides an overview of how food production and climate change are intertwined. The second section looks at what the Paris Agreement on mitigation means for food and beverage companies, including new research on the GHG footprints of specific food commodities. The third section asks the same question about climate change adaptation, presents new research on the contribution of food commodities to regional water scarcity, and explores how food and beverage companies can support small-scale farmers to strengthen their resilience to climate shocks. The final section offers a set of specific post-Paris policy recommendations to the food and beverage industry on both climate mitigation and adaptation.

1 HOW FOOD PRODUCTION AND CLIMATE CHANGE ARE INTERTWINED

In the 2014 report 'Standing on the Sidelines', Oxfam set out the business case for the food and beverage sector to act on climate change. This section provides a brief overview of its twin pillars – the major threats climate change poses to the global food system, and its significant contribution to causing the problem.

The IPCC Fifth Assessment Report showed that climate changes over the past 30 years have already reduced global agricultural production in the range of 1–5 percent.

Climate change is a major threat to the global food system

For the first time, the 2016 World Economic Forum's global risks report ranks the failure of climate change mitigation and adaptation as the most impactful risk to countries and industries, with water crises coming third.[14] Agriculture is undoubtedly one of the most climate-sensitive sectors.[15]

The *Fifth Assessment Report* of the Intergovernmental Panel on Climate Change (IPCC) showed that climatic changes over the last 30 years have already reduced global agricultural production in the range of 1–5 percent, and that extreme weather events affecting major agricultural producers have helped to drive global food price volatility in recent years.[16]

The report confirms that developing countries will continue to be hit hardest as climate change gathers pace – the very same countries from which many food and beverage companies source their raw ingredients.[17] For example:

- In Vietnam, rice production has decreased because of saline intrusion in the soil due to rising sea levels.[18]
- In West African countries in or near the Sahel, decreases in growing areas are projected for 70 percent of crops by 2050, and by more than 50 percent in the case of bananas, maize and beans.[19]
- In Nicaragua, climate change has contributed to stagnating yields for maize and beans, while drought and heavy rain have led to crop losses.[20]

In the Brazilian state of Mato Grosso, responsible for supplying 10 percent of the world's soybeans, a temperature increase of 1°C could lead to a 9–13 per cent decrease in soy and maize production.

Across the world, farmers face decreasing yields and need larger areas for production, forcing the price of commodities to rise.[21] A new study on the Brazilian state of Mato Grosso, which as of 2013 supplied 10 percent of the world's soybeans, found that a temperature increase of 1°C will lead to a 9–13 percent decrease in soy and maize production, largely due to farmers putting less land into production or only planting one crop at a time.[22]

Higher temperatures will increase heat stress among livestock and, where combined with decreases in precipitation, will reduce the amount of water available for irrigation.[23] The increase in the frequency and/or severity of extreme weather events will be particularly damaging to small-scale farmers and people living in or at risk of poverty, because they generally lack access to social safety nets.

Price volatility is especially damaging to small-scale food producers, whether prices are too low when harvests are good or too high in times of scarcity and when disaster strikes. Any decreases in production in such circumstances affect both levels of income and food consumption.

Oxfam's experience shows that when farmers lose income they often resort to selling assets such as livestock, taking children out of school or cutting down on medical expenses.[24] Without a safety net, small-scale farmers and their families lose the ability to achieve a decent livelihood or invest in their farm's future, and are more likely to experience malnutrition and hunger.[25]

Women farmers are more vulnerable to climate change impacts than men because they are often more dependent on climate-sensitive livelihoods such as rainfed agriculture and collecting water for household use. They also have unequal access to productive resources such as land and agricultural inputs, and have less of a support system to fall back on in times of crisis.[26]

Women farmers are highly vulnerable to climate change because they are often dependent on climate-sensitive livelihoods, have unequal access to productive resources such as land, and have less of a support system to fall back on in times of crisis.

In countries where a significant proportion of household budgets are spent on food and many people are dependent on agriculture, the social and economic consequences of climate-related production changes and price shocks can have disastrous implications for the wider economy.[27]

These increased risks faced by small-scale food producers are increasingly reflected in the bottom lines of the world's biggest food and beverage companies too. For example, in 2010 – a year of extreme weather in many parts of the world – several companies experienced production shocks and financial losses that could be attributed to the changing climate. For example:

- Fresh Del Monte Produce Inc. faced a $9m loss due to heavy rains and flooding in Guatemala, which affected banana production.[28]
- The global commodity trading firm Bunge reported a $56m loss in its sugar and bioenergy business due to drought.[29]
- Severe droughts in Russia led the country to ban wheat exports, which created a disastrous ripple across global stock markets and prompted a 2.2 percent drop in the share price of General Mills.[30]

The food system is a major driver of climate change

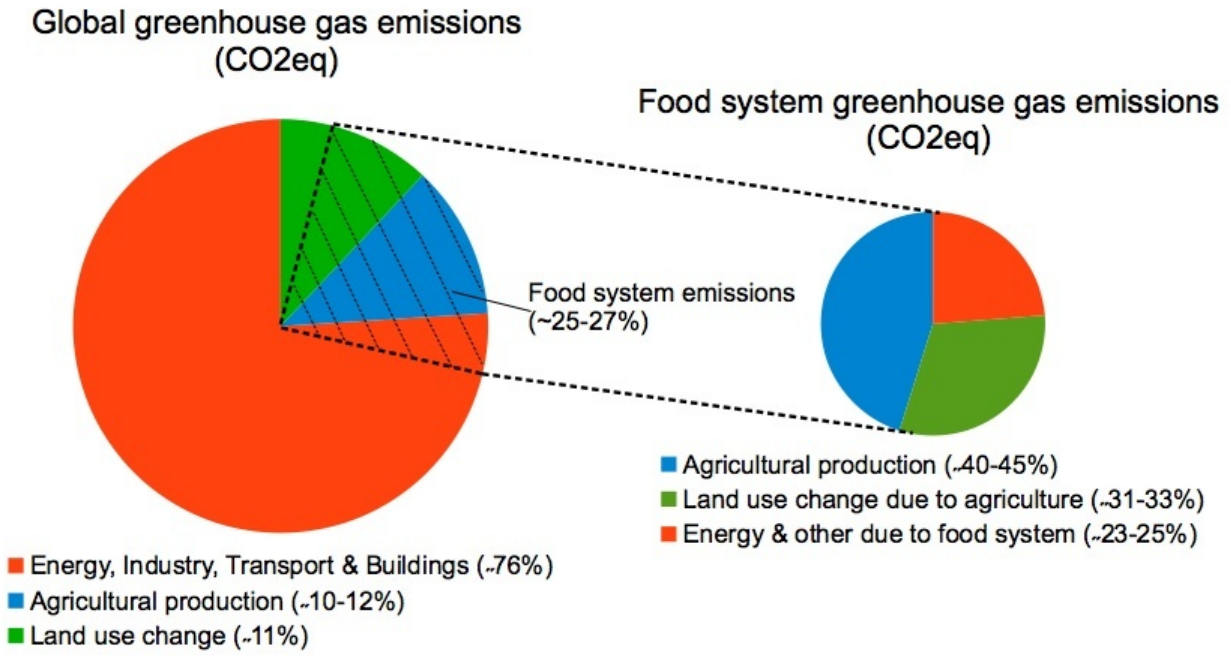
As well as being acutely vulnerable to changes in the climate, the global food system is itself a significant driver of climate change, contributing about a quarter of the world's GHG emissions (see Figure 1).[31]

Agriculture is both a primary driver of deforestation globally, and accounts for the largest share of non-carbon GHGs (about 56 percent in 2005).[32] These 'super pollutants' like methane and nitrous oxide – which have a higher global warming potential[33] although are emitted in smaller

quantities than carbon dioxide – are driven by emissions from livestock, manure added to pasture, the use of synthetic fertilizer and paddy rice cultivation.[34]

Note that, while livestock are a major source of methane emissions in agriculture, the study commissioned from CE Delft for this paper focuses instead on the often overlooked contributions of major agricultural commodities to GHG emissions.

Figure 1: Global GHG emissions and food system emissions



Source: Oxfam. (2014). *Standing on the Sidelines*.[35]

While the public and political debate on climate change has traditionally been dominated by players in the energy and energy-intensive industries, this is starting to change.

As one of the sectors most at risk from climate change, food and beverage companies have a clear business interest in early and effective action on both mitigation and adaptation. As an industry with such a sizable emissions footprint and one that relies on millions of farmers and agricultural workers in regions that are already being significantly affected by climate change, the sector also has a major responsibility to play a prominent role in fighting climate change. The stage is set for food and beverage companies to lead the way in defining the post-Paris agenda for corporate climate action on both mitigation and adaptation.

2 WHAT DOES THE PARIS DEAL ON MITIGATION MEAN FOR FOOD AND BEVERAGE COMPANIES?

The Paris Agreement saw unprecedented commitments to cut emissions from nearly every country in the world, alongside significant commitments from the private sector, cities and other non-state actors. It included a number of core provisions on mitigation, which:

- strengthened the agreed temperature target to keep warming 'well below 2°C, and to pursue efforts to limit the temperature increase to 1.5°C';[36]
- established a new global mitigation goal of achieving 'a balance between anthropogenic emissions by sources and removals by sinks ... in the second half of this century';[37] and
- require countries to regularly increase their national emission reduction targets every five years.[38]

And yet, a significant gap remains between near-term projected emissions and the levels needed to stay on track to achieve the global temperature goal.[39] With the global food system responsible for around 25 percent of global emissions, the food and beverage sector must play a key part in closing this gap.

Tackling supply chain emissions with science-based targets

As revealed by Oxfam in 2014, the world's 10 biggest food and beverage companies have a giant collective emissions footprint, equivalent to all the Scandinavian countries combined.

The world's 10 biggest food and beverage companies have a collective GHG emissions footprint equivalent to all of the countries of Scandinavia combined.

The vast majority of these emissions stem from agricultural supply chains, which, until recently, were not covered by the emissions reduction targets the companies had set.[40] With a small number of notable exceptions, until recently the food and beverage industry had for the most part remained on the sidelines of efforts to reduce emissions.[41]

New commitments from General Mills and Kellogg have started to buck that trend. In 2015 both companies made industry-leading commitments

to set science-based reduction targets for both their operations and supply chains:

- General Mills set a target of 28 percent absolute reduction in GHG emissions by 2025 across the entire value chain, with an absolute cut in emissions of 41–72 percent by 2050 across the value chain (compared to 2010).
- Kellogg set a target to cut GHG emissions by 65 percent across its own operations and 50 percent across it supply chain by 2050 (compared to 2015).

These commitments followed important efforts by other companies in the sector. For example, Unilever forged some of the earliest commitments to eliminate deforestation from supply chains,[42] while Coca-Cola was among the first to commit to sourcing 100 percent of their electricity demand from renewable sources.[43]

In the wake of the Paris Agreement's establishment of a long-term global mitigation goal, it is vital that the food and beverage sector continues to get serious about driving down these massive supply chain emissions through setting fair but science-based targets specific to their supply chains.

Box 1: Implications of the net-zero long-term global goal for the food and beverage industry

Emissions scenarios consistent with a chance of avoiding 2°C of warming described in the IPCC's Fifth Assessment Report assume that net emissions from agriculture and deforestation end entirely and that the sector becomes a net carbon sink by the middle of the century.

This is a critical assumption, because in the absence of this huge new carbon sink, the IPCC's '2 degree' scenarios rely on a huge scaling-up of as-yet unproven and highly risky technology for Carbon Capture and Storage (see Annex). Where this is combined with massive use of bioenergy it will entail major implications for land use and the land rights of millions of people in developing countries.

It is therefore clear that while some residual emissions will be unavoidable in global agriculture, the sector must undertake major emission reductions as a vital part of global efforts to achieve the Paris long-term mitigation goal.

Worryingly, emission trends in this sector are currently heading in the wrong direction. Emissions from agriculture have increased significantly over the past 50 years and even more so over the past decade. They are set to increase another 30 percent by 2050.[44] Meanwhile, recent research suggests that global deforestation rates are continuing to rise, despite progress in some areas.[45]

Building on progress in palm oil

To date, most companies have focused on eliminating the deforestation emissions associated with their use of palm oil. Draining and burning peatlands to grow palm oil in countries like Indonesia accounts for a significant proportion of global emissions – and recent studies have found the indirect emissions linked to palm oil are even greater than previously thought.[46]

While recent efforts to eliminate deforestation linked to palm oil are highly welcome, rice, soy, maize and wheat are all higher emitters in absolute terms.

Hundreds of companies have now announced 'deforestation-free' sourcing policies geared toward protecting rainforests and peatlands while also respecting the rights of local communities.[47] Efforts led by companies such as Unilever and Nestlé (and joined more recently by traders like Wilmar and Cargill) show the positive role the industry can play in curbing global emissions.[48]

While these efforts to eliminate deforestation emissions linked to palm oil are welcome and must continue, new research commissioned by Oxfam from CE Delft reveals that rice, soy, maize and wheat are all higher emitters (in absolute terms) than palm oil (see Box 2 and Figure 2a). The research also reveals that while land use change linked to expansion of agricultural land into forests is a major driver of global emissions, it is equally urgent to tackle direct emissions of nitrous oxide and methane from agricultural soils (see Figure 2b).

The combined impact of the top five emitting food commodities – rice, soy, maize, wheat and palm oil[49] – is equivalent to the carbon emissions of around 1,170 coal-fired power plants each year.[50] If they were a country, those five food commodities alone would be the third highest emitter in the world, behind China and the USA.

The combined impact of the top five emitting food commodities – rice, soybean, maize, wheat and palm oil – is equivalent to the carbon emissions of around 1,170 coal-fired power plants each year.

The implications of this are clear; in the wake of the Paris Agreement, food and beverage companies must not only redouble their efforts to eliminate deforestation from their palm oil supply chains, but also address the massive emissions associated with supply chains of other key food commodities. As Kellogg and General Mills have demonstrated, the best way to do this is through setting science-based mitigation targets for their entire supply chains.

Box 2: GHG footprints of food commodities

Oxfam commissioned CE Delft to assess the GHG footprints of 17 key global food commodities, 11 of which each account for over one percent of global food production.[51] The CE Delft study is based on the agricultural phase of each commodity's life cycle, including on-farm factors such as land, machinery, fertilizer and water, but excluding processing, retail, transport, and the consumer. The analysis included commodities used for food, but for other purposes as well, such as livestock feed and biofuels. The full report is available at: http://www.cedelft.eu/publicatie/food_commodity_footprints%2C_global_ghg_footprints_and_water_scarcity_footprints_in_agriculture/1766. A Food Commodity Footprints interactive map highlighting this data and the impact of climate change on food commodities can be found at: www.oxfamamerica.org/fccmap

The key findings have major implications for the food and beverage industry's efforts to tackle agricultural supply chain emissions:

- Rice, soy, maize and wheat all have higher GHG footprints than palm oil. The footprint of rice is almost three times as high.[52]
- Globally, direct emissions from agricultural soils are at least as big a problem for GHG emissions as land-use change attributed to the expansion of agricultural land.
- In Asia and Oceania – the region with the highest GHG footprint associated with food commodities – the biggest drivers are soil emissions associated with rice production, followed by land-use change emissions associated with palm oil, maize and wheat.
- In Latin America, the majority of emissions are derived from land-use change associated with soybean production.
- In North America and Europe, the biggest drivers are soil emissions associated with maize and wheat production.
- Among the commodities with the highest GHG footprint per tonne are: cocoa from Asia and Oceania and Africa; soybean and coconut from Latin America; and coffee from Asia and Oceania. Due to increasing demand but low yields for these products compared with other commodities studied, the conversion of forested land to meet demand is a key driver of emissions.

Source: I. Odegard, M. Bijleveld and N. Naber. (2015). *Food Commodity Footprints.*

Figure 2a shows the annual global GHG footprint for the 17 commodities included in the CE Delft study. The five commodities with the highest footprints are rice, soybean, maize, wheat and palm oil fruit.

Figure 2a: Annual global GHG footprint per commodity

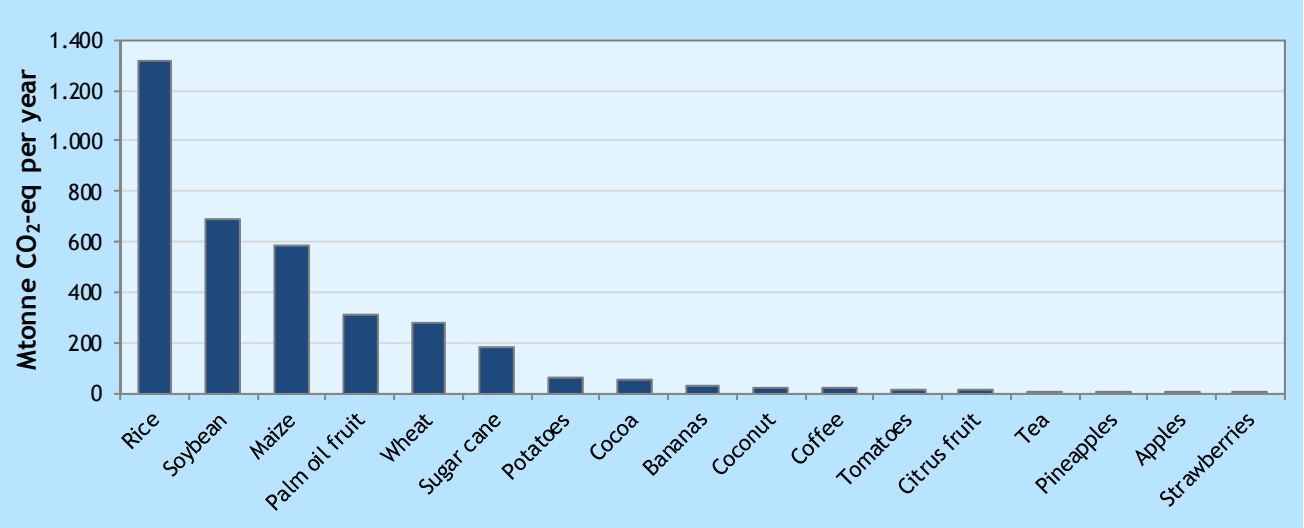


Figure 2b shows the annual global contribution of different drivers to the footprint of the 17 commodities – including soil emissions, land use change emissions, machinery, fertilizers, and other.

Figure 2b: Annual global GHG footprint per driver

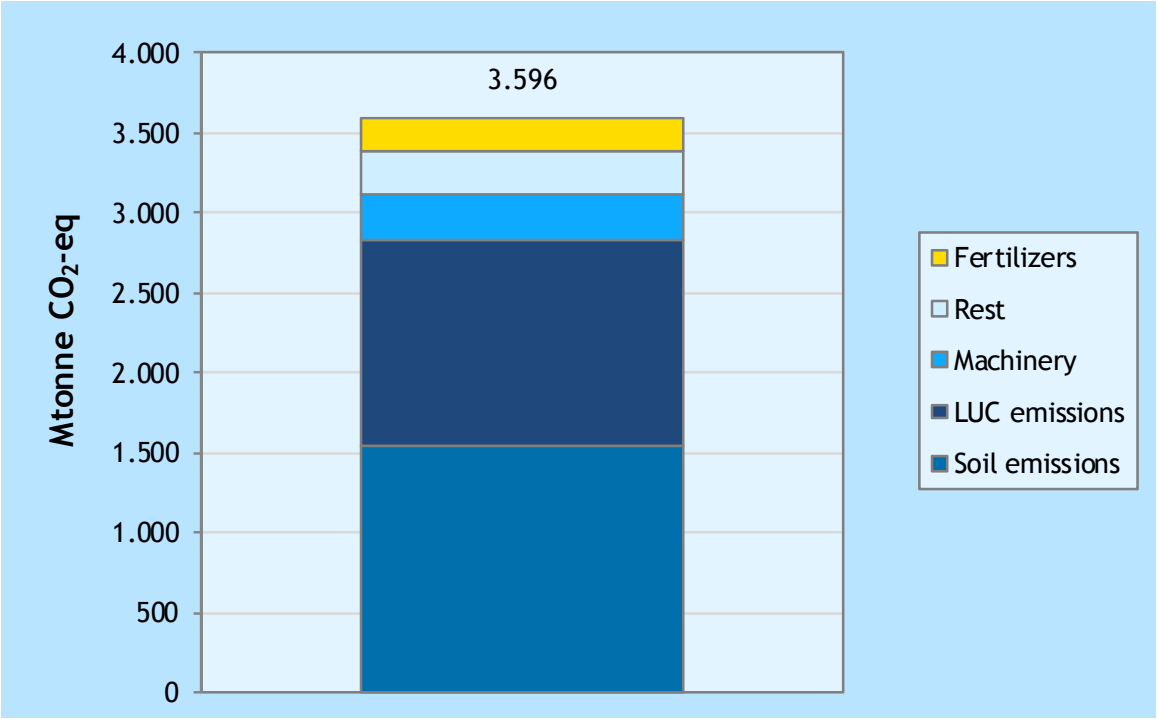


Figure 2c shows the annual regional GHG footprint for each of the 17 commodities included in the CE Delft study.

Figure 2c: Annual regional GHG footprints per commodity

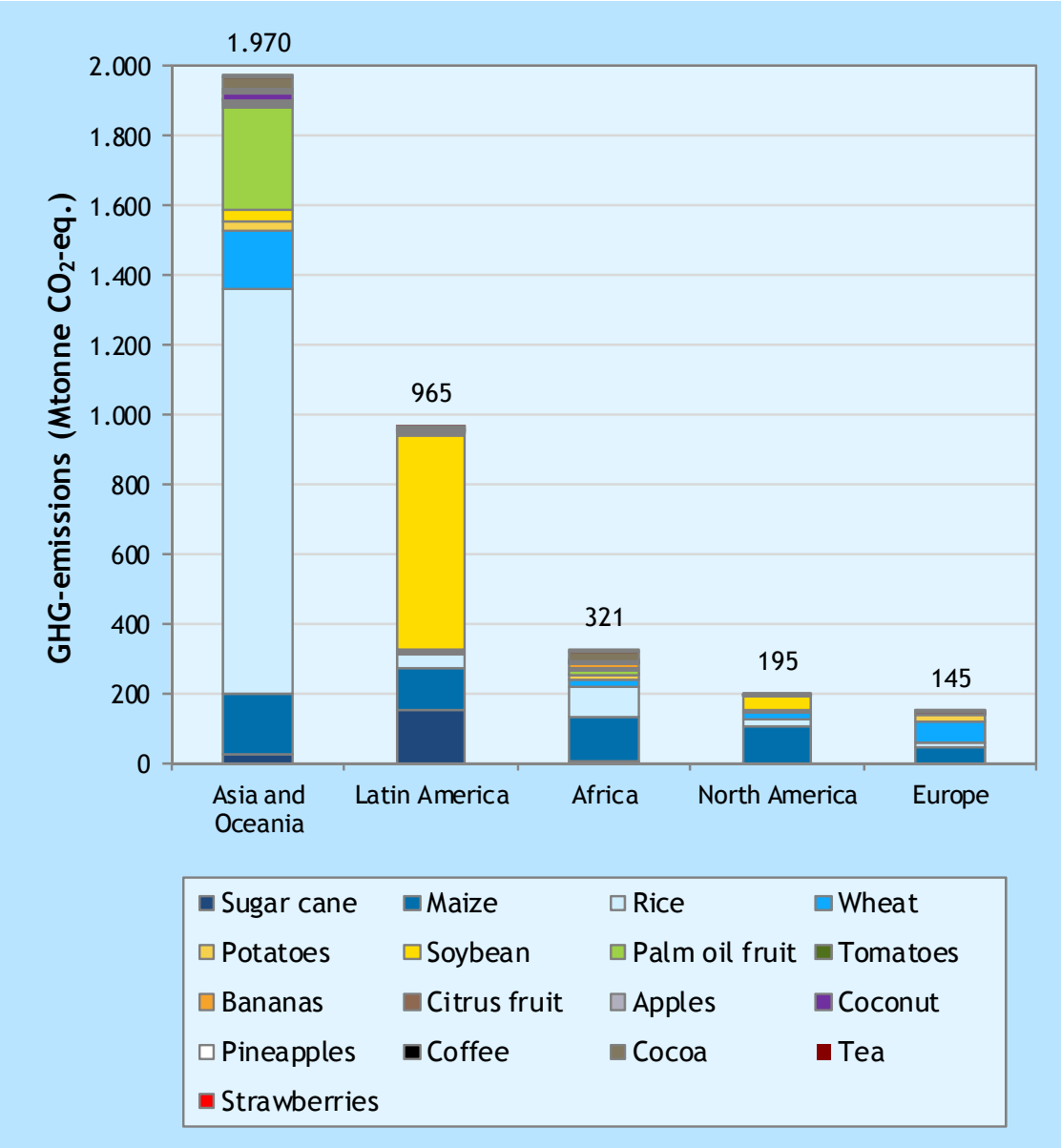


Figure 2d shows the contribution of different drivers to annual regional GHG emissions.

Figure 2d: Annual regional GHG footprints per driver

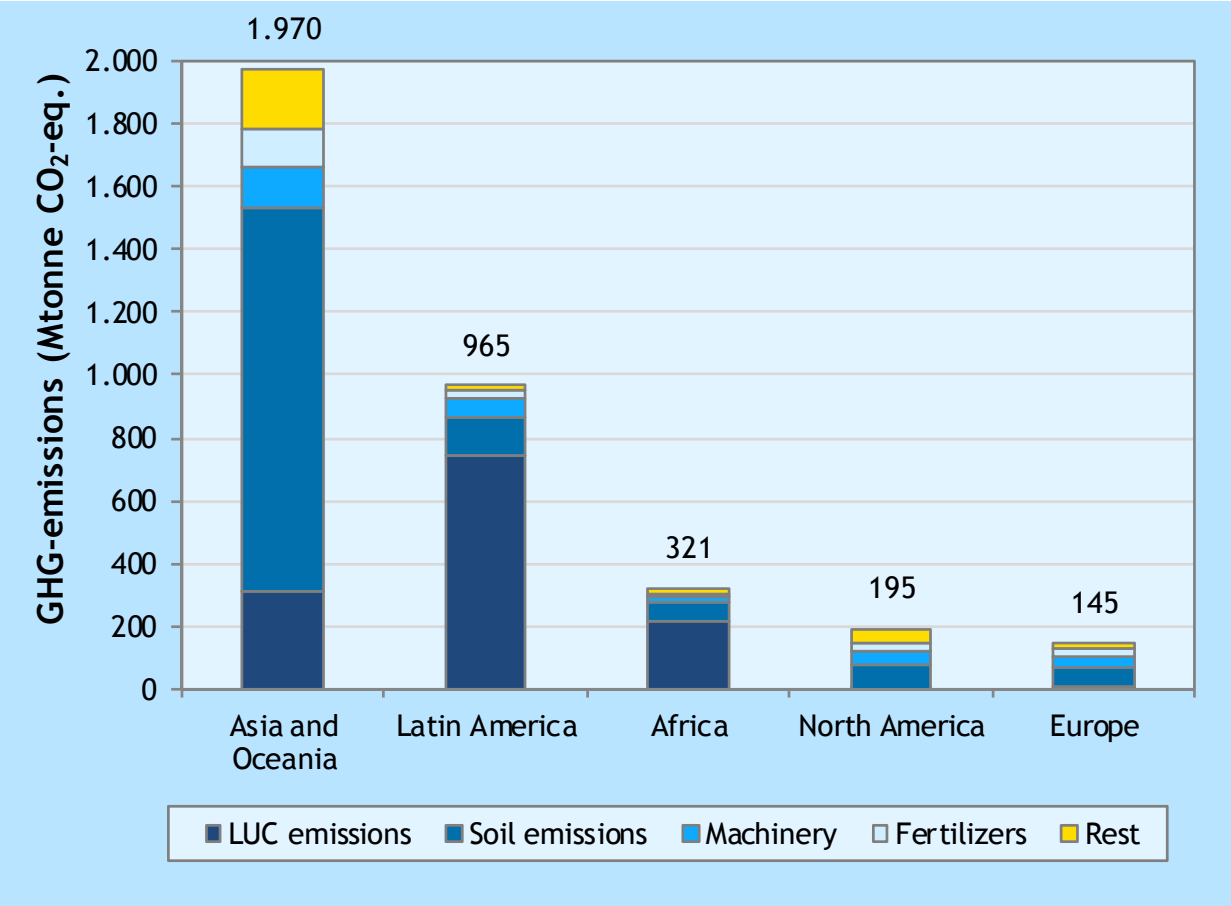
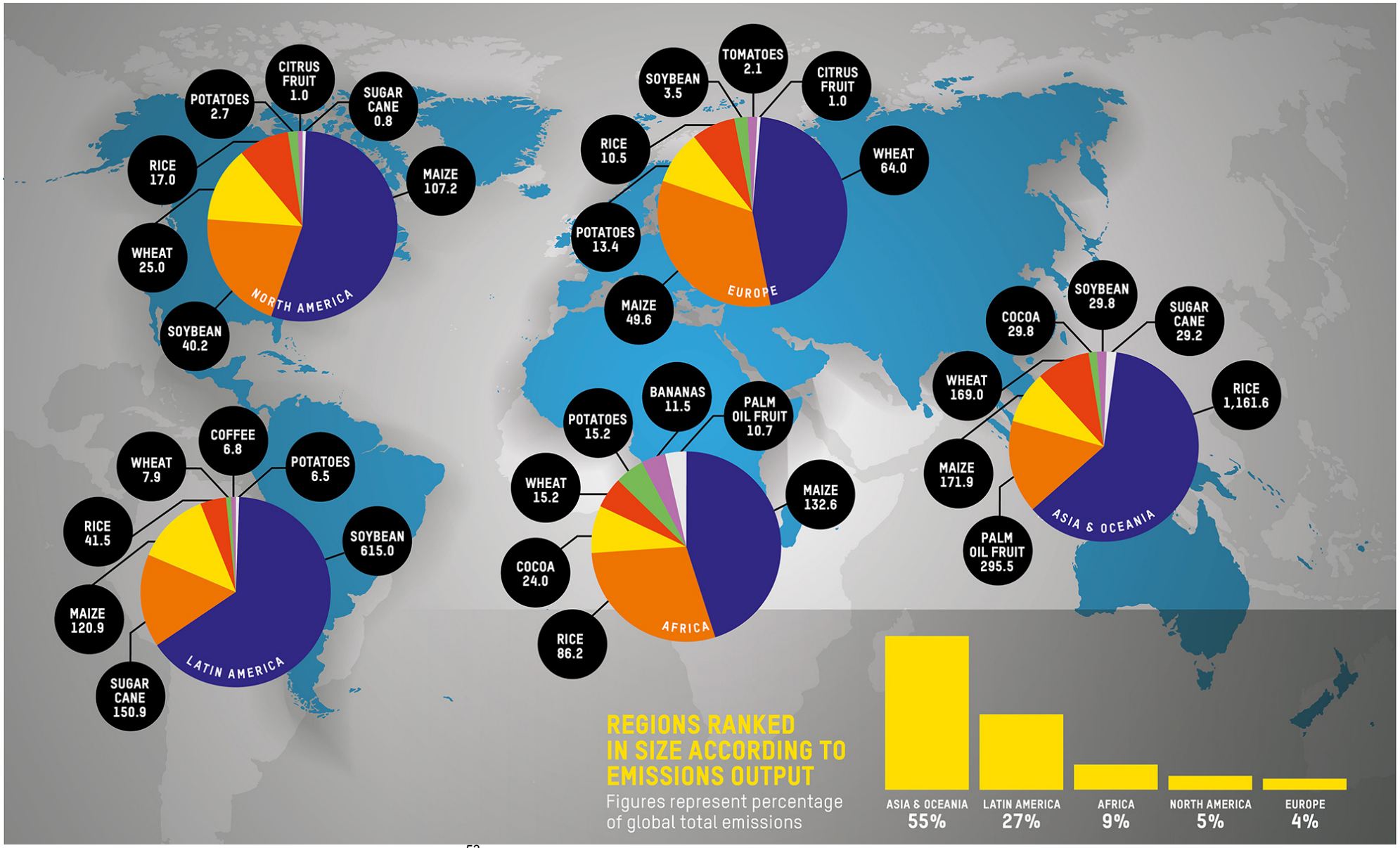


Figure 3 presents the commodities in each region that have the highest GHG emissions, and shows the share and relative scale of emissions from each region.

Figure 3: Share of annual GHG emissions among the seven commodities with the highest emissions in each region (in metric tonnes of carbon dioxide equivalent)



Data for this figure was sourced from the CE Delft study[53]

The food and beverage companies that play a major role in driving the production and trade of these commodities have a clear responsibility to address their contribution to global emissions. This is the new frontier of climate action – not just for food and beverage companies, but ultimately for the business community as a whole.

As submissions to the Carbon Disclosure Project (CDP) help to reveal, across all industries, more than three-quarters of GHG emissions come from supply chains.[54] In some cases, this amounts to up to four times higher than the emissions from a company's direct operations.[55] Companies purchasing large amounts of commodities clearly have the potential to significantly influence other actors in their supply chain to adopt more sustainable agricultural practices.

Submissions to the Carbon Disclosure Project (CDP) reveal that more than three-quarters of GHG emissions come from supply chains.

Lowering emissions through sustainable agricultural approaches

There is no shortage of farming approaches that minimize emissions while supporting adaptation and improving the productivity and food security of small-scale producers. The IPCC groups agricultural mitigation measures into seven categories (see Figure 4). One innovation that could play a vital role in driving down the massive emissions from rice production while also benefiting small-scale producers is the System of Rice Intensification (SRI) (see Box 3).

Figure 4: Mitigation measures in agriculture

Mitigation Measures in Agriculture	Examples
Cropland management	Agronomy (e.g. reduced reliance on fertilizers, pesticides and other inputs) Nutrient management Tillage/residue management (e.g. avoiding burning of farm residue) Water management (irrigation, drainage) Agro-forestry Set-aside, land-use change
Grazing land management/pasture improvement	Grazing intensity Increased productivity (e.g. fertilizations) Nutrient management Species introduction
Management of organic soils	Avoid drainage of wetlands
Restoration of degraded lands	Erosion control, organic amendments, nutrient amendments (e.g. application of composts)
Livestock Management	Improved feeding practices Specific agents and dietary additives Longer term structural management changes and animal breeding
Manure/biosolid management	Improved storage and handling Anaerobic digestion More efficient use as nutrient source
Bio-energy	Energy crops, solid, liquid, biogas, residue

Source: IPCC 4th Assessment Report. (2007).[56]

Box 3: The System of Rice Intensification (SRI)

Across the 17 food commodities studied, Asia and Oceania[57] – home to the largest share of the world population – is by far the region with the highest GHG footprint. The region's 90 percent share of global rice production is the main culprit.

Rice provides the largest source of employment and income for rural people throughout the world.[58] It is a staple crop critical to the food security of at least half the world's population, predominantly those in Asia.[59] If the global population were to increase by 1 billion, an additional 100 million megatons of rice would need to be produced every year.[60]

Rice has a significant carbon footprint because of the methane emitted by flooded rice paddies, which contributes about 1.5 percent of global GHG emissions and a significant proportion of agricultural emissions.[61] The crop also uses up to 40 percent of irrigation water, contributing to worsening water scarcity.[62]

The System of Rice Intensification (SRI) has been shown to reduce emissions from rice cultivation. Originally used in Madagascar in the 1980s, it improves productivity by changing the management of plants, soil, water and nutrients.[63] While it is applied differently across regions, farmers who implement SRI produce more rice and use less water, agrochemicals and seeds.

For that reason, SRI is considered a source of income generation, food security, and increasing resilience to shocks resulting from climate change.[64] In one study in Korea, SRI practices reduced methane emissions by up to 72.8 percent of the carbon dioxide equivalent when compared with plots that used conventional practices.[65] In south-east India, SRI produces less than half the GHG emissions per kilogram compared with conventional rice production.[66]

Oxfam started promoting SRI in 2002 to help farmers improve their food and income security and increase their resilience. As of 2013, more than 1.5 million smallholder farmers in groups supported by Oxfam's partners in Cambodia, Sri Lanka and Vietnam have benefited from SRI using both improved and local rice varieties.[67]

Overall, SRI has increased farmers' autonomy by reducing their reliance on external inputs. The method is accessible to farmers with limited assets, and helps them adapt to the challenges of climate change while also enhancing their knowledge. While part of the responsibility for rice emissions rests with large food and beverage companies, the significant role of small-scale farmers in rice production demands an approach that prioritizes building food security and the resilience of small-scale farmers in the face of climate change.[68]

Measures to mitigate the carbon footprint of agriculture should support rather than undermine the food security and livelihoods of poor people in developing countries. The sizeable GHG footprint of key food commodities, particularly from soil emissions and land conversion, is an opportunity to change how these crops are produced in a way that supports small-scale farmers and helps to build their resilience to climate shocks. It is therefore important that the private sector respects farmer-led innovations such as SRI and builds on its smaller environmental footprint to develop sustainability standards in rice production.

3 WHAT DOES THE PARIS AGREEMENT ON ADAPTATION MEAN FOR FOOD AND BEVERAGE COMPANIES?

The Paris Agreement establishes a new long-term global goal on adaptation, putting it on an equal footing with the agreement's objectives on mitigation. As one of the business sectors that is most vulnerable to climate change risk, with millions of small-scale food producers and agricultural workers in its supply chains and millions more in communities affected by them, the food and beverage industry should lead the way in translating these new adaptation provisions into corporate climate action.

'I used to think adaptation subtracted from our efforts on prevention. But I've changed my mind… Poor countries are vulnerable and need our help.'

Al Gore, environmental activist and former US Vice President, quoted in the Economist, 2008.

From international commitments to corporate action on adaptation

The new long-term adaptation goal commits all countries to *'enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal [to limit temperature increase to well below 2°C and pursue efforts to limit temperature increase to 1.5°C]'*.[69]

This marks the culmination of a process in which governments have moved from seeing adaptation as a dangerous distraction from the 'real business' of cutting emissions in the 1990s and early 2000s, to first accepting and now fully embracing the imperative to adapt at the same time as seeking to mitigate.[70] It can no longer be disputed that the world is experiencing the harmful consequences of climate change, which will only continue to worsen *even if* the international community pursues urgent mitigation actions.

Just as governments have changed their views, so too must the private sector. Yet robust policies on climate change adaptation and resilience are the exception rather than the rule across the business community.

While all business sectors will ultimately need to 'adapt or die', the food and beverage industry's business model depends on the resilience of millions of small-scale food producers and agricultural workers in its supply chains. This means that the sector has a clear business case for investing in enhancing their adaptive capacity, strengthening their resilience and reducing their vulnerability to climate change.

With agriculture being the world's biggest user of water, the food and beverage sector has significant responsibilities to ensure that supply chain practices are not undermining the resilience and adaptive capacity or increasing the vulnerability of local communities.

With agriculture being the world's biggest user of water, the sector also has significant responsibilities to ensure that supply chain practices are not undermining the resilience and adaptive capacity or increasing the vulnerability of local communities. The food and beverage industry

should lead the way in setting out the next generation of corporate climate commitments on adaptation and resilience.

Water scarcity footprints show how agricultural practices can increase vulnerability to climate change

To demonstrate the responsibilities of food and beverage companies to strengthen resilience and ensure that their supply chains do not increase the vulnerability of farmers, agricultural workers and local communities to climate change, Oxfam commissioned CE Delft to conduct research on the water scarcity footprints of key food commodities (see Box 4).

Two-thirds of the world's population live with severe water scarcity – where consumption exceeds availability – for at least one month a year. Half a billion people face severe water scarcity all year round.

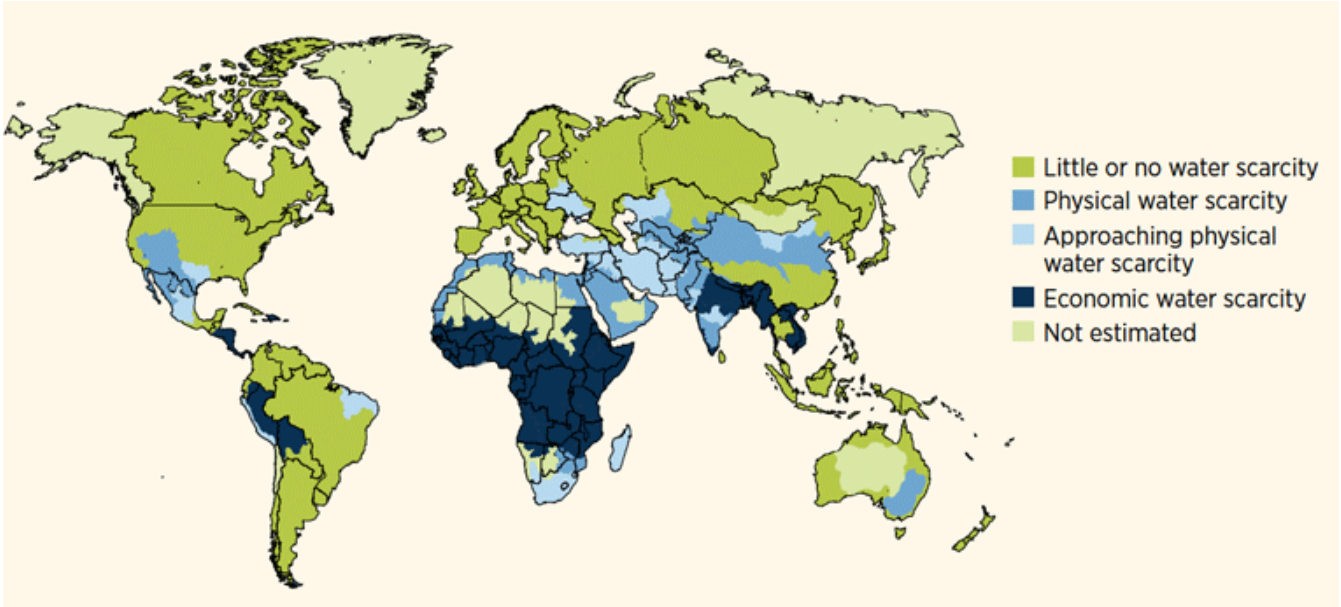
Two-thirds of the world's population (about 4 billion people) live with severe water scarcity (where consumption exceeds availability) for at least one month a year, and half a billion people face severe water scarcity all year round.[71]

Significant parts of Africa, Asia, and Latin America experience physical water scarcity, where demand outstrips the land's ability to provide the water needed. Most countries in sub-Saharan Africa and several in Asia and Latin America, however, face economic water scarcity, where a population lacks the monetary means to utilize an adequate source of water (see Figure 5).[72]

Food commodities are not only responsible for significant GHG emissions, but are also the major contributor to significant water use in areas that are highly likely to be already experiencing water scarcity.

With agriculture responsible for 70 percent of global water usage,[73] agricultural practices have the potential to significantly increase the vulnerability of communities in rural areas to climate change. This means that major food commodities are not only responsible for significant GHG emissions, but are also the major contributor to significant water use in areas that are highly likely to be already experiencing water scarcity (see Box 4 and Figures 6a and 6b).

Figure 5: Global physical and economic water scarcity



UN Water for Life Decade, *Water Scarcity*. UNDESA and UN-Water, http://www.un.org/waterforlifedecade/scarcity.shtml

Box 4: Water scarcity footprints of food commodities

The CE Delft study calculated water scarcity footprints for the same 17 food commodities that were analyzed for GHG emissions. Water scarcity was calculated based on estimates of the amount of water used in irrigation for each crop multiplied by regional water scarcity indicators (calculated as volumes of consumed water as a fraction of available water). While the data used for the analysis included water use for processes other than irrigation, these uses usually have little impact on water scarcity. The full report is available at: http://www.cedelft.eu/publicatie/food_commodity_footprints%2C_global_ghg_footprints_and_water_scarcity_footprints_in_agriculture/1766.

The key findings on water use and scarcity should help guide food and beverage industry efforts to address climate change resilience associated with their agricultural supply chains:

- Food commodity water scarcity footprints are highest by far in the Asia and Oceania region. This means food and beverage companies with supply chains in this region should be highly sensitive to the water use of their commodities and its impact on local communities.
- The high water scarcity footprints in the Asia and Oceania region are due to high water use for irrigation (10 times higher than in other regions), and high regional water scarcity indicators. For the 17 commodities included in this study, Asia and Oceania uses 541km^3 of water every year, compared with 54km^3 per year in Africa, 47km^3 per year in North America and lower amounts in Latin America and Europe.
- The three commodities that contribute the most to the high water scarcity footprint in Asia and Oceania are rice, wheat and sugarcane.
- Globally, rice and wheat are the biggest drivers of water scarcity among food commodities, notably in Asia and Oceania, along with sugarcane from Asia and Oceania and maize from North America. On a per tonne basis, the most water intensive commodities, depending on the region, are wheat, rice and tea.
- Even in regions where available water exceeds water use, water scarcity may still be an issue on a more local scale.

Source: I. Odegard, M. Bijleveld and N. Naber. (2015). *Food Commodity Footprints.*

Figure 6a shows the annual global water scarcity footprint for each commodity. Rice, wheat, sugar cane, maize, and soybean are the commodities with the largest footprints.

Figure 6a: Annual global water scarcity footprint per commodity

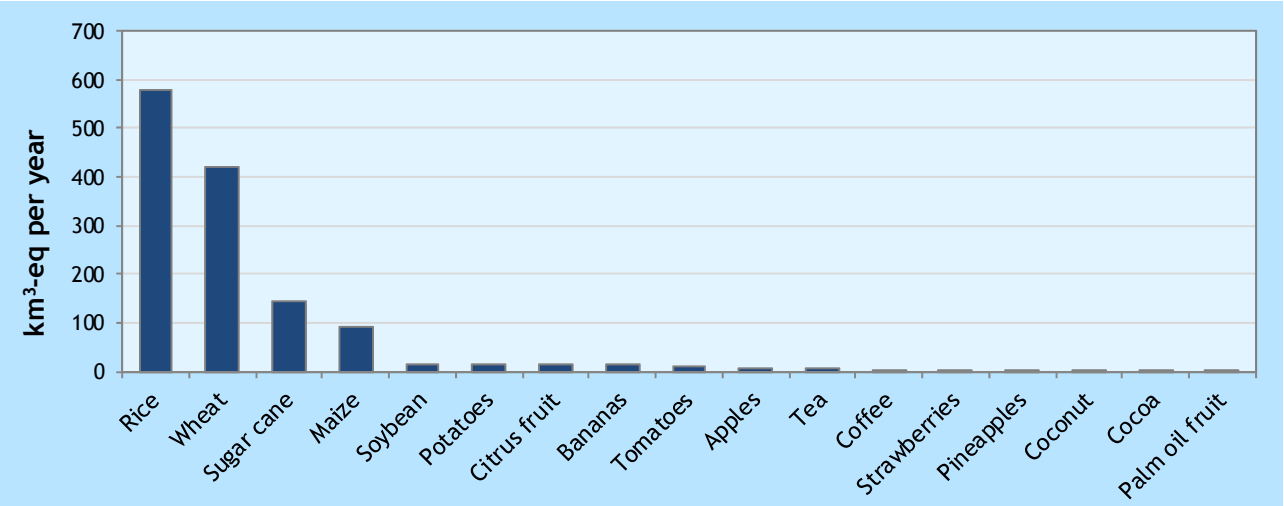
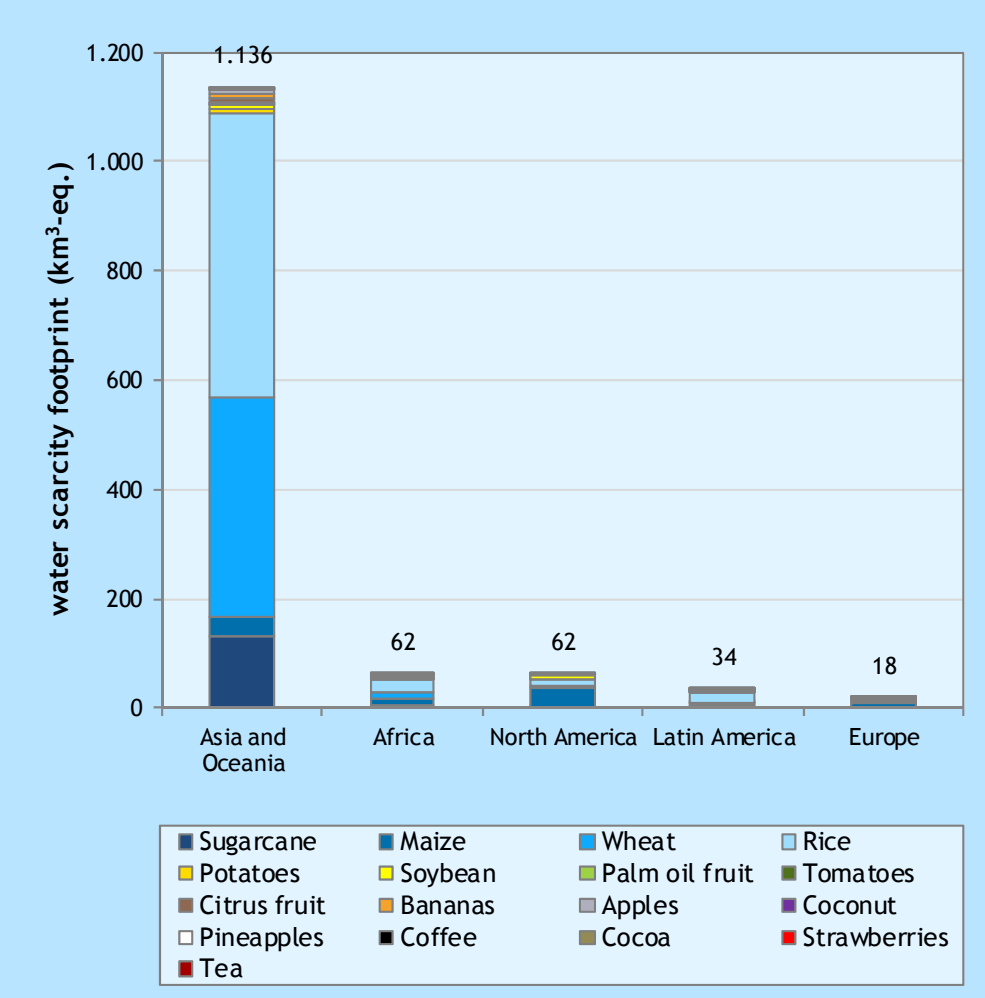


Figure 6b shows the annual regional water scarcity footprint for each commodity.

Figure 6b: Annual regional scarcity footprints per commodity



Responsible companies should develop adaptation and water management strategies to protect local communities' right to access water while also supporting farmers. These strategies should be developed together with local communities and governments so that the people most affected have a say in the amount of water used and the adaptation solutions employed.

Responsible companies should develop climate adaptation and water management strategies to protect local communities' right to access water while also supporting farmers.

As with reducing GHG emissions, there is also a strong business case for addressing water scarcity. Doing so would mean companies avoiding the risks of financial losses from disrupted operations. It would avoid them having to invest in water treatment beyond what is necessary for avoiding pollution, and may avoid delayed growth due to lack of water availability or competition with the needs of local communities.[74]

However, addressing water scarcity is just one aspect of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change in food and beverage sector supply chains. In the wake of the Paris Agreement, a much broader agenda is needed.

Building the resilience of small-scale farmers in supply chains

More than 80 percent of the food we eat, in terms of value, is produced by small-scale farmers, many of whom are women (see Box 5).[75] As many as 500 million small-scale farmers may work in the supply chains of the 'Big 10' food and beverage companies alone,[76] overwhelmingly in regions that are already experiencing significant impacts of climate change. This means that these companies have a unique opportunity and responsibility to support those farmers in the face of increasing climate risks.

As many as 500 million small-scale farmers may work in the supply chains of the 'Big 10' food and beverage companies alone, overwhelmingly in regions that are already experiencing significant impacts of climate change.

Although small-scale agriculture is well placed to develop climate adaptation and coping strategies, many farmers remain acutely vulnerable to climate change due to a range of socio-economic factors that make it harder to absorb and bounce back from – let alone to thrive in spite of – climate-related shocks,[77] including lack of adequate access to markets, investment and inputs.

Even where they have access to value chains, such as those that supply the 'Big 10', they almost certainly do not receive a fair share of the value their products generate further along the chain. In Oxfam's experience, this means small-scale producers are all-too-often being left to shoulder the increased costs associated with a changing climate – incurring all the risk, while those they supply reap most of the reward.

Box 5: Supporting women farmers

In many developing countries the majority of economically active women work in agriculture, yet women's agricultural work is often invisible. Women are often:

- excluded from the more profitable aspects of agricultural enterprises;
- excluded from land, with husbands, brothers or fathers having ownership rights;
- ineligible to join cooperatives or receive credit;
- not targeted to take part in technical training or benefit from other extension services; and
- Illiteracy and lack of bargaining power in the family, creating significant economic disadvantages compared to their male counterparts.

At the same time, risks and vulnerability to disasters have a strong gender dimension. Women and girls – in their varied roles as producers and providers of food, care-givers and economic actors – are most likely to be affected by disasters, climate change and food price shocks. The impacts of systemic shocks have repercussions at the household level, which often exacerbate women's vulnerability.

Food and beverage companies should pay particular attention to supporting small-scale women farmers. This should include scaling up their own sustainable practices or investing in new technologies and training to encourage women to adopt new, innovative adaptation measures. Recruiting women into the supply chain and providing opportunities for them to participate meaningfully in decision making bodies will increase their chances of success as farmers and build their resilience in the face of a changing climate.[78]

Small-scale food producers are all too often being left to shoulder the increased costs associated with a changing climate – incurring all the risk, while those they supply reap most of the reward.

A post-Paris agenda for supply chain resilience: establishing a living income

As food and beverage companies assess their responsibilities with regard to the new Paris long-term adaptation goal, they should consider how they can address these fundamental drivers of socio-economic vulnerability to climate change in their supply chains.

Ultimately, to survive and thrive, small-scale farmers need to be able to balance the revenues they generate on the one hand with their costs of living and investments for future income generation on the other. They need to be left with sufficient income for a decent livelihood or a 'living income' (see Box 6).

Ultimately to survive and thrive, small-scale farmers need to be able to balance the revenues that they generate on the one hand with their costs of living and investments for future income generation on the other, and be left with sufficient income for a decent livelihood.

Box 6: A living income for small-scale farmers in agricultural supply chains

A 'living income' is one that enables farmers and their families to afford a basic lifestyle, considered decent by the society they live in, at its current level of development.

By ‘income’, we mean the sum of all the net incomes that the members of a farmer’s household are able to earn, in a particular period of time. Having a ‘basic lifestyle’ means that the income earned should include a small margin that farmers can accumulate as savings. Being able to save money means farmers can cope better in the event of an emergency or ‘shock’ – such as those associated with climate change – and gives them the freedom to decide for themselves what other reasonable expenses are necessary for a decent life.

All of the world’s citizens, and especially the smallholders who produce the world’s food, should be able to earn a living income from work performed in decent working conditions and following sustainable agricultural practices.[79]

When the risks of producing agricultural goods increase – for example because recurrent droughts push up the price of livestock feed or record temperatures threaten to regularly destroy harvests – striking this balance becomes increasingly difficult as the costs associated with food production go up. When the revenues from selling agricultural products fail to compensate for this increase in cost, farmers are forced to reduce investment, which only increases their vulnerability.

A post-Paris food and beverage company strategy for enhancing the adaptive capacity, strengthening the resilience and reducing the vulnerability of small-scale farmers in value chains should ultimately aim at achieving a living income for all.

A post-Paris food and beverage company strategy for enhancing the adaptive capacity, strengthening the resilience and reducing the vulnerability of small-scale farmers in value chains should ultimately aim to achieve a living income for all. This can be advanced through various means, including by:

- supporting farmers to raise their incomes through increasing agricultural productivity;
- ensuring the provision of training and support so farmers can adapt their agricultural practices to climate change;
- guaranteeing transparent, stable and fair sourcing relationships in relation to price, volume, quality, delivery, payment schedules and other trading conditions, appropriate to conditions of climate change;
- guaranteeing collective bargaining rights for farmers and workers with suppliers;
- establishing grievance mechanisms tailored to their situation, enabling farmers to report business practices within their supply chain that create or aggravate vulnerabilities.

What is clear is that investing in the resilience of small-scale farmers in food and beverage supply chains must go beyond purely technical approaches to help people manage climate-related risks. Following the Paris Agreement on adaptation, and in light of the rising public debate on supply chain due diligence,[80] responsible food and beverage companies must set out an ambitious agenda to address the very inequalities and power dynamics of the food system that make small-scale farmers so vulnerable to climate change in the first place.

4 CONCLUSIONS AND RECOMMENDATIONS

Buoyed by the engagement of a broader range of private sector actors than ever before, the Paris Agreement has set a floor under global efforts to tackle climate change. But the food and beverage industry – which has so much at stake in a warming world – should see it as a springboard for further action to protect not only their own short-term financial bottom lines, but critically the interests of millions of small-scale farmers and agricultural workers in their supply chains.

Food and beverage companies can make a major contribution to the further emissions reductions needed to keep the new 1.5°C temperature goal within reach, by targeting pro-poor but science-based emissions cuts among the highest-emitting food commodities in their supply chains.

The industry has an equally vital contribution to make to the new global adaptation goal of 'enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change' by placing the resilience of small-scale farmers in their supply chains at the heart of their business model.

In the wake of the Paris Agreement, Oxfam calls on food and beverage companies to:

Measure, disclose and reduce agricultural emissions in value chains

1. Commit to measuring and disclosing 'scope 3' agricultural emissions in their supply chains (e.g. through the Carbon Disclosure Project's Investor Reports).
2. Disclose the top five suppliers (by spend or volume) of commodities with a high GHG footprint.
3. Support suppliers to calculate their primary GHG emissions data (e.g. by joining the Cool Farm Alliance); and commit to preferential sourcing from those suppliers that disclose and reduce emissions.
4. Commit to setting science-based emission reduction targets across the full value chain, including 'scope 3' agricultural emissions, consistent with the global temperature goal agreed in Paris.
5. Commit to a clear and quantifiable target to specifically reduce 'scope 3' emissions by a specified year in their agricultural value chains.
6. Require the top five suppliers (by spend or volume) with a high GHG footprint to establish clear and quantifiable targets to reduce agricultural emissions by a specified year.
7. Commit to developing time-bound implementation plans for achieving deforestation and exploitation-free sourcing of commodities to conserve High Carbon Stock and High Conservation Value areas, and to uphold people's human rights, labour rights and rights to land.

These plans should ensure:

- Traceability and transparency in palm oil and soy supply chains, including the disclosure of top suppliers of both commodities.
- Protection of rights of local communities, including a commitment to the principle of free, prior and informed consent (FPIC) and other land tenure standards such as the UN's Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the context of national food security across the operations of the company and all its suppliers.
- Efforts to enhance the livelihoods of smallholders and communities.

Invest in enhancing the adaptive capacity, strengthening the resilience and reducing the vulnerability of small-scale farmers in value chains

1. Conduct climate and water risk impact assessments in supply chains and ensure that the results inform business decisions.
2. Disclose any water-stressed regions where the company operates and from where it sources ingredients.
3. Identify raw materials coming from regions subject to water-related risk and require suppliers to take additional measures in water-stressed areas to mitigate impacts of water use.
4. Develop water management strategies to protect communities' right to water while supporting small-scale farmers. These strategies need to be developed together with local communities and governments, and other stakeholders in the watershed, who should have a say in decisions on the amount of water used.
5. Identify and disclose the impacts of the company's sourcing practices on the productivity and resilience of small-scale farmers (particularly women farmers) in their supply chains in consultation with key stakeholders such as farmers' organizations and representative rural communities.
6. Commit to clear, measurable and time-bound targets with accompanying strategies that reduce risk and vulnerability for small-scale farmers (particularly women farmers) and increase the productivity and resilience of farmers and their communities by:
    - Transferring a greater share of the value created in supply chains to small-scale producers so that they can earn a living income. A company's success in doing this can be assessed through credible human rights impact assessments (HRIAs) and they should also report on progress. Companies should offer transparent, stable and fair sourcing relationships to small-scale producers in relation to price, volume, quality, delivery, payment schedules and other trading conditions, appropriate to conditions of climate change.
    - Supporting and investing in small-scale producer organizations and cooperatives. These organizations can help farmers better protect themselves against risks and strengthen their negotiating position in supply chains.

- Helping small-scale producers gain access to resilience-enhancing solutions like weather information, sustainable farming strategies, access to inputs (food, water and seeds), access to loans, financing and technical assistance.
- Introducing tailored grievance mechanisms that enable small-scale farmers to report any business practices that create or aggravate vulnerabilities.
- Demanding that intermediaries, traders and processors implement policies and practices that support and enable small-scale producers to earn a living income and become more resilient to the impacts of climate-related shocks.
- Promote low external-input technologies and strengthen extension and educational services for small-scale farmers on the use of agro-ecological techniques.

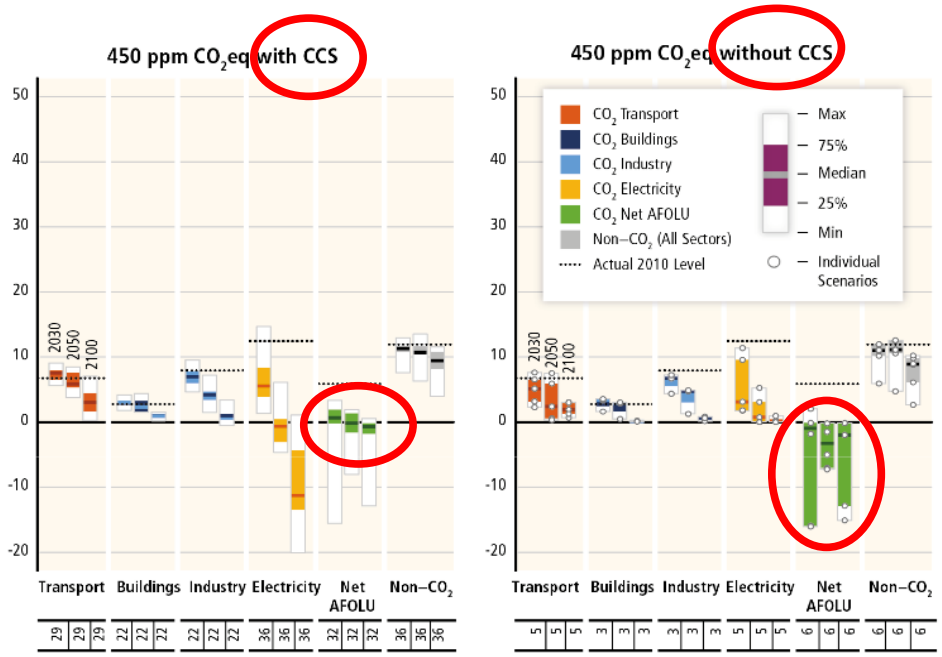
Advocate for climate action

1. Publicly advocate for further science-based climate action in the wake of the Paris Agreement on both mitigation and adaptation with governments, private sector peers, consumers and in multi-stakeholder forums.
2. Examine the climate policies of industry associations that the company is a member of in order to understand their positioning on climate action and to determine whether that association has worked to undermine progressive climate policy. Work proactively within each trade association to push for constructive engagement on climate issues.

ANNEX

Excerpt from IPCC. (2014). *Summary for Policy Makers*. Figure 7, in: *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. IPCC Working Group II Contribution to the Fifth Assessment Report. http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf

Emissions scenarios giving a reasonable chance of keeping global warming below 2°C require net emissions from agriculture, forestry and land-use change to become a significant net sink by mid-century. In the absence of such a sink, scenarios require significant use of unproven and risky technology for Carbon Capture and Storage (CCS).



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80 The issue of supply chain responsibility and due diligence is rising in the public debate; the French parliament, for example, is discussing legislation. Food and beverage companies should therefore start preparing to include assessments with regard to living income in their due diligence reporting by taking stock of the production costs and calculating the living incomes needed for the food producers who supply them.

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