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GLOBAL SECTOR STRATEGIES: RECOMMENDED INVESTOR EXPECTATIONS FOR FOOD AND BEVERAGE

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ABOUT CLIMATE ACTION 100+ AND THE GLOBAL SECTOR STRATEGIES

Climate Action 100+ is an investor-led engagement initiative that strives to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change. More than 615 investors with \$55 trillion in assets collectively under management are engaging 167 focus companies to improve climate governance, curb emissions, align their emissions performance with net zero, and strengthen climate-related financial disclosures. Climate Action 100+ is delivered by five investor networks working with the initiative's investor signatories (AIGCC, Ceres, IGCC, IIGCC and PRI).

In March 2021, Climate Action 100+ published the first company assessments from its [Net-Zero Company Benchmark](#) ('Benchmark'), which evaluates climate performance and corporate transition plans. Acknowledging that corporate net zero strategies will vary significantly by sector, Climate Action 100+ is developing a series of Global Sector Strategies, to accelerate sectoral decarbonisation.

This marks a new workstream from the Climate Action 100+ initiative which aims to rapidly accelerate the industry transition by identifying key actions for companies, investors and industries overall. Aligned with the Benchmark, the Global Sector Strategies will guide investor engagement being carried out by Climate Action 100+ signatories, mapping out what corporates in a number of carbon intensive industries need to do to build out effective transition plans and decarbonised value chains.

For further questions or feedback on this project, please email mrichards@ceres.org

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ABOUT THIS REPORT

The Global Sector Strategies: Recommended investor expectations for food and beverage is part of the Climate Action 100+ Global Sector Strategies. This report outlines what companies in the global food and beverage sector can do to transition to a net zero economy with a focus on Indicator 5 of the Climate Action 100+ Net-Zero Company Benchmark: Decarbonisation Strategy. Without a clear transition strategy, companies will be unable to achieve their emissions reductions commitments. This report – the result of input from investors, companies, and issue experts – draws on recent scientific research to provide investors with decision-useful and actionable information intended to inform engagements with food and beverage companies on developing and implementing climate transition action plans. This report does not specifically cover other indicators included in the Benchmark, including capital expenditure alignment, just transition, and policy engagement. High-level suggestions for these indicators as they pertain to this sector are included in the Appendix.

The recommendations in this report align with the Science Based Targets initiative (SBTi) and its forthcoming methods¹ for companies with extensive agriculture and forestry footprints to set science-based emissions reduction targets in line with what the most recent science says is necessary to limit global temperature rise to well-below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit warming to 1.5 degrees Celsius.

What is included in this report:

- Executive summary
- Background on the role of the food and beverage sector in the global transition to net zero, and the sector boundary this report draws
- Sources of greenhouse gas emissions from the food and beverage sector
- Mitigation levers and key considerations for a transition to net zero in the food and beverage sector
- Suggested investor expectations for food and beverage companies to align with net zero
- Recommendations for company engagements and additional actions investors can take
- Sector-specific implications of all Climate Action 100+ Net-Zero Company Benchmark indicators
- Endnotes with references, supplemental information, and explanations

This report has been circulated to Climate Action 100+ investor signatories, companies engaged under the *Global Sector Strategies* workstream, and a scientific advisory committee to solicit feedback on its conclusions which have been assessed and incorporated. It will now be used as a tool by investor signatories that are actively engaging with food and beverage companies on the Climate Action 100+ focus list, through sector-wide dialogue that encourages collaborative action and individual engagement.



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Scientific advisory committee

This guide was developed through a consultative process with an advisory committee of experts in the field. Our thanks to the following individuals who generously shared their time and expertise to review the data and information in this guide for methodology and transparency of messaging, and to **Meridian Institute** (Elliott Davis, John Ehrmann, Tannera George,

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Role of the investor networks

Each Global Sector Strategy is developed by the investor network with the most in-depth strategic understanding of the sector ('lead'), in consultation with the other investor networks that deliver Climate Action 100+ ('supporting').

The lead investor network develops the strategy in consultation with external sector technical experts, signatory investors and focus companies. The supporting investor networks assist by contributing insights to the report and gathering feedback from their investor network members and focus companies.

The reports provide sector-wide actions that investors can request from focus companies for each regional context. Each investor network will play an important role in taking regionally specific actions to their investors, to inform local focus company engagement.

Ceres and PRI led on the development of the Global Sector Strategy for the food and beverage sector. The supporting investor networks - AIGCC, IGCC, and IIGCC - have all reviewed and endorsed the recommendations outlined in this report.

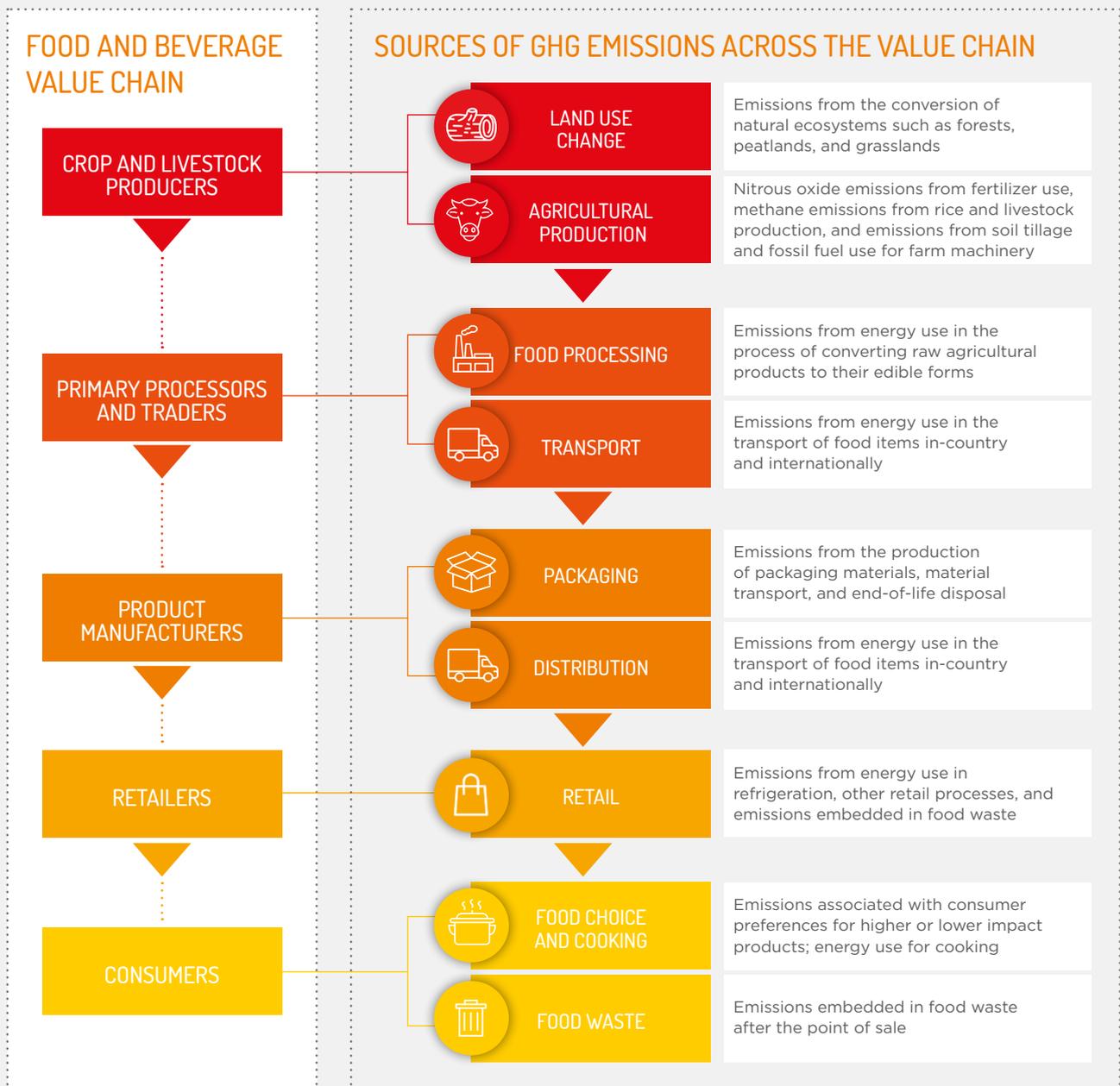
Report design by Perivan



EXECUTIVE SUMMARY

This report aims to guide investor engagements with companies in the global food and beverage sector, through the Climate Action 100+ initiative and more broadly, to take the actions necessary in the transition to a net zero global economy. Drawing on recent research and input from sector experts, investors, and companies, this paper sets forth recommended investor expectations for actions companies in this sector must take to align with net zero and recommendations for company engagements.

The global food system is responsible for approximately one third of global anthropogenic greenhouse gas emissions – **a net zero future is not possible without action from food and beverage companies.** To align with the goals of the Paris Agreement, land-based emissions must be reduced by 85% compared to a business as usual scenario by 2050. Given that most of the emissions in this sector are embedded in corporate value chains, companies must set long term net zero and interim GHG emissions reduction targets that cover



scope 3 emissions in order to meet the global ambition expected for corporate GHG emissions reductions and mitigate exposure to climate transition risk.

Companies will not be able to meet ambitious emissions reduction targets without taking commensurate actions, both in company operations and in the supply chain.

With the above in mind, **recommended investor expectations for corporate action in this sector** include:

- **INTEGRATE** supply chain climate action into corporate decision-making processes and procurement policies
- **INCENTIVIZE** and support agricultural producers to reduce the climate impact of crop and livestock production and enhance agricultural carbon sequestration
- **ALIGN** capital expenditures, product development, and R&D with a 1.5-degree scenario
- **TRANSITION** to more efficient and renewable energy use and transportation across operations, distribution, and supply chains
- **IMPROVE** processing, manufacturing, and packaging practices to reduce emissions and food loss
- **PARTNER** with peers, suppliers, and policymakers to drive transformations across the sector

Investors can further accelerate progress by engaging portfolio food and beverage companies on key topics based on the companies' sourcing and the role they play in the supply chain, and by engaging portfolio companies in other sectors that can impact the ability for this sector to ambitious actions, including:

- **Chemical companies** that produce agricultural inputs such as seeds and synthetic fertilizers
- **Machinery companies** that produce agricultural and farm machinery
- **Banks** that play a key role in financing agricultural commodity production in emerging markets





PART 1: BACKGROUND

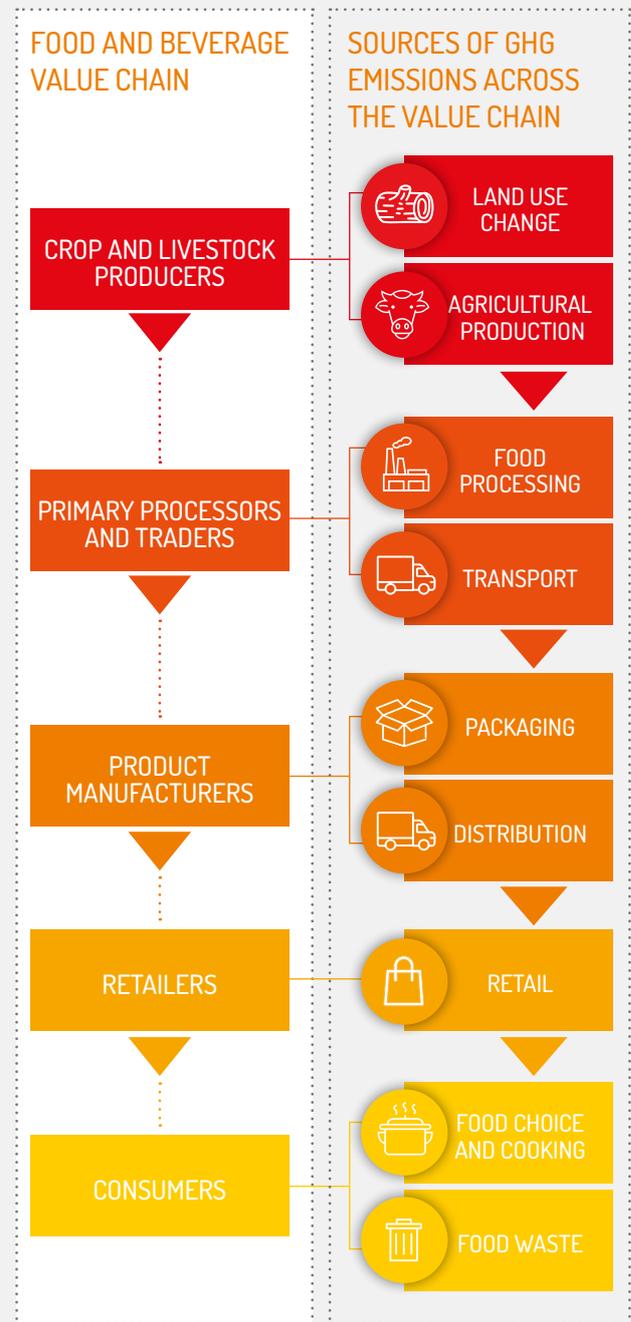
The global food system is responsible for approximately one third of global anthropogenic greenhouse gas emissions, with most of the emissions coming from the supply chains of food and beverage companies.² Achieving the Paris Agreement goal of limiting global temperature rise to no more than 1.5 degrees Celsius above pre-industrial levels will not be possible without substantial action and supply chain engagement from companies that produce, source, manufacture, distribute, and sell food and beverage products. Some analyses suggest that even if all non-food system GHG emissions immediately ceased, emissions from the food system alone would likely exceed what is needed for a 1.5-degrees C scenario.³

THE BREADTH OF COMPANIES IN THIS SECTOR

Notably, the food and beverage sector is associated with high market concentration in several segments, including meat processing (primary processors and traders), ready-to-eat cereal (product manufacturers), and retail grocery. As a result, a handful of these companies control a high proportion of their segment's market share, have vast global supply chains, and own many international subsidiaries. **By engaging the high-leverage companies in this sector on developing robust climate action plans, investors can help accelerate a sector-wide transition to a lower carbon economy.**

However, for there to be transformative progress across this sector, there needs to be coordinated and collaborative action among this diverse set of actors along complex supply chains. And because these supply chains span many different countries, local political contexts can also either help or hinder that progress. Despite these challenges, this report provides guidance on how investors can help accelerate the necessary shifts in strategy and investments by companies in this sector to align with net zero.

Figure 1: Key players and processes in the food and beverage sector



Sector classification: While there are many ways to classify this sector, this report draws on MSCI's Global Industry Classification Standard (GICS),⁴ with a focus on GICS industries in the consumer staples sector that are responsible for the production, processing, distribution, and sale of food and beverage products and associated ingredients.⁵

APPLICATION OF THIS REPORT TO OTHER SECTORS AND INDUSTRIES

The recommendations in part 4 of this report do not simply apply to food and beverage companies. **Any company that sources agricultural commodities**, including household and personal product companies that source palm oil, apparel companies that source cotton, leather, and other fibers, forestry and other companies that produce or source paper, timber, and pulp products are impacted by the climate change risks of the food and beverage supply chain.⁶ Consumer discretionary companies, namely hotel, restaurant, and leisure companies, that depend on food and beverage companies for sourcing will fail to meet ambitious climate targets, particularly with regards to supply chain emissions, unless they engage their suppliers in the food and beverage sector on taking commensurate

actions. However, this report may not cover some major drivers of emissions – such as energy use by downstream consumers – that may be more material for companies in these other industries than for food and beverage companies.⁷

FINANCIALLY MATERIAL CLIMATE-RELATED RISKS IN THIS SECTOR

Companies that fail to address value chain emissions from agriculture and land use change will be increasingly exposed to both transition and physical risks associated with climate change (Table 1). [The World Business Council for Sustainable Development’s TCFD Preparer Forum](#) for food, agriculture, and forest products provides a more detailed analysis of financially material climate-related risks and opportunities affecting food and agriculture companies.

Table 1: Material transition and physical climate risks for companies in the food and beverage sector

Transition risks	
Operational	Companies along food and beverage supply chains, from commodity producers to downstream manufacturers, may incur stranded assets if they are unable to function at current or projected capacity due to the risks listed below. Changes could manifest in a company’s own operations, or from suppliers being unable to produce sufficient volumes of inputs due to changes in policy, consumer demand, physical impacts of climate change, and other factors.
Market	Upstream and midstream companies, including crop and livestock producers, and primary processors and traders, may lose contracts or see lower credit ratings and reduced competitiveness as their downstream buyers seek to align with net zero and respond to increasing consumer demand for products with lower carbon footprints, including deforestation-free products and plant-based alternatives to meat and dairy products. ⁸
Regulatory	Policy mechanisms like carbon pricing, border carbon taxes, and other climate change regulations will increase purchasing costs for carbon intensive commodity inputs. Other policy measures may make it costly or impossible for companies to import products associated with practices like deforestation.
Litigation	Increasingly, legal actions are being taken against high emitting companies that may be responsible for escalating climate-related damages, and similar actions could follow in this sector. Illegal deforestation in the supply chain already exposes companies to legal action, and this could soon extend to all deforestation with pending EU due diligence legislation for companies. ⁹
Reputational	Investors and consumers alike are increasingly demanding that companies align products and services with global emissions reduction goals and there are strong consumer trends towards low-impact products including plant-based alternatives to meat and dairy products.
Physical risks	
Operational	More extreme weather events and natural disasters as well as shifting production zones may lead to lower yields and stranded assets on company-owned lands. ¹⁰ Companies may also need to invest in technologies and nature-based solutions to help producers adapt to long-term changes in climate and relocate operational facilities.
Market	Companies may face increased operating costs due to the increased variability in the availability and quality of key commodity inputs.



PART 2: SOURCES OF GREENHOUSE GAS EMISSIONS FROM THE FOOD AND BEVERAGE SECTOR

According to two recent studies, the global food system is responsible for an estimated 25 to 35% of global greenhouse gas emissions, or between 13.6 billion¹¹ and 17.9 billion¹² tons of CO₂e annually (figure 2), though the sector’s contribution could be even higher.^{2,7} Estimates vary given the vast range of actors and processes involved in the food and beverage sector, but there

is a consensus that most of the emissions from this sector come from land use change, which includes the expansion of agricultural production into forests and other natural ecosystems^{13,14} and direct emissions from agriculture, particularly nitrous oxide emissions from fertilizer use and methane emissions from livestock and rice production.^{2,7}

Figure 2: Comparison of emissions estimates from Poore and Nemecek (2018) and Crippa et al. (2021). Both reports indicate that the majority of emissions from this sector come from land use change and agriculture.

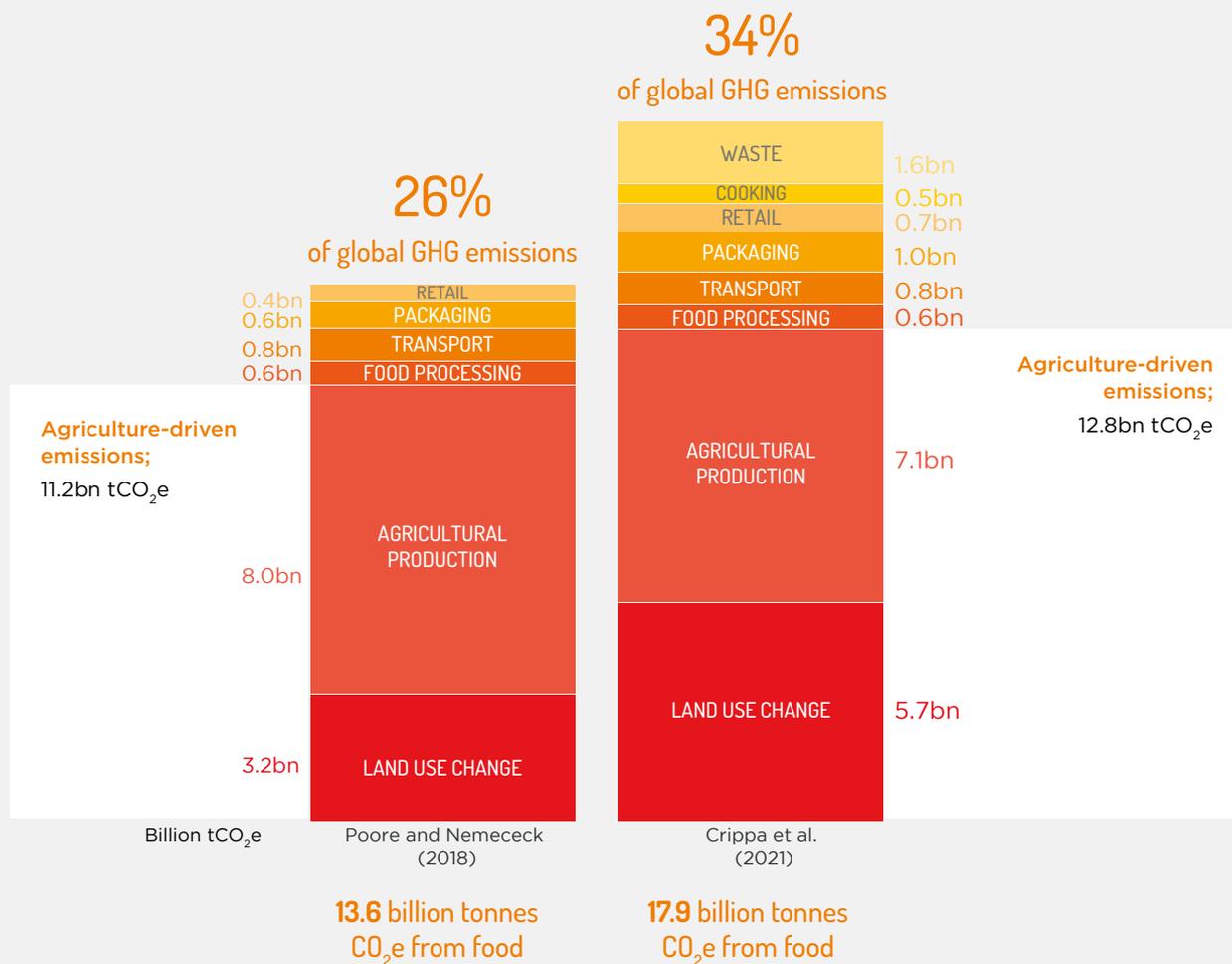


Figure adapted from Hannah Ritchie, Our World in Data (2021).

AGRICULTURE

7.1-8 billion tons of CO₂e in the food and beverage sector are associated with direct emissions from agriculture, aquaculture, and capture fisheries. This includes emissions from: energy use for synthetic fertilizer production and nitrous oxide from fertilizer use on crop fields; carbon, methane, and nitrous oxide emissions from soil tillage practices, fossil fuel use from on-farm equipment; methane emissions from beef, dairy, and rice production; and emissions associated with aquaculture (fish farming).

LAND USE CHANGE

3.2-5.7 billion tons of CO₂e are associated with land use change. Land use change in this sector is largely the result of commodity-driven land conversion, which includes both deforestation and the conversion of other important natural ecosystems, such as grasslands like the Cerrado in Brazil, where much of the country's soy is produced. When natural ecosystems are converted to agriculture and other land uses, vegetation is burned or left to decompose. Not only does this emit carbon dioxide and other GHGs into the atmosphere, it also eliminates the cleared land's ability to store more carbon in the future.¹⁵

PACKAGING

0.6 -1.0 billion tons of CO₂e are associated with the production of packaging for food and beverage products, largely due to energy use in the production of raw materials used for packaging such as paper, plastic and glass. Conventional plastics used in packaging are produced from petroleum byproducts including crude oil and natural gas. Fuel combustion and volatilisation of raw materials in glass production drive packaging-related emissions. Paper production is very energy-intensive, and paper packaging may also be associated with deforestation in countries like Indonesia, where peatlands are converted to pulp plantations.

TRANSPORTATION

Around 0.8 billion tons of CO₂e are associated with transportation. Along food and beverage supply chains, commodities and end products are transported between farms, regional storage and distribution facilities, processing and manufacturing plants, retailers, and to end-consumers homes. Transportation in this sector includes shipping of international cargo, domestic road transport, and international and domestic aviation. Emissions from transportation vary depending on the mode of transportation, fuel source, and region-specific transportation infrastructure.

FOOD PROCESSING

Around 0.6 billion tons of CO₂e are associated with the processing of raw commodities, such as meat processing and processing fruit for use in fruit beverages. Much of these emissions come from combustion and energy use.

RETAIL

0.4-0.7 billion tons of CO₂e are associated with the retail phase of the food system. The main sources of retail emissions are from electricity use for storage, refrigeration, and cooking. Refrigeration in retail stages often rely on HFCs, which have high global warming potential and are increasingly being phased out by national regulations.

POST-RETAIL EMISSIONS

Although difficult to estimate, approximately 1.6 billion tons of CO₂e are associated with consumer food waste. Use-phase emissions in this sector also come from electricity and other fuel use for cooking and cooking appliances and refrigeration.

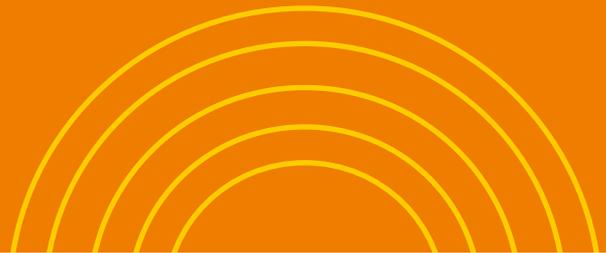
NON-CO₂ EMISSIONS IN THE FOOD AND BEVERAGE SECTOR

Though decarbonization tends to be the focus of net zero efforts, companies in this sector must address agricultural non-CO₂ emissions, such as methane and nitrous oxide, as well as fluorinated gases. Together, these account for approximately 47% of all the GHG emissions from this sector. **These emissions all have greater warming potential than carbon dioxide, which means that the food and agriculture sector has a disproportionate impact on climate change compared to other sectors where CO₂ is the dominant greenhouse gas.**¹⁶

Agriculture is responsible for around 38 % of global **methane** emissions, with 25 % directly associated with livestock production, including beef and dairy.¹⁷ Cattle and other ruminants produce methane as a by-product of digesting and breaking down plant materials, such as the grasses, corn, and soy that they consume as feed. Manure management practices, or the lack thereof, can also lead to methane emissions, such as when pig manure is kept in uncovered open lagoons. Rice production accounts for 6 % of global methane emissions.¹⁸

80% of global anthropogenic **nitrous oxide** emissions come from agricultural production, specifically from livestock manure and the use of synthetic fertilizer to grow crops.¹⁹ Nutrient mismanagement, namely the overapplication of fertilizer, exacerbates these emissions.

Fluorinated gases, including hydrofluorocarbons (HFCs) which are commonly used as refrigerants, account for 2% of food systems emissions.² In accordance with the Kigali Amendment of the Montreal Protocol, which aims to phase out the production and consumption of HFCs by over 80% 2047, signatory countries around the world are increasingly implementing regulations to phase out this potent greenhouse gas.



REGIONAL IMPACTS

Globally, the top five national emitters of greenhouse gas emissions associated with the food system, from production to consumption, are China (13.5%), Indonesia (8.8%), the U.S. (8.2%), Brazil (7.4%), and the E.U. (6.7%).² However, these figures only account for emissions from production and consumption that occur within these countries and regions. Because much of the emissions from palm oil production in Indonesia and soy production in Brazil, for example, are driven by demand by developed markets, companies in countries that import these products, including China, the U.S., and the E.U., are disproportionate drivers of these emissions.

Upstream land use change and agricultural production are the biggest drivers of emissions in both emerging and developed markets, but a larger proportion of emissions come from downstream processing, packaging, transportation, retail, and consumer food waste in developed markets.²⁰ Over the last few decades, emissions have stayed more or less the same in developed markets, but have increased sharply in emerging markets, largely due to land use change driven by increased demand in developed markets. Although there have been increasing efforts in recent years from both investors and companies to tackle commodity-driven deforestation, companies largely failed to meet their targets to eliminate deforestation from their supply chains by 2020, and much more action is needed to curb emissions from this sector.

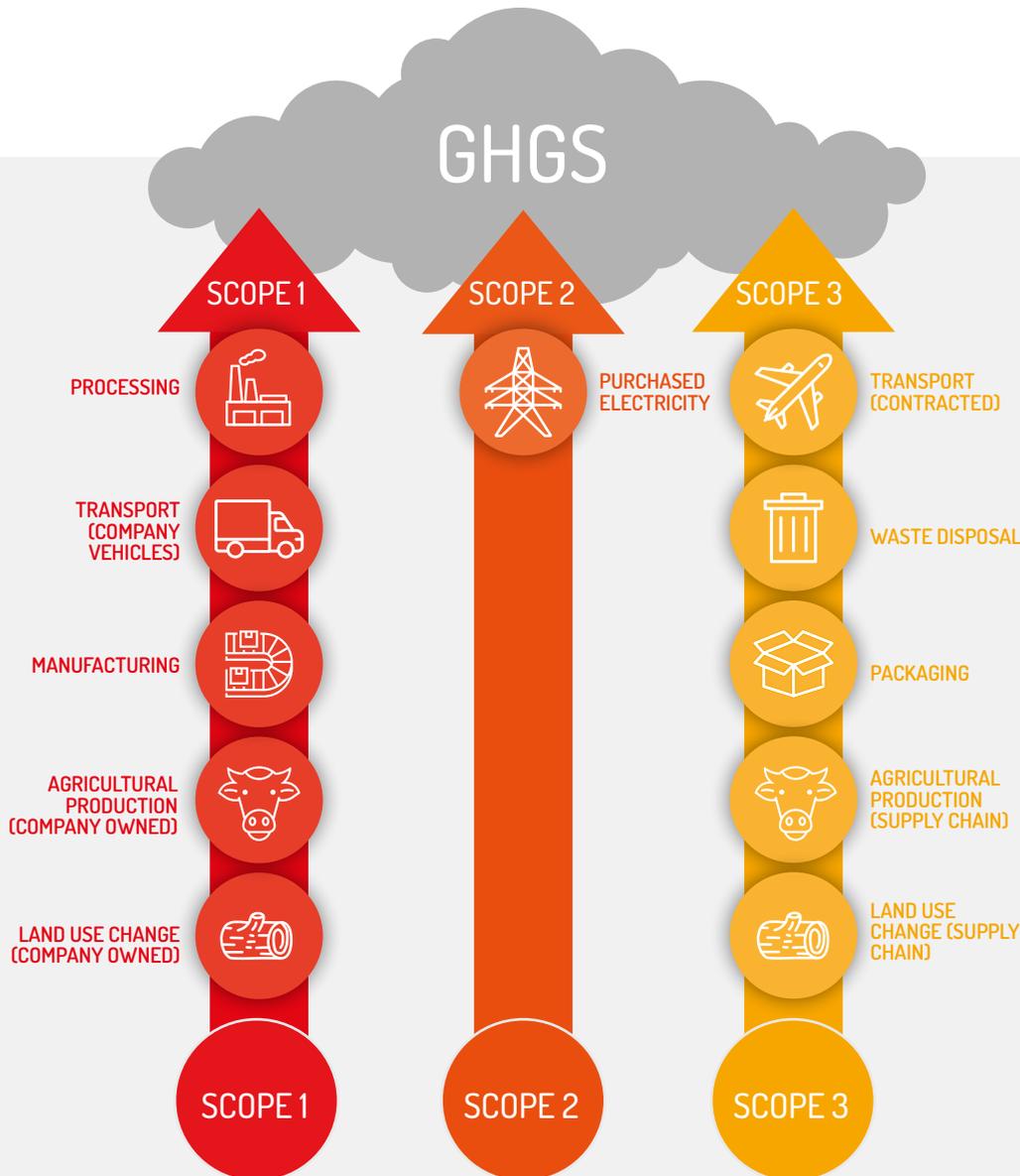
THE SIGNIFICANCE OF SUPPLY CHAIN EMISSIONS

The majority of emissions for all companies in this sector come from agriculture and land use change. Following the framework developed by the GHG Protocol,²¹ these emissions are categorized as direct operational emissions (scope 1) or indirect supply chain emissions (scope 3), depending on a company’s place in the supply chain (Figure 3).

For most companies sourcing, producing, and distributing agricultural commodities and food and beverage products—packers, traders, distributors,

food and beverage manufacturers, and retailers—GHG emissions from agricultural production, deforestation, and land conversion fall under scope 3 emissions from purchased goods and services. These emissions fall under scope 1, direct emissions for companies that own or control agricultural operations, such as vertically integrated palm oil companies that have company-owned plantations or meat processors with company-owned agricultural operations.

Figure 3. The majority of emissions in this sector fall under scope 3, supply chain emissions



Examples of company reporting on emissions from land use

- U.S. meat processor Tyson Foods **estimates**, but has not formally reported, that 90% of its emissions fall under scope 3, through emissions from fertilizer for feed corn, refrigeration processes, and energy used by independent farmers to raise cattle, hogs, chicken, and turkeys.
- The Hershey Company, an American multinational chocolate and snacks manufacturer, **reports** that 94.4% of its total GHG emissions fall under scope 3. The company further details that 41.5% of its emissions come from land use change and 29.8% from agriculture embedded in its ingredients sourcing.
- Musim Mas, a vertically integrated global palm oil company, reported that 27.1% of its scope 1 emissions came from its company-owned palm oil plantations (agriculture and forestry). At 368,038 tons CO₂e, these emissions were greater than the company's total scope 2 emissions from purchased electricity. The company did not disclose its scope 3 emissions, but the inclusion of these emissions would likely increase the contribution of land-based emissions to its overall footprint, through the independent palm oil smallholders in its supply chain.

Supply chain engagement is critical for companies in this sector to align with a scenario that limits global temperature rise to 1.5-degrees Celsius. Though the types of companies in this sector are wide-ranging, **neither the individual companies nor the sector as a whole will be able to meet science-based emissions reduction targets without addressing upstream emissions from agriculture and land use change.**

GHG emissions reduction targets in this sector must cover scope 3 emissions:

Companies in this sector that set targets that only cover scope 1 and 2 emissions will not meet the global ambition expected for corporate GHG emissions reductions, and will be increasingly exposed to climate risk. In line with the Climate Action 100+ Net-Zero Company Benchmark indicators 1 through 4, companies should pair net zero greenhouse gas emissions targets with ambitious but realistic interim emission reduction targets for the short term (2020-2025), medium term (2026-2035), and long term (2036-2050), and regularly disclose progress against these targets. **For this sector, investors should engage companies on setting targets that explicitly cover scope 3 emissions.**

As the SBTi develops concrete guidance for companies to set science-based net zero targets, the initiative will incorporate **new guidance** for companies to set short- and medium-term targets that include emissions from forests, land, and agriculture, which will align with **emerging guidance from the GHG Protocol** on accounting for these emissions. In the interim, companies can consult Quantis' methodology to measure emissions from land, forests, and soils across the supply chain that are embedded in corporate and product emission footprints.⁹ The GHG Protocol already provides guidance for agricultural producers to account for direct emissions from agriculture.¹⁰ **By implementing interventions today, companies will be well-positioned to meet the sector-specific targets that the SBTi will soon be able to validate.**



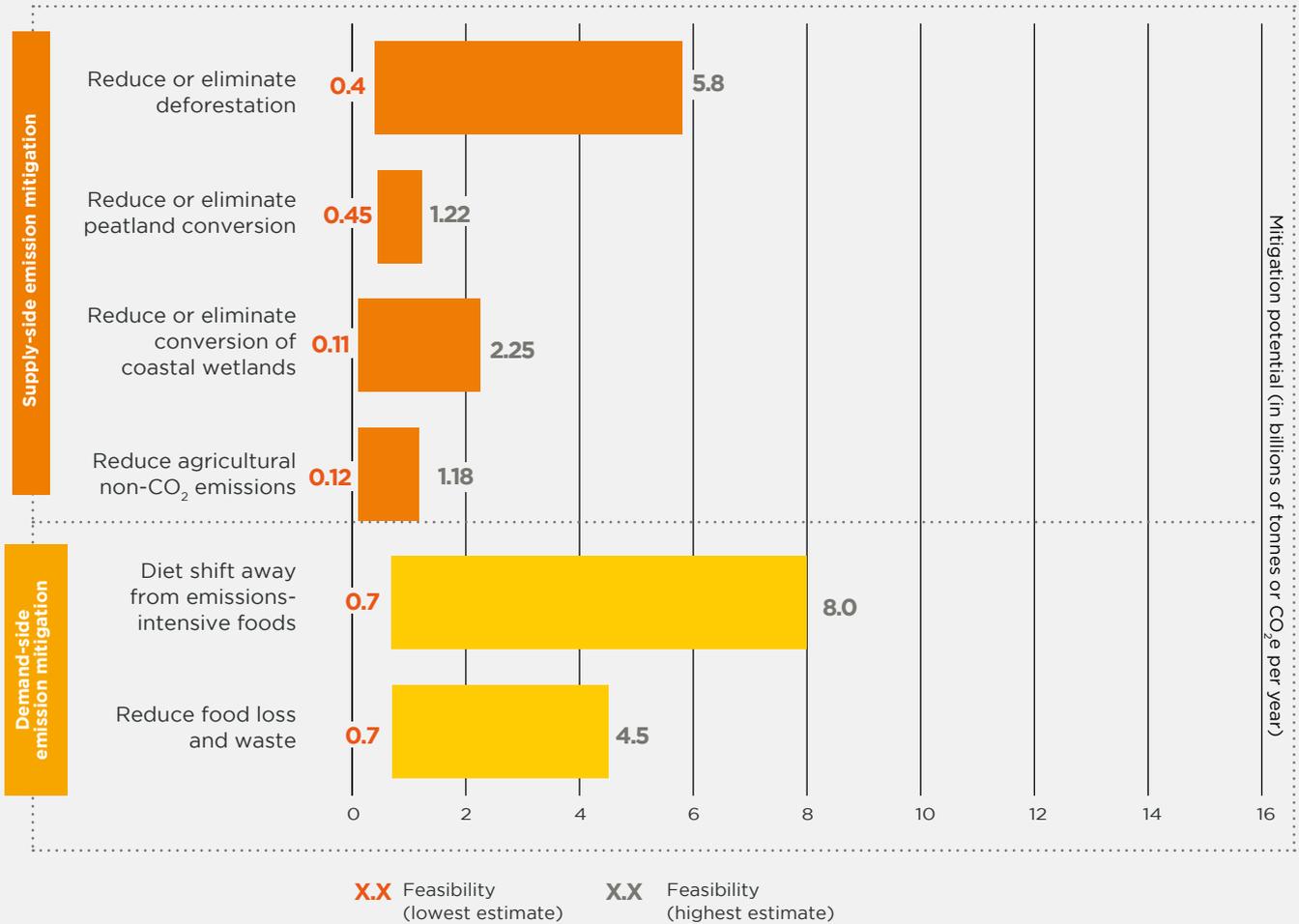
PART 3: MITIGATION LEVERS IN THE SECTOR AND KEY CONSIDERATIONS FOR COMPANIES

Given that most of the emissions from this sector are from agriculture and land use change, it is critical that companies align with mitigation pathways for land-based emissions to accelerate the transition to a net zero global economy. As mentioned earlier, Science Based Targets initiative (SBTi) has forthcoming guidance for companies with extensive footprints in agriculture and forestry to set and verify emissions reduction targets that explicitly address land-based emissions and align with the emissions reductions needed for sectoral decarbonisation.²² SBTi will draw on **an analysis** of scenarios in the IPCC Special Report on 1.5-C Scenario Database to align emissions reductions in this sector with what science says is necessary to limit warming to 1.5 to well-below 2 degrees Celsius.^{23,24,25}

To align with a 1.5-degree scenario, the analysis suggests that land-based emissions must be reduced by 85% compared to a business as usual scenario by 2050. This can be achieved by reducing emissions from land use change, agriculture, diet shifts, and reduced food waste by 7.4 Gt CO₂e per year between 2020 and 2050, based on conservative estimates that consider economic, technical, and environmental feasibility.²⁶ When combined with a tenfold increase in carbon removals over two decades from carbon-sequestering measures such as forest restoration, agroforestry, forest management and increased soil carbon sequestration in agricultural systems, these land-based interventions could deliver 25% of the global mitigation needed across all sectors. Although the largest share of land-based emissions mitigation is associated with the forestry sector, mitigating direct agricultural non-CO₂ emissions, as well as halting agriculture-driven land use change are critical in the transition to net zero global emissions.



Figure 4: Ranges annual mitigation potential of key levers to reduce emissions from agriculture, forestry, and other land use. Data from Roe et al (2019), using the low and high feasibility estimates from the report's supplementary information



As the public and private sectors mobilize to mitigate land-based emissions, it is important to ensure that interventions do not lead to undesirable tradeoffs.²⁷

EMISSIONS FROM NON-LAND-BASED PROCESSES

An additional estimated 17-18% of emissions from the food system are associated largely with the energy use embedded in other key processes, including processing, transportation, packaging,

and retail.²⁸ As much as possible, these emissions must be mitigated in line with established 1.5-degree pathways such as those by the International Energy Agency with targets validated by the SBTi.²⁹ Importantly, while there is often a focus on reducing “food miles” from transportation and distribution as a way to mitigate the climate impact of this sector, mitigating land-based emissions, engaging in diet shifts, and minimizing food loss and waste will proportionately have a much greater impact in the near-term.

KEY CONSIDERATIONS FOR A TRANSITION TO NET ZERO IN THE FOOD AND BEVERAGE SECTOR

As companies set ambitious emissions reduction targets and implement mitigation strategies to align with net zero, it is critical that they consider potential tradeoffs, as well as opportunities to maximize co-benefits, through their climate actions. These considerations were incorporated into the recommended investor expectations for companies as outlined in the next section. However, to prioritize measures appropriately, companies should also account for the specific implications these considerations may have in their value chains.

The need to feed a growing population

Global population growth, expected to reach nearly 11 billion by 2100,³⁰ will increase the demand for food, while the consumption of carbon intensive foods including red meat is expected to increase with rising incomes in emerging markets. Substantial transformations are needed to reduce the GHG emissions per unit of food consumed and to reduce food loss along the supply chain. Because about a quarter of the world's food is lost or wasted every year,⁷ reducing food loss and waste along supply chains can have a significant impact on mitigating the pressure on food systems to meet rising demand.³¹ If recovered, this food would be enough to feed billions of people around the world. In addition, a demand-side shift in diets away from emission intensive food like beef to a plant-rich diet alone has the potential to curb emissions in line with a scenario with a 50% likelihood of limiting global temperature rise to 1.5 degrees C.³²

The role of natural climate solutions

Given the significance of land use within food and beverage supply chains, natural climate solutions (NCS) will be core to the mitigation pathway for this sector. NCS are activities that protect, restore, or improve the management of natural or working lands. This includes measures that reduce greenhouse gas emissions as outlined above, including eliminating land conversion and reducing agricultural non-CO₂ emissions. NCS also include activities that enhance land-based carbon removals. In other sectors, companies are looking to offset emissions they are unable to mitigate through the purchase of carbon credits

from NCS. However, because the majority of food and beverage companies' emissions come from land-based processes such as deforestation and agricultural production, either directly or through the value chain, NCS are a legitimate way to mitigate scope 3 emissions.

Investors should encourage food and beverage companies to finance or implement carbon removal solutions, such as afforestation and forest restoration, agroforestry, and regenerative agriculture, where appropriate, for carbon removals *within their value chains*. **However, carbon removals should not take the place of reducing emissions, especially through eliminating deforestation. Preserving existing forests has much greater benefits to climate, biodiversity, and local communities than replanting trees later on.** For more information on the role of natural climate solutions in corporate climate commitments, please refer to [Ceres and IIGCC's investor brief](#) on the topic.

The importance of biodiversity to global food systems

The preservation of biodiversity is critical to agricultural production and the supply chains that depend on agricultural commodities. For example, pollinators help maintain and increase agricultural yields – between \$235 and \$577 billion worth of annual crop production is at risk from pollinator loss.³³ Furthermore, biodiversity's role in climate stabilization is critical to helping maintain the adequate crop growing environments in many key regions of the world.³⁴ While agriculture benefits from thriving biodiversity, it can also drive biodiversity loss, due to the direct impacts of agricultural production on local and regional ecosystems. Agriculture's contributions to climate change also exacerbate global biodiversity loss. When considering land-based climate interventions, companies should prioritize actions that minimize potential harms and maximize potential benefits to biodiversity. For example, some agricultural practices, such as agroforestry, can benefit biodiversity while simultaneously helping drive down a company's overall GHG emissions. For more information, see the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)'s [Global Assessment Report on Biodiversity and Ecosystem Services](#), as well as their other assessments and resources.



PART 4:
RECOMMENDED INVESTOR
EXPECTATIONS FOR ACTIONS
COMPANIES CAN TAKE TO
ALIGN WITH NET ZERO

Mitigating emissions in this sector presents companies with enormous business and environmental opportunities. **Eliminating deforestation, restoring previously cleared land, and employing agricultural practices that mitigate and sequester carbon³⁵ have the potential to mitigate more emissions than implementing renewable energy technologies across all sectors.**³⁶ Some of these same measures can also lead to increases in agricultural yield and efficiency, as well as decreases in food loss that can benefit companies' bottom lines and help minimize emissions. Furthermore, companies have the opportunity to develop new product lines that align with shifts in societal preferences towards more sustainable and lower carbon products.

However, **companies must ramp up their level of ambition and pace of adopting key mitigation measures in order for the sector as a whole to contribute to global efforts to achieve a net zero global economy by 2050.**

There are a number of key actions companies can take to accelerate the economy-wide transition to net zero as it pertains to Indicator 5 of the CA100+ Net-Zero Company Benchmark: Decarbonisation strategy. As previously noted, non-CO₂ emissions are a key driver of emissions in this sector which should also be addressed by "decarbonisation" strategies. Importantly, the key emissions sources companies in this sector must address are complex and have multiple mitigation approaches and, in many cases, consensus on the single best strategy is still emerging. These recommendations are not intended to constitute a comprehensive or prescriptive list of actions all companies must take, and appropriate action will likely entail a combination of some of the listed actions. Recognizing there is no silver bullet, investors can refer to this guidance as a starting point for developing corporate engagement strategies for the sector. Additional sector-specific recommendations for other Benchmark indicators can be found in the appendix, including for GHG emissions disclosures and targets, capital expenditure alignment and the role of food and beverage companies in a just transition.

The importance of climate scenario analysis and GHG emissions accounting: The climate impacts of food and beverage production, and thus the appropriate mitigation levers, differ greatly between regions and even between farms or operations in the same region. Impacts will become even more variable and unpredictable with the predicted effects of climate change. To decide which actions to prioritize, companies should conduct climate scenario analysis per the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).³⁷ To minimize unintended consequences and to ensure a just and equitable transition, companies should base this analysis on a holistic understanding of the company's operational and supply chain impacts on climate, biodiversity, and people. Further, companies should base corporate decision making and emissions mitigation efforts on robust GHG emissions accounting that covers scope 3 emissions



1. INTEGRATE climate action into corporate decision-making processes and procurement policies and standards:

Given that most of the emissions from this sector are driven by agricultural production in the supply chain, companies will not be able to sufficiently address climate-related material financial risks without ensuring that corporate sustainability governance also covers the company's supply chain environmental performance and climate impacts. To operationalize climate action in both operations and the supply chain, companies should also codify climate-related requirements within procurement policies and strategies, rather than addressing sustainability in siloes within the company.

Examples of ways companies can better integrate climate action into core decision-making processes include:

- **Ensure clear board oversight of and remuneration for delivery of GHG targets**, per Indicator 8 of the Climate Action 100+ Net-Zero Company Benchmark: Climate Governance. For this sector, oversight and remuneration should cover the corporate supply chain's climate impact and environmental performance
- Embed key climate-related indicators, metrics, and environmental performance within **procurement strategies and policies**, as well as in the key responsibilities of procurement and supply chain professionals, in addition to financial performance targets
- **Achieve supply chain traceability** to a level that allows for targeted interventions and assessments
- **Embed a commitment to a no-deforestation and no-conversion supply chain** within corporate procurement policies across all business functions, with time-bound non-compliance protocols in place to address supplier non-compliance
- **Conduct and disclose in-depth climate scenario analysis** to understand the key climate-related risks and opportunities and to target interventions appropriately, including the key sources of supply chain and operational emissions, food loss, and impacts to biodiversity and people

Company example: Danone strives to be fully certified as a B Corp — businesses that have committed to balancing purpose and profit, across its entire company portfolio by 2025. To date, 50% of its brands and subsidiaries have achieved B Corp certification. To embed this commitment to social and environmental sustainability in its procurement strategies, Danone requires suppliers to adhere to its [Sustainability Principles for Business Partners](#), which covers several fundamental environmental principles, including preserving key natural resources, measuring and minimizing direct and indirect greenhouse gas emissions, controlling environmental risks, and addressing animal welfare. In its 2020 Universal Registration Document,³⁸ Danone notes that it bases its strategy on materiality assessments and TCFD-aligned climate scenario analysis, which reinforced its strategy regarding plant-based products, regenerative agriculture, and approaches to a circular economy.

2. INCENTIVIZE and support agricultural producers to reduce the climate impact of crop and livestock production and enhance agricultural carbon sequestration:

Companies can substantially mitigate emissions by making it easier for agricultural producers to make the economic decision to shift to more sustainable agricultural practices. Financial necessity drives some commodity producers towards unsustainable practices that may have higher perceived returns in the short term. This can be the case in emerging markets, where certain producers may have difficulty accessing credit, but can also occur in developed markets, where the tight economic margins may make producers less willing to test new practices. Importantly, **many practices that mitigate agricultural emissions also have long-term economic benefits to both producers and buyers of agricultural ingredients** from yield and quality improvements, leading to more resilient supply chains.

Examples of ways companies can incentivize sustainable commodity production include:

- **Focus procurement spend** on sustainability produced commodities to expand market demand
- Engage certification bodies and actors along the supply chain to **ensure that financial premiums reach producers**

Agricultural non-CO₂ emissions: Methane and nitrous oxide are considered hard-to-abate emissions in this sector—companies will likely not be able to drive them down to zero. However, implementing enteric methane inhibitors in cattle production, improving manure management, using systems such as anaerobic digestion and composting to convert methane from manure to bioenergy and fertilizer, and optimizing fertilizer application are examples of ways farmers can reduce these emissions, largely with existing technologies.

- **Support producers' access to credit and other financing**, including helping producers achieve legal compliance. For more information, see Ceres' [Investor Primer on Financial Mechanisms to Incentivize Deforestation-Free Commodity Production](#)
- Provide producers with **technical assistance** as needed to facilitate the shift to sustainable practices
- Facilitate the **transition to zero emissions on-farm machinery and irrigation** in owned agricultural operations
- Incentivize the use of **agricultural practices that enhance on-farm carbon sequestration**, such as the use of optimal crop rotations, cover crops, and the incorporation of shade trees into croplands for agroforestry

Companies should prioritize reducing land-based greenhouse gas emissions as much as possible, and specifically eliminating supply chain deforestation as soon as possible, before investing substantially in reforestation (tree planting) efforts. Companies can simultaneously invest in efforts to enhance soil carbon sequestration in agricultural systems along the supply chain. For more information on how investors can accelerate corporate progress on eliminating deforestation and examples of company actions to address supply chain deforestation, see Ceres' [Investor Guide to Deforestation and Climate Change](#).

3. ALIGN capital expenditures, product development, and R&D with a 1.5-degree scenario

Per Indicator 6 of the Climate Action 100+ Net-Zero Company Benchmark: Capital allocation alignment, companies should work to align future capital expenditures with Paris Agreement goals.

Companies along the food and beverage supply chains have a role to play in both avoiding capital expenditures that will “lock” them into a high-emitting trajectory and increasing investments in innovations that drive both supply- and demand-side emission reductions.

Examples of ways companies can shift and strategize future investments include:

- **Support the phase out of hydrofluorocarbons (HFCs)** from refrigeration use along the supply chain
- **Consider the GHG impact** of any new capital expenditures and avoid expenditures that would increase GHG emissions
- **Prioritize expenditures** that reduce emissions and improve resilience, such as infrastructure to improve food storage and avoid food loss, or anaerobic digesters along the supply chain to convert food waste, inedible food by-products, and livestock manure to energy, fertilizer, or compostable materials
- **Integrate lifecycle GHG assessments into product development** and assess the climate impacts of sourcing, production, and post-consumer use of any new products
- **Shift marketing budgets** to lower emissions products and transform the product portfolio to include a greater proportion of plant-based and other lower impact options
- **Make strategic R&D** investments to develop innovative lower carbon products, or technologies such as enteric methane inhibitors that could reduce the GHG emissions associated with current products, in response to growing consumer demand for such products

Company example: As a part of its Net Zero Roadmap, Nestlé commits to transforming its product portfolio to both respond to growing consumer demands and to spur product innovation and further expand the demand for plant-based and other lower-carbon products. It seeks to achieve this both by focusing on driving down the GHG emissions footprint of its products through increased production efficiency and a more circular business model and by investing in R&D to evolve its product offering and shift towards more sustainable alternative ingredients. Nestlé’s efforts also involve educating its employees about climate change so that climate impact is integrated into the product development process.

4. TRANSITION to more efficient and renewable energy use and transportation across operations, distribution, and supply chains:

Companies that address energy use (scope 2 emissions), both by improving efficiency, shifting to renewable energy, and engaging producers of raw materials and inputs on their energy use, can also reduce operational costs related to food and beverage processing and manufacturing. Companies can also mitigate transportation-related emissions by optimizing distribution strategies. Because many companies do not own their own fleet, this may also involve engagement of distribution service providers.

Examples of ways companies can mitigate emissions from energy use include:

- **Improve energy efficiency** by improving operational efficiency, optimizing energy consumption during non-production times, switching to LED lighting systems, and recovering heat energy from production processes
- **Shift to renewable energy** by investing in on-site renewable energy through on-site installation of solar panels and wind turbines and through power purchase agreements, and engage contractors, suppliers, and distributors on energy use
- **Maximize the use of space in vehicles** to increase distribution efficiency
- Optimize transportation routes and locate distribution centres strategically to **increase logistics efficiency and reduce potential food loss**

- **Invest in fleet electrification and support programs to expand charging infrastructure** in markets with existing renewable energy infrastructure; demonstrate demand and support the expansion of renewable energies in other markets

Company example: Unilever achieved its 2020 target of a 40% improvement in emissions efficiency of its global logistics network, largely associated with its logistics suppliers, through network redesign that helped decrease the distance travelled by its contracted fleets and through improved truck utilization that reduced the total number of trucks they used for distribution. Moving forward, the company believes it can deliver an additional 40-50% reduction of GHG emissions from its logistics and distribution network over the next decade by accelerating the transition to zero emissions transport solutions through the increased adoption of intermodal solutions, hydrogen fuel cell and battery electric vehicles, alternate fuels, and last-mile delivery solutions.

5. IMPROVE processing, manufacturing, and packaging practices to reduce emissions and food loss:

Inefficiencies in corporate operations can lead to emissions as well as lost revenue. Food loss within the supply chain, from the farm gate to point of sale, is a major driver of food systems emissions. Recovering this loss by improving food processing and manufacturing practices not only reduces overall emissions from this sector, but it can also allow companies to recover lost revenue.

Examples of way companies can reduce food loss and enhance operational efficiency include:

- **Conduct food loss audits** in their processing, manufacturing, and retail facilities, as well as for distribution practices to identify the amount and key sources of food loss
- **Increase efficiency** in food and beverage processing and manufacturing by maximizing the use of ingredients and optimizing production efficiency
- **Divert food by-products** to other value-added uses, including selling into upcycling markets³⁹
- **Donate food surpluses** to organizations that serve food-insecure populations

- **Shift to more efficient packaging practices** while noting that packaging in some contexts helps mitigate food waste. It is critical that companies prioritize options that use packaging materials efficiently without compromising food storage and shelf life

Company example: Walmart seeks to achieve zero waste, including food and plastic waste, through its global operations by 2025 in Canada, Japan, the U.K., and the U.S. Its three-pronged approach to addressing plastics in its supply chain include working with its suppliers to use less plastic and encouraging consumers to shift away from single use plastics; encouraging the use of packaging that is 100% recyclable and increasing the use of recycled materials, and supporting system-wide improvements to improve recycling infrastructure and spur innovation in more sustainable alternatives. The company has adopted several approaches to tackling food waste, including food donations, composting, animal feed, anaerobic digestion, and biochemical processing. In 2020, it diverted 81% of its waste materials, including food waste and plastic, from landfill and incineration throughout its global operations.

6. PARTNER with peers, suppliers, and policymakers to drive transformations across the sector

Addressing climate risk in an ambitious and timely way requires transformative shifts in corporate procurement and partnership strategies. No company in this sector will be able to transition to a net zero economy through its own efforts alone. Coordination and collaboration are key, both through market-based interventions, such as increasing procurement spend on sustainable commodities, and through pre-competitive strategies, such as participating in multi-stakeholder initiatives that seek to address systemic barriers to transitioning to lower emitting practices. Because companies often shift suppliers and because many companies may source from the same suppliers, companies must coordinate strategies to systematically mitigate climate risk along the supply chain.

Examples of way companies can engage in a sector wide transition to net zero include:

- **Engage suppliers, contractors, and other supply chain actors** on sourcing, energy use, and other actions as outlined in this section, including shifting procurement requirements and implementing non-compliance protocols in addition to providing financial and technical support
- Engage in **pre-competitive approaches** to increase the demand for sustainably produced ingredients and simultaneously facilitate producers to expand the supply of sustainable commodities
- Increase **traceability and transparency** by adopting coordinated disclosure metrics across the sector
- Support **jurisdictional approaches** to eliminate deforestation, as well as **landscape-level sustainability efforts** which address land use change in key geographic areas among multiple private and public sector stakeholders in a region over the long term. For more information, see the Tropical Rainforest Alliance's [Jurisdictional Approaches Resource Hub](#)
- **Support climate policies** at the international, national, and local levels, in line with Indicator 7 of the CA100+ Net-Zero Company Benchmark: Climate policy engagement. For this sector, this may include policies that support producers in a transition to climate smart agriculture, facilitate producers' access to carbon markets, and regulate trade of commodities linked to deforestation
- **Align lobbying practices**, both direct and indirect through trade associations, with the recommendations in this report, noting that for agriculture, non-climate policies such as those regarding agricultural subsidies can influence the ability and rate at which the sector can transition to net zero ⁴⁰



PART 5: RECOMMENDATIONS FOR COMPANY ENGAGEMENTS

As more and more companies set ambitious net zero targets, **it is critical that investors engage companies on the concrete actions they are taking to ensure that they make progress towards their climate goals.** Net zero targets with little description of action plans and an overreliance on offsetting through the voluntary carbon market will expose both companies and their investors to climate risks.

PRIORITIZING TOPICS FOR ENGAGEMENT

Investors are well positioned to drive the transformative changes needed for this sector transition to net zero by engaging on key levers that can be employed at different stages of food and beverage value chains. To do this, investors can prioritize engagement topics for companies in their investment portfolios, based on the type of company and the company’s key sourcing practices and regions.

Engagement topics based on commodity sourcing and geographies

Table 2 summarizes the key commodities with the highest associated greenhouse gas emissions, and the priority topics investors can raise in dialogues with companies about their supply chains based on the company’s key sourcing regions.

Companies typically disclose key commodities that are material to their operations in financial disclosures, but not all companies publicly disclose granular information about the regions they are sourcing those commodities from. This information is critical to understanding what companies must include in their climate action plans to target interventions appropriately along their supply chains. **When this information is unavailable, investors should engage companies on improving supply chain traceability and more transparent disclosures.**

Table 2: Potential topics for engagement based on key commodities and sourcing regions

Commodity	Sourcing region	Example priority topics
Beef and dairy	Brazil, Australia	Deforestation, pasture management
	EU, U.S., Australia	Enteric fermentation, manure management, feed crops
Poultry and eggs	U.S.	Sustainability of feed crop production (e.g. corn and soybeans)
Pork	U.S.	Manure management, feed crops (corn and soybeans)
Rice	China, India, Indonesia	Paddy management, fertilizer use
Maize	Brazil, Argentina	Deforestation
	U.S., China, E.U.	Fertilizer use, machinery, irrigation
Wheat	China, India, Russia, U.S.	Fertilizer use, machinery, irrigation
Palm oil	Indonesia, Malaysia	Deforestation
Soybeans	Brazil, Argentina	Deforestation
	EU, U.S.	Fertilizer use, machinery, irrigation

OTHER SECTORS INVESTORS CAN ENGAGE TO ACCELERATE PROGRESS

In addition to engaging food and beverage companies directly, investors can further accelerate progress by engaging key companies in other sectors that can influence the trajectory of emissions in this sector.

Materials sector: Chemicals – Seed, fertilizer and agricultural chemical providers

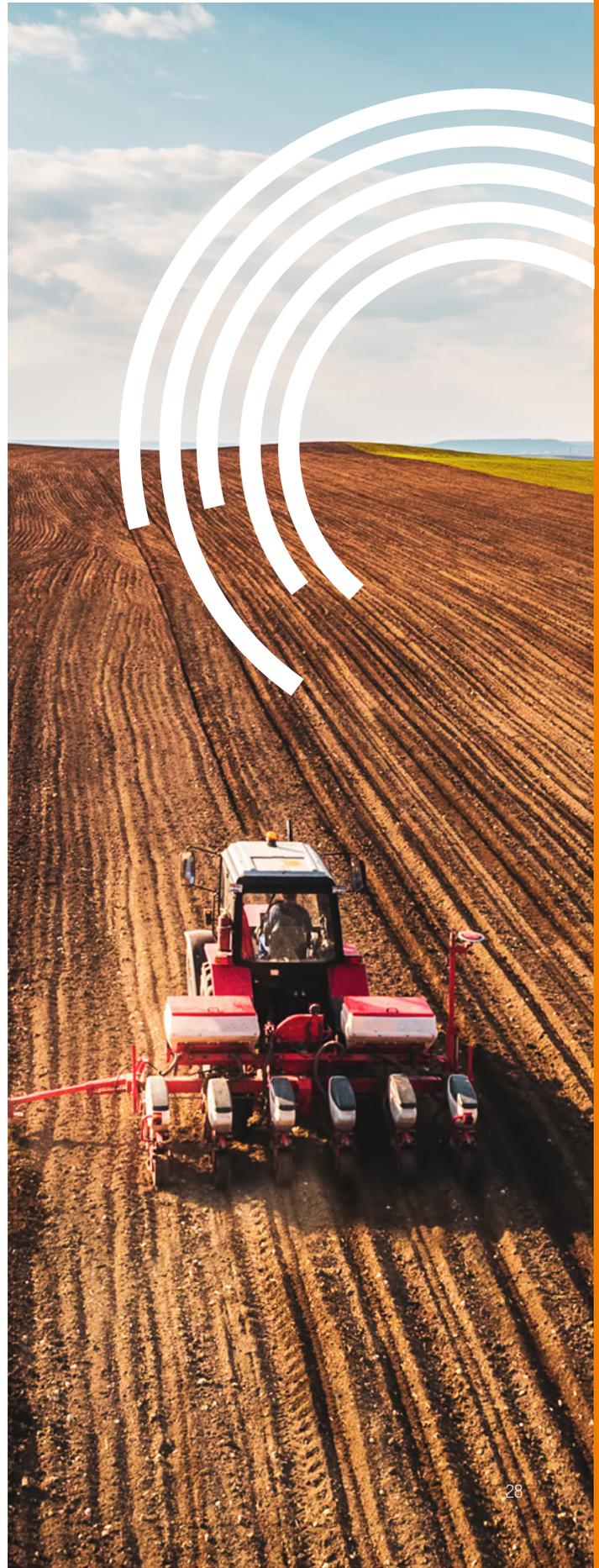
Large mergers in the past few decades have led to increased market concentration in the global seed and agrochemical industries, with the top four firms controlling 70% of the global pesticides market and around 60% of the global seed market.⁴¹ Investors can engage agricultural input providers in their portfolios on developing lower emission fertilizers and seed and crop varieties with climate-resilient and high yielding properties.

Machinery sector: Agricultural and farm machinery manufacturers

Approximately 1 billion tons of agricultural emissions come from on-farm use of machinery and equipment such as tractors.⁴² Currently, the majority of this equipment is fossil fuel-based, but there is an emerging market for zero emissions machinery that utilizes renewable energy. Investors can accelerate emissions mitigation in the food and beverage sector by engaging agricultural machinery companies on electrifying their product lines.

Financials sector: Banks

In emerging markets where much of the commodity-driven conversion of natural ecosystems occurs, financial institutions play a key role in providing credit to agricultural commodity producers. Investors can engage banks on their financing practices, particularly regarding the financing of high emitting practices and their plans to mitigate their financed emissions.



APPENDIX: PROPOSED ADDITIONAL ACTIONS FOOD AND BEVERAGE COMPANIES CAN TAKE TO DELIVER NET ZERO

Climate Action 100+ indicator and description	Proposed supplemental actions and disclosure in the food and beverage sector	Rationale
1 Ambition If the company has set an ambition to achieve net zero GHG emissions by 2050 (or sooner)	A net zero commitment for companies in this sector should include scope 3, indirect emissions embedded in purchased goods and services from land use and land use change, including direct agricultural non-CO ₂ emissions and emissions associated with deforestation and other land use change. Companies should also disclose how much of their targets will be met through the use of carbon credits or carbon removals. Carbon credits should only be used in addition to the company reducing its emissions in line with a 1.5-degree scenario.	Scope 3 emissions from purchased goods and services, and more specifically emissions from agricultural production and land use change upstream in the supply chain, represent the largest portion of companies' emissions profiles in this sector and are thus material disclosures. Including these emissions in net-zero targets is crucial for both companies and the sector as a whole to approach net zero emissions.
2-4 Targets If clearly defined short-, medium- and long-term targets to reduce GHG are in place covering all material emission scopes and aligned to a goal of limiting global warming to 1.5°C	In addition to setting short-, medium-, and long-term targets inclusive of scope 3 emissions, companies should also set robust, short-term no-deforestation and no-conversion targets for their entire supply chain.	An explicit commitment to no-conversion supply chains embedded within corporate procurement policies helps solidify a company's commitment to mitigate supply chain emissions associated with land use change.
5 Decarbonisation Strategy If a decarbonisation strategy to meet its long, medium and short term GHG reduction targets is in place and if it includes a commitment to 'green revenues'	This indicator is elaborated in this report	
6 Capital stock alignment If a company is working to decarbonise its future capital expenditures and discloses the methodology used to determine the Paris alignment of its future capital expenditures	In addition to committing to investing in R&D to generate increased revenue from lower carbon food and beverage products as a part of their decarbonisation strategy, companies should align their other future capital expenditures with what is needed in the transition to net zero, including future investments in commodity and food product storage, locations of key plants and other infrastructure, refrigerants used in storage and retail, and other capital expenditures.	Companies that do not align future capital expenditures with a net zero transition, including consumer trends towards lower-carbon alternatives to meat and dairy products and increasing climate-related regulation, will be increasingly exposed to climate transition risk.
7 Climate policy Engagement If a clear commitment and set of disclosures, clarifying intent to support climate policy, has been developed by the company, together with a demonstration of how direct and indirect lobbying is consistent with this intent	Companies should support international and domestic climate policies, including those that specifically address agriculture such as facilitating farmers' access to credible carbon markets and technical and financial support for sustainable agricultural practices while ensuring that their direct and indirect lobbying and trade associations are aligned with these intents. In addition, companies should support policies related to deforestation and other land use change, including regulations seeking to ban the import of products linked to deforestation.	Agribusiness lobbies are highly influential in many countries, and companies in this sector are well-positioned to National regulatory pressure to limit the import of deforestation-linked commodities can protect in-country food and beverage manufacturers and their investors from key climate-related transition and physical risks while promoting and levelling the field for a more sustainable global supply chain.
8 Climate Governance If the company's board has clear oversight of climate change sufficient capabilities/competencies to assess and manage the risks, if climate targets are included in the executive remuneration scheme	Board-level oversight of climate change should cover management of climate change risks stemming from the company's supply chain, and executive remuneration schemes should also cover supply chain climate impacts and environmental performance.	Because much of this sector's climate impact comes from the supply chain, there should be clear governance over the supply chain's environmental impacts and on the company's procurement strategies and policies.
9 Just Transition If it considers the impacts from transitioning to a lower-carbon business model on its workers and communities	Companies should disclose how they are financially incentivizing sustainable commodity production and the type of support the company is providing either financially or via inputs and other investments. Companies should also support producers in covering additional costs associated with shifting practices in line with new regulations and corporate commitments. More to follow once this indicator is developed.	In accelerating the transition to net zero, companies in this sector should work to address any potential trade-offs that lead to inequities both along the supply chain and among consumers and ensure that the cost of transitioning does not fall solely on neither producers nor consumers.
10 TCFD If it has committed to implement the recommendations of the Taskforce on Climate-related Financial Disclosures (TCFD) and employs climate-scenario planning to test its strategic and operational resilience.	Companies should provide consistent disclosures on scope 3 emissions, including direct emissions from agriculture and deforestation, and include an assessment of the predicted impacts of climate change, both transition and physical, to their operations and to the operations of their key agricultural commodity suppliers.	Few food and beverage companies disclose their full scope greenhouse gas emissions inclusive of scope 3 emissions from land use change and agriculture. For companies in this sector, climate scenario analysis would not be complete without an assessment of the impacts of climate change and the associated transition on suppliers and other upstream actors.

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2. Crippa et al. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*, 2 (March). <https://doi.org/10.1038/s43016-021-00225-9>
3. Clark et al. (2020). Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets. *Science*, 370(6517), 705-708. <https://doi.org/10.5880/pik.2019.001>
4. This report focuses on the following GICS industries: Food and staples retailing, Beverages, and Food products. For more information, please see: MSCI. The Global Industry Classification Standard (GICS). <https://www.msci.com/gics>.
5. CA100+ focus companies in this sector are Bunge, Coca Cola Company, Danone S.A., Nestlé, PepsiCo, Inc., and Walmart, Inc.
6. CA100+ focus companies in the household and personal products industries that source palm oil include Colgate-Palmolive Company, Proctor & Gamble Company, and Unilever PLC. Importantly, palm oil production is often linked to peatland conversion, which has a disproportionate impact on climate change. Thus, these companies may have greater exposure to agricultural emissions even if agricultural commodities do not represent a majority of their material inputs.
7. Scope 3 emissions are also material for household and personal products companies, but a greater proportion of these emissions comes from consumers' use of sold products rather than from purchased goods and services.
8. Downstream food manufacturers are increasing implementing non-compliance protocols related to high emitting practices such as deforestation. For an example, see <https://www.supplychaindiver.com/news/Hershey-end-deforestation-goal-2030-suppliers/596081/>
9. Companies anticipate the need to cut suppliers to comply with the new laws proposed in the EU, which could pose material financial impacts not only for the suppliers who may lose contracts, but also for the buyers who may see losses as they work to stabilize purchasing volumes. For an example, see <https://www.reuters.com/article/cocoa-sustainability-olam-idUSL8N2M73WJ>
10. For an overview of stranded assets from the physical impacts of climate change along agricultural supply chains, see <https://www.eria.org/ERIA-DP-2017-01.pdf>
11. Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360(6392), 987-992. <https://doi.org/10.1126/science.aaq0216>
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13. Tubiello et al 2021 <https://iopscience.iop.org/article/10.1088/1748-9326/ac018e#erlac018es5>
14. A source of discrepancy among estimates of GHG emissions associated with food systems is due to the percentage of deforestation allocated to agriculture, compared to other drivers of deforestation. Agriculture drives 50-80% of tropical deforestation (see Roe et al supplementary information), with the rest driven by timber production, urban development, mining, and other resource extraction.
15. For more information on how investors can engage companies on addressing commodity-driven deforestation, please see Ceres' Investor Guide to Deforestation and Climate Change.
16. Greenhouse gas emissions are typically measured as carbon dioxide equivalents, or CO₂e. According to the IPCC's AR5 100-year Global Warming potential values without climate-carbon feedbacks, nitrous oxide and methane have global warming potentials that are 265 and 28 times that of CO₂, respectively. See the GHG Protocol's guidance on global warming potentials here: https://ghgprotocol.org/sites/default/files/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf
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18. Rice-driven methane emissions come from the anaerobic conditions created by flooding rice fields for a greater part of the growing season. Alternative methods, such as dryland rice farming or wet-dry irrigation systems, can reduce methane emissions, but have yet to generate large-scale uptake. <https://drawdown.org/solutions/improved-rice-production>
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21. World Resources Institute, Development & World Business Council for Sustainable. Greenhouse Gas Protocol. <https://ghgprotocol.org/>
22. The sectoral decarbonization approach presents a way for companies to set science-based targets based on allocation of the global carbon budget to different sectors. For more information, see Science Based Targets (2015). Quick Guide to the Sectoral Decarbonization Approach. <http://sciencetargets.mudbank.uk/resources/files/A-Quick-Guide-to-the-Sectoral-Decarbonization-Approach.pdf>. For more information on the project underway for target setting in the Forest, Land and Agriculture sector, see Science Based Targets (2020). Forest, Land and Agriculture (FLAG). 1-8 <https://sciencebasedtargets.org/sectors/forest-land-and-agriculture>
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24. The food and beverage sector does not yet have an established, sector-specific pathway for emissions reductions in line with a 1.5-degree or 2-degree global scenario that encompasses all emissions sources from the sector, due to the range of emissions sources and differing ways to set a sector boundary.
25. Half of the emissions from agriculture, food, and other land use currently come from direct emissions of methane, nitrous oxide, and carbon dioxide from agricultural production and on-farm fossil fuel use. The other half are emissions from land use, land use change, and forestry, including the emissions associated with deforestation and the conversion of other natural ecosystems. Although some of these emissions may be associated with other sectors such as forestry, food and beverage companies will have a large role to play given that much of the land conversion emissions are driven by agricultural expansion.
26. For Roe et al's review of literature, including emissions mitigation ranges for the different land-based interventions, please see the supplementary information (available publicly). <https://www.nature.com/articles/s41558-019-0591-9#Sec18>
27. Potential tradeoffs that are critical to consider include the potential for emissions mitigation and sequestration to come at the expense of food security, if interventions limit the overall quantity of food that can be produced; and the potential for increased competition of land if there is an overreliance on interventions such as reforestation and afforestation to meet the mitigation targets for this sector as a whole.
28. Based on estimates from Poore and Nemecek (2018) (2.4 GtCO₂e from retail, packaging, transport and food processing) and Crippa et al (2021) (3.1 GtCO₂e from the same processes). These estimates were then divided by the total emissions allocated to the food sector, 13.6 and 17.9 GtCO₂e, respectively.
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31. Food loss refers to food that spills, spoils, is reduced in quality, or otherwise gets lost or discarded before it reaches the consumer, and typically occurs during production, storage, processing, and distribution stages of the food value chain. Food waste refers to food that is of good quality and fit for human consumption but is discarded or left to spoil. Food waste typically occurs in the retail and consumption stages of the value chain. <https://www.wri.org/insights/numbers-reducing-food-loss-and-waste>
32. Clark et al. (2020). Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets. *Science*, 370(6517), 705-708. <https://doi.org/10.5880/pik.2019.001>
33. IPBES (2020). The Global Assessment Report on Biodiversity and Ecosystem Services - A summary for policymakers. https://ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_en.pdf#page=13
34. Dinerstein et al. (2019). A Global Deal for Nature: Guiding principles, milestones, and targets. *Science Advances*. <https://doi.org/10.1126/sciadv.aaw2869>
35. Climate smart agriculture refers to an approach to agriculture that sustainably increases productivity and incomes, adapts to climate change, and reduces greenhouse gas emissions where possible. <http://www.fao.org/climate-smart-agriculture/overview/en/>
36. Ceres (2020). Investor Guide to Deforestation and Climate Change. <https://engagethechain.org/investor-guide-deforestation-and-climate-change>
37. For more information on what companies in this sector should include in their TCFD-aligned climate scenario analyses, see the WBCSD's Food, Agriculture and Forest Products TCFD Preparer Forum: <https://docs.wbcsd.org/2020/04/WBCSD-TCFD-Food-Agriculture-and-Forest-Products%20AC-Preparer-Fourm-report.pdf>
38. Danone (2020). 2020 Universal registration Document. <https://www.danone.com/investor-relations/publications-events/registrations-documents.html>
39. Upcycled food refers to foods that use ingredients that would have otherwise ended up in the landfill, and using them to create value-added products for human consumption. For more information, visit the Upcycled Food Association's website: <https://www.upcycledfood.org/>
40. Lobbying in this sector, both on climate and more general topics, can influence the sector's ability to transition. See <https://insideclimatenews.org/news/02042021/meat-dairy-lobby-climate-action/>
41. The top four firms include CA100+ focus companies: BASF SE and Bayer AG. For more information, see: Clapp (2021) The problem with growing corporate concentration and power in the global food system. *Nature Food* 2, 404-408 <https://doi.org/10.1038/s43016-021-00297-7>
42. McKinsey & Company (2020). Agriculture and Climate Change: Reducing emissions through improved farming practices. <https://www.mckinsey.com/-/media/McKinsey/Industries/Agriculture/Our%20Insights/Reducing%20agriculture%20emissions%20through%20improved%20farming%20practices/Agriculture-and-climate-change.pdf>

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