Food, Agriculture and Forest Products TCFD Preparer Forum

Disclosure in a time of system transformation: Climate-related financial disclosure for food, agriculture and forest products companies

April 2020

In collaboration with:

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Executive summary

1 Executive summary

The production, transformation and distribution of food, agriculture and forest products are routine and essential aspects of global society. These sectors are critical for people's health, survival and well-being, providing food, buildings, packaging and infrastructure. They also support the livelihoods of millions of people through their multi-tiered and complex value chains.

Food, agriculture and forest products are susceptible to both the transitional and physical impacts of climate change. There will be change inherent in the move from business-as-usual to a low carbon economy while regulation, markets and consumers will shape operational practices and product offerings. Long-term temperature change will impact agricultural and forestry yields and extreme weather events have the potential to cause disruption across value chains.

For companies to develop and maintain resilience in the context of climate change, production and consumption must adapt and transform. The food, agriculture and forestry sectors need to reduce emissions and become a net carbon sink – restoring the environment, enhancing biodiversity and improving soil health. Production systems must transform to achieve greater productivity, resource efficiency and resilience to climate variability. These imperatives create business opportunities for companies to provide solutions and those who capitalize on them while adapting and transforming to mitigate the risks will be most resilient in an uncertain future.

The Food, Agriculture and Forest Products Task Force on Climate-related Financial Disclosure (TCFD) Preparer Forum ("the Forum") is a collaboration between Mondi, Nestlé, Olam, Stora Enso, Syngenta, Unilever and the World Business Council for Sustainable Development (WBCSD). Its aim is to advance the implementation of the recommendations of the TCFD by providing commentary on members' individual experiences, supported by examples of effective practices.

Three years on from the release of the TCFD's recommendations, corporate reporting on climate change is evolving in line with the TCFD's anticipated five-year "implementation path". The 2019 TCFD Status Report showed progress but the pace of implementation by companies has been slow. There is scope for improvement in disclosure practices with specific areas requiring greater clarity including the potential financial impact of climate-related issues and the resilience of company strategies under different climate scenarios.

In this report, Forum members explore some of the challenges associated with climate-related financial disclosure. They provide examples of individual company approaches and make proposals about how disclosures might evolve and be enhanced. Members' commentary is supported by external perspectives from investors and other stakeholders who use climate-related financial disclosures to assess and quantify risk and to decide how to allocate financial capital.

MAIN FINDINGS AND THEMES FROM THE REPORT

Risk management: Managing the unique characteristics of climate risk - Forum members' climate-related risk management approaches are evolving in response to the unique characteristics and challenges associated with climate change risk. Burgeoning risk management techniques are extending the time horizon of risk assessments, monitoring risk from multi-dimensional perspectives and relying on collaboration between internal and external experts across disciplines.

Chapter 3 includes an illustration of key transition and physical climate change-related risks and opportunities and how they might impact food, agriculture and forest product companies' direct operations, financial performance, supply chains and customer base. In Chapter 4, the Forum goes on to describe some of the key factors and steps in the assessment and prioritization of physical climate-related risk.

Strategy: Climate-related transition and mitigation opportunities - Forum members are pursuing and disclosing information about opportunities to develop solutions and products that support the low carbon transition. These include technology-enabled agricultural and forestry practices, investments in natural climate solutions, healthy and sustainable food products, and circular bio-based solutions.

As illustrated in Chapter 5, disclosures related to climate-related opportunities often include case studies about solutions and products and key messaging relating to their potential impacts. Some Forum members are beginning to include financial disclosures such as research and development expenditure and potential financial performance, as well as development of sales, earnings before interest and taxes (EBIT), expenditure, market size and growth.

Strategy and governance: Business resilience and decision-making - Business resilience refers to the way in which a company's strategy supports and prepares to maintain resilient operations under different climate scenarios.

In Chapter 6, Forum members show how they are demonstrating resilience by disclosing how climate considerations are integrated into corporate processes, risk mitigation and adaptation, innovation and investment in new products and services that leverage opportunities associated with climate change. Members are also conducting pilot scenario analysis to explore the business resilience of key material and at-risk commodities and geographies under different transition pathways. This analysis supports members' decision-making in the context of complex and uncertain future.

Metrics and targets: Measuring impact, performance and response - Forum members disclose operational metrics about business impacts including greenhouse gas (GHG) emissions, water consumption and energy usage. Members also measure the impact of products across their value chains and are exploring climate-related financial metrics that can support these assessments

In Chapter 7, members have included a table of illustrative metrics that are potentially useful in climate-related financial disclosures by food, agriculture and forest product companies. These metrics relate to activities ranging from finance and operations to mitigation and adaptation and may be evaluated by companies to identify relevant, useful and material metrics for their reporting objectives.

Conclusion: Collective responsibility and opportunity for enhancing disclosure - Forum members are committed to enhancing climate-related disclosures through continued collaboration with other companies and with users of disclosed information. In common with other companies, Forum members contend that individual, corporate and global goals to address climate change and associated disclosures will be most effectively achieved through collaboration.

Members call for collaborative efforts to develop complex decision-making techniques using scenario analysis by sharing knowledge and data and building communities of practice. They also call on investors to recognize and reward positive climate action and resilience measures. Finally, they call on policy makers to develop clear and consistent long-term frameworks aligned with climate, agricultural, food and forestry science to create a stable and enabling operating environment. This will allow companies to optimize both business and climate performance.

2 Introduction

2 Introduction

Background to the Food, Agriculture and Forest Products TCFD Preparer Forum

MEMBERSHIP AND PURPOSE

The Food, Agriculture and Forest Products TCFD Preparer Forum is made up of representatives from Mondi, Nestlé, Olam, Stora Enso, Syngenta, and Unilever.

Established in July 2019, its work is coordinated by the WBCSD.

Forum membership is aligned with the Agriculture, Food and Forest Products grouping of non-financial industries identified by the TCFD in the Annex to their Final Report. However, its members do not represent all activities within that grouping. Membership of the Forum is deliberately restricted to a small number of companies because of the limited time the Forum had to complete its work.

Forum member companies represent different sectors and activities associated with food, agriculture and forest products. The senior management of member companies have made public statements of support for the TCFD's work and have welcomed the initiative to enhance transparency regarding climate-related financial risk.

FORUM MEMBERS

Gladys Naylor - Mondi
Christian Ramaseder - Mondi
Martina Strassl - Mondi
Eva Babinec - Mondi

Duncan Pollard - Nestlé
Javiera Charad - Nestlé

Chris Brown - Olam
Ravi Abeywardana - Olam

Roy Antink - Stora Enso
Joni Mäkitalo - Stora Enso
Johan Holm - Stora Enso
Antti Marjokorpi - Stora Enso

Marina Prada - Syngenta
Heidi Nielsen - Syngenta
Kirsten Elce - Syngenta

Sabina Nealon - Unilever
Jonny McCaig - Unilever
Paula Rutherfoord - Unilever

ABOUT THIS REPORT

In this report, the Forum provides a commentary on key areas of the TCFD's recommendations based on members' individual experience of implementing them. This commentary is supported by examples of effective practice that are consistent with the recommendations.

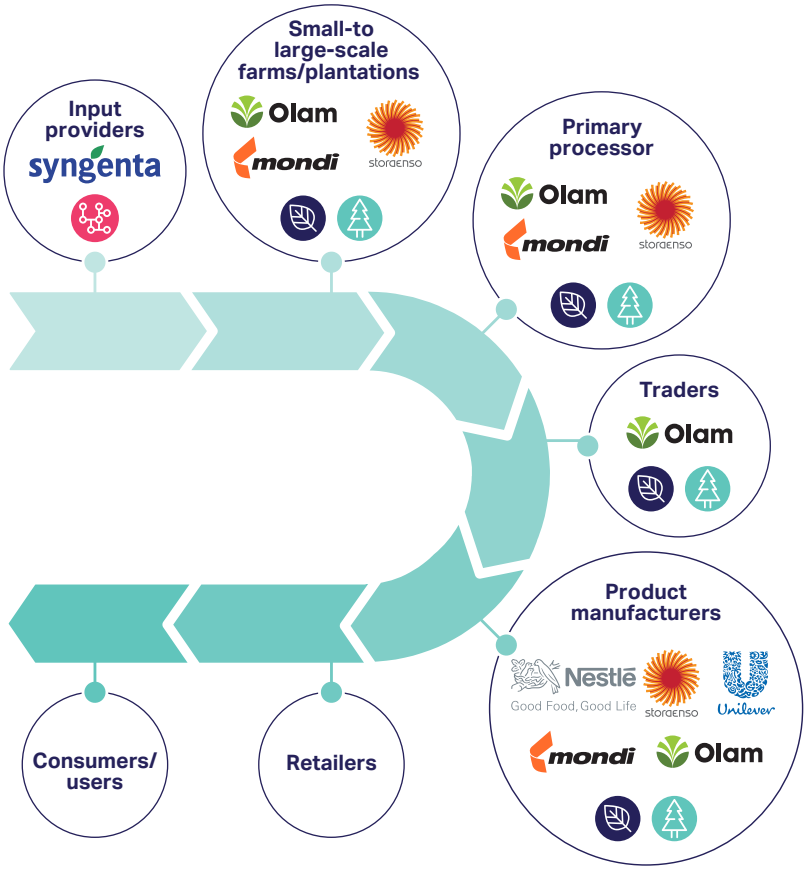
The report also includes proposals about how disclosures might be enhanced over time. Given its publication date, most examples are taken from Forum members' 2018 Annual Reports and public materials. Where the publication dates of Forum members' 2019 Annual Reports allow, some examples from 2019 disclosures are included. The exception is Chapter 7 Metrics and Targets, where all examples originate from 2018 disclosures.

The Forum received valuable input from the TCFD Secretariat, representatives from the University of Lancaster and a limited group of self-selected users of climate-related financial disclosures across a range of investor and data user types and institutions. The purpose of this engagement was to seek views on how companies can maximize the usefulness of disclosures for financial market participants. Stakeholder comments have been summarized and are presented anecdotally as "user perspectives". Readers should recognize the limited nature this external engagement and anecdotal input.

The absolute and relative impacts of climate-related transition and physical risks vary between producers and processors of food and fiber (see context below). In addition to sharing the experience of individual member companies in implementing the TCFD's recommendations, the Forum has explored the responses of companies at different nodes in the value chain and how this translates into climate related financial disclosures.

In this report, reference to 'the Forum' includes only those parts of food, agriculture and forest products sectors and value chains represented by Forum members. Figure 1 depicts a simplified value chain and indicates the position(s) of Forum member companies within the value chain.

Figure 1: Simplified, illustrative food, agriculture and forest product value chain incorporating indicative positions of Forum members



PURPOSE OF THE REPORT

- Reflect the current state of climate-related financial disclosure by highlighting how Forum member companies are implementing the TCFD recommendations, giving practical examples of effective disclosure.
- Provide insight into particular disclosures that demonstrate the role of Forum members individually and collectively in managing climate-related risks. These include transition risks, and the work to enable the low carbon transition as well as efforts to mitigate and adapt to physical climate-related risks.
- Provide recommendations on how climate-related financial disclosure could continue to develop in the future.

WHO THE REPORT IS FOR

- Food, agriculture and forest product companies seeking to enhance their climate-related financial disclosures.
- The TCFD, in order to provide input into further deliberations on how the recommendations should evolve over time.
- Investors and users of climate-related financial disclosures seeking to understand the current state of disclosure practice and its scope for development over time.
- Organizations the TCFD has identified as making valuable contributions towards adoption of the recommendations, including stock exchanges, investment consultants, credit rating agencies, organizations that develop climate-related scenarios etc. so that they can consider what further work is required to support and enhance climate-related financial disclosure.
- Companies from all industries looking to implement the TCFD's recommendations.

The **structure** of the report reflects Forum members' agreed work plan which was influenced by known challenges associated with climate-related financial disclosure. For example, the TCFD's June 2019 Status Report identified disclosure of strategic resilience against climate change risks as a priority area for improvement across all sectors.

The **focus** of the report is on the TCFD's recommendations and climate-related financial disclosure. However, Forum members note that climate change risks and opportunities are strongly linked with other sustainability issues and complementary initiatives on sustainability, such as low carbon circular economy practices, which also have some application to climate-related financial disclosure.

INITIAL STEPS FOR IMPLEMENTING THE TCFD'S RECOMMENDATIONS

The TCFD's recommendations were established to help organizations understand, manage and disclose appropriately the risks and opportunities they face around climate change. All Forum members support the TCFD recommendations and have begun their journey of implementation. Drawing upon their learnings and experiences of implementing TCFD, the Forum suggests some initial steps for companies that are developing their climate disclosure practices.

TIPS FOR TCFD IMPLEMENTATION

Board level governance:

- A mandate from the board helps to elevate the importance of climate issues;
- Strong governance and decision-making processes at board-level support management's work. Those processes will determine the frequency with which the board must be updated about risks. For example, more frequent updates on transition risks may be required in the short-term to inform near term investment decisions.

Secure senior management support:

- Securing C-suite support is essential when implementing the TCFD recommendations, particularly the support of the Chief Financial Officer (CFO). Gaining the support of a C-suite member helps to:
    - Secure the necessary resources for implementation;
    - Obtain space in the annual report for climate-related financial information;
    - Agree leadership, oversight and sign off formalities related to TCFD disclosures.

Mobilize a multidisciplinary team:

- An interdisciplinary team and process supports an integrated approach from those with influence over strategic, operational and investment decisions;
- Representatives with different skill sets and from different functions, including sustainability, risk management, finance, investor relations, commercial, communications, operations, research and development (R&D), procurement and strategy, bring important insight and expertise and help to ensure climate-related issues are integrated into the company.

Understand your baseline:

- A gap analysis is a useful exercise to identify and understand whether current climate-related financial disclosures meet the TCFD's recommendations;
- Guidance and frameworks that complement the TCFD's recommendations – such as resources developed by Accounting for Sustainability and the Climate Disclosure Standards Board – offer implementation support.[1, 2]

3 Context: Food, agriculture and forest products and the climate challenge

3 Context: Food, agriculture and forest products and the climate challenge

THE LOW CARBON TRANSITION CHALLENGE IN THE FOOD, AGRICULTURE AND FOREST PRODUCTS SECTORS

Globally, the production, transformation and distribution of food, agricultural and forest products are routine and essential aspects of society. As well as providing food products essential for survival, wood and paper products are crucial for buildings, infrastructure and packaging and the food, agriculture and forest products sectors support the livelihoods of millions of people through their complex, multi-tiered value chains.

However, the provision of these vital services has come at a cost. At different times throughout human history, demand for food, fuel and, to a lesser extent, fiber has driven the expansion of plantations and agriculture and resulted in the clearance of natural ecosystems around the world. In parallel, population growth and rising consumption has led to freshwater scarcity and loss of natural systems and biodiversity. The rate of soil erosion is currently estimated to be between 10 to 100 times higher than soil formation[3] and emissions from land use account for almost one-quarter of anthropogenic greenhouse gas (GHG) emissions, with agriculture making up a significant proportion.[3] The main sources of agricultural emissions are livestock production, inefficient application of chemical fertilizers, diesel and gasoline use, land use change and manure management.[4]

Certain commodities have particularly high emissions; for example, the cultivation of rice relies on carbon intensive flooding which releases methane into the atmosphere and is responsible for 24% of global agricultural methane emissions.[5]

This concentration of GHG emissions at the point of production means that companies further downstream in agricultural supply chains – such as product manufacturers and retailers – tend to be characterized by having relatively small scope 1 and 2 emissions and larger scope 3 emissions.[6] Value chain emissions due to food loss and waste during the journey from farmer to consumer are also material for downstream companies – some 14% of the world's food is lost from production before reaching the retail stage.[7]

In the face of these challenges, pioneering companies are taking transformative steps to mitigate GHG emissions in agriculture and to actively sequester carbon in line with the goals of the Paris Agreement. Steps include investing in transformative agricultural technologies, improving soil health,[8] restoring ecosystems and working to prevent deforestation through operational improvements and engagement with suppliers.

It is essential that sustainable agriculture becomes commonplace to meet the goals of the Paris Agreement and ensure the food system retains its collective license to operate.

Forestry companies producing fiber products tend to have significant scope 1 and 2 GHG emissions due to the energy needed to power mills and packaging plants.[9] On the other hand, forests are an important carbon store and sustainable forest management offers opportunities to support resource efficient bio-based and circular business models. There are already public sector incentives that encourage greater use of wood-based products in energy, building materials and construction (e.g. EU 2020 Climate and Energy Package).

The eventual impacts of climate-related transition risks depend very much on the actions and decisions taken by companies and governments now. Introduction of carbon pricing and regulation mandating reporting/measurement of scope 3 and product-level emissions will require investment, while policies and regulation restricting agricultural expansion could increase the cost of raw materials. Companies that fail to respond to changing markets and consumer preferences could see a reduction in demand for their products and, ultimately, in sales. Those unable to meet societal expectations and those perceived not to be acting on climate change are exposed to reputational risks that could lead to loss of market share, reduced revenues and even legal action, be it directly or indirectly associated with climate change-related risks.

There is a strong business case for companies to embrace opportunities to support transformative climate solutions through their supply chains, operations, products and services. Recent shifts in public sentiment away from plastic packaging have demonstrated the power and velocity of public opinion to change behavior.[10] Producers of fiber-based products are already benefiting from strengthened consumer preference for renewable, fiber-based alternatives to plastic. The food industry is also seeing shifting consumer demands as certain market segments move towards plant-based diets for a variety of reasons, including environmental concerns.[11]

While companies are taking individual action to address their climate risks and influence their supply chains, the most effective solutions require whole-scale systems transformation. This will require the private sector, governments and society to act together, at the same pace and according to the same objectives to address climate change.

RESILIENCE IN THE FACE OF THE PHYSICAL IMPACTS OF CLIMATE CHANGE

The physical impacts of a changing climate threaten the long-term resilience of the food, agriculture and forest product sectors. Long-term temperature change will have a range of positive and negative impacts on yields, depending on the region and commodity. Boreal forests, for example, are expected to benefit in the shorter term from climatic changes in certain production areas,[12] while heat stress and increased prevalence of disease are predicted to cause significant reductions in growth, yield and quality of several agricultural crops.[13] Around the world, forest diversity and pest resilience are expected to decline and the incidence of droughts and fires is expected to increase.[14] Extreme weather events have the potential to cause disruption across value chains, limiting or even halting manufacturing processes, production capacity and distribution networks. Sea level rise and saltwater intrusion could see a reduction in usable cropland, while losses to biodiversity threaten agricultural resilience and crop productivity.[15]

Building the resilience and ability of smallholder farmers to enable them to respond to the physical challenges presented by climate change is particularly critical.[16] Companies are investing in climate-smart agriculture initiatives in their value chains and working on the ground with farmers in productive landscapes to increase productivity, reduce and sequester emissions and enhance their resilience.[17] At the same time, they are exploring how technological innovation can be used to enable the transformation required. Similarly, forest product companies are building strategic partnerships to expand forest certification among small- and medium-sized private forest owners and increase awareness of climate change.[18]

RESILIENCE FOR A RANGE OF POTENTIAL FUTURE SCENARIOS

In the context of the challenges, companies' long-term resilience depends on the successful adaptation and transformation of current production and consumption systems. Food, agriculture and forest products industries need to reduce emissions and become net carbon sinks, restoring the natural resource base and improving biodiversity and soil health.[19] Production systems must be transformed to achieve greater productivity, resource efficiency and resilience to climate variability in the context of a range of future potential scenarios.

CLIMATE-RELATED RISKS AND OPPORTUNITIES FOR FOOD, AGRICULTURE AND FOREST PRODUCTS COMPANIES

Forum member companies routinely disclose details of the climate-related risks and opportunities that have current or anticipated future effects on their businesses. Beyond the action of individual entities, collaboration within and between companies in the food, agriculture and forest products sectors offers powerful scope for addressing climate-related risks and opportunities.

Public corporate disclosures generally focus on the performance of individual entities and rarely articulate instances where progress to address climate change risks and opportunities depends on collaboration. The absence of disclosures that demonstrate the benefits of collective action limits the potential for investors to allocate finance and drive investment towards jointly developed climate-related solutions. It also limits investors' ability to recognize the variation in timing, impact and intensity of risks and opportunities depending on, amongst other things, where in the value chain companies operate.

Tables 1 and 2 below are designed to illustrate some of the common and differentiated transition and physical climate change-related risks and opportunities affecting food, agriculture and forest product companies. These risks and opportunities potentially impact companies' direct operations, financial performance, supply chains and customer base. However, the extent of the potential impact depends on the individual and collective actions companies take to manage their risks and opportunities. The more prepared and forward-looking a company is, the better placed it will be to maximize opportunities in the low carbon transition, while mitigating and managing climate-related risks.

Industry types key

- Input providers
- Food and agriculture producers and sellers
- Forest products

Table 1: Transition risks and opportunities

RISK/ OPPORTUNITY CATEGORY	INDUSTRY TYPE	TRANSITION RISKS/ OPPORTUNITIES	POTENTIAL FINANCIAL IMPACT		
			CATEGORY	IMPACT	DETAIL
Policy and legal		Increased pricing of GHG emissions (e.g. EU Emissions Trading System (ETS), California cap-and-trade) or costs to comply with other relevant regulation (e.g. taxes on food waste etc.)	Operating costs	↑	Particularly material for manufacturing and production sites.
			Competitiveness	↑ ↓	Regional GHG pricing schemes have the potential to impact competitiveness between operators based in different regions.
			Capital investment	↑	Required for transition to lower emissions or more efficient technologies.
			Sensitivity to future price changes	↓	Companies that reduce their exposure to GHG emissions will have less sensitivity to changes in the cost of carbon and will be more competitive as a result.
			Competitiveness	↑ ↓	Rising demand for low carbon materials and products.
			Revenues	↑	Forest product companies have potential new revenue streams around the sale of carbon credits.

RISK/ OPPORTUNITY CATEGORY	INDUSTRY TYPE	TRANSITION RISKS/ OPPORTUNITIES	POTENTIAL FINANCIAL IMPACT		
			CATEGORY	IMPACT	DETAIL
Policy and legal		Requirements to provide detailed environmental information at product level (e.g. scope 3 emissions or sequestered carbon) in different jurisdictions	Operating costs	↑	Requirements to measure and provide new environmental information, particularly if standards or methodologies vary regionally.
			Revenues	↑ ↓	Changes in demand for products based on more detailed environmental information.
		Increased cost of raw materials due to transition-enabling policies preventing agricultural expansion into new areas (e.g. government moratoriums on peatland)	Production costs	↑	Higher input prices.
			Revenues	↓	Reduced production capacity.
		Changes in government subsidies or regulations around the use of agricultural products or areas allowed to be planted with certain crops	Revenues	↑ ↓	Changes to demand for products and services.
		Regulations that promote biomass-based energy production and green building materials present opportunities for sales of bio-based products, for example forest energy biomass and green wood products	Capital investment	↑	Increased capital investment in R&D to meet demand for new products e.g. requirement for wood construction materials.
			Revenues	↑	New revenue streams from sales of forest energy biomass and wood building materials.
		Increased logging tax in producing countries or regulation of harvesting volume to prevent deforestation	Costs	↑	Increased costs for timber procurement.
		Regulations that encourage reforestation and afforestation of degraded areas	Revenues	↑	Opportunities associated with tax bonuses and other government incentives.
			Costs	↓	
Technology advances		Development of new low carbon manufacturing solutions (e.g. natural refrigerants that could replace hydrofluorocarbons (HFCs))	Operating costs	↑	Capital investment in new technologies (e.g. those required to develop safe and efficient natural refrigerant solutions and to phase out existing HFC appliances).
		Technological advances enabling efficiency gains in use of resources, production and distribution processes (e.g. development of ultrafiltration to enable waste water reuse)	Operating costs	↓	Efficiency gains, cost reductions or reduced reliance on external input sources (e.g. reduced water consumption and reliance on external sources, reduced risk of shutdown in operations due to water shortages).
			Sensitivity to future price changes	↑ ↓	Reduced risk of exposure to future energy and other input price increases (depending on the success of efficiency measures).
		Development of products which enable the low carbon transition (e.g. inputs that increase yield, prevent the need for further farmland expansion, or advances precision agriculture)	Revenues	↑ ↓	Changes to demand for products and services dependent on ability to meet demand and provide new solutions.
		Development of new low carbon products that reduce or sequester carbon (e.g. increases to carbon content of soil) or can substitute for fossil fuel-based products (e.g. lignin, formed fiber bio composites)	Revenues	↑	Changing demand for products and services and the development of new revenue streams for new products and services.

RISK/ OPPORTUNITY CATEGORY	INDUSTRY TYPE	TRANSITION RISKS/ OPPORTUNITIES	POTENTIAL FINANCIAL IMPACT		
			CATEGORY	IMPACT	DETAIL
Market changes		Changing consumer preferences towards products seen as better/ worse for the environment (e.g. dietary shifts towards low carbon products, inputs that increase yield and prevent further farmland expansion or renewable packaging and construction materials)	Revenues	↑ ↓	Changes to demand for low emission products and services based on a company's ability to reflect shifting consumer preference in their product portfolio and provide new solutions.
		Demand for food and bioenergy is increasing with global population and could outcompete wood material production, jeopardizing supply	Production costs	↑	Increased demand and pressure on existing resources increases input prices (e.g. wood, energy and water) and output requirements (e.g. wastewater).
		Changes in demand for and use of renewable carbon-neutral products or by-products that can complement and/or substitute similar fossil fuel-based products for internal energy generation (e.g. saw dust residue from solid wood products), or for higher value raw materials for other industries (e.g. packaging or construction)	Revenues	↑ ↓	Dependent on ability to meet demand for lower emissions products and services.
Reputation		Increased stakeholder concern or negative/positive stakeholder feedback if a company is perceived to not be/to be living up to customer or societal expectations on climate action	Revenues	↑ ↓	Changes to demand for products and services dependent on ability to fulfill customer expectations.
		Prioritization of standing forests over sustainably managed forests as a result of negative reputation due to challenges by some non-governmental organizations (NGOs) and other actors	Revenues	↓	Decreased demand for products and services due to negative impacts on reputation.
		Diverse perceptions around the means to achieve food security and the impact of food production practices on the environment and communities (e.g. the role of agricultural inputs)	Revenues	↑ ↓	Changes in demand for products and services based on the perception of its impact.
		Companies face reputational risks and a threat to their license to operate if they take strategic decisions to ensure business resilience that neglect to account for the resilience of communities in which they operate and depend upon	Revenues	↓	Decreased demand for products and services due to negative impacts on reputation.
		Acceptability of sustainable forest management and working forests as a recognized natural climate solution	Revenues	↑ ↓	Dependent on recognition of the value of working forest investments.

Table 2: Physical risks and opportunities

RISK/ OPPORTUNITY CATEGORY	INDUSTRY TYPE	PHYSICAL RISKS/ OPPORTUNITIES	POTENTIAL FINANCIAL IMPACT		
			CATEGORY	IMPACT	DETAIL
Acute		Increased incidence and severity of extreme weather events such as cyclones and floods	Capital costs	↑	Damage to property and assets.
			Revenues	↓	Decreased production capacity due to business interruption to manufacturing operations and supply chains right down to losses at farm and plantation level.
		Failure of farmers to adapt to climate change and build physical resilience to extreme weather events	Revenues	↓	Decreased production capacity and demand for products and services.
			Costs	↑	Procurement costs to find new suppliers.
			Revenues	↑	Demand for new products and services to help farmers adapt and build resilience in the transition.
		Increased opportunity and demand for solutions to improve crop resilience (e.g. water efficiency, drought and heat tolerance, as well as soil carbon sequestration)	Revenues	↑	New products and services (e.g. products that provide greater resilience to extreme weather events).
		Temperature extremes may include occurrence of severe frost periods in the subtropics causing damage to tree species (e.g. Eucalyptus)	Capital costs	↓	Damage to tree species requiring expenditure to facilitate alternative water sources and/or replace lost trees.
Chronic		Rising mean temperatures and changes in precipitation patterns causing water stress in certain regions	Operating costs	↑	Disruption to the supply of quality agricultural raw materials, increasing their prices, and disruption to manufacturing sites.
			Revenues	↓	Decreased production capacity as a result of pricing changes and disruption.
		Rising sea levels	Revenues	↓	Decreased production capacity due to reduced availability of land for agriculture or forestry.
			Capital costs	↑	Damage to facilities and assets in coastal areas (e.g. mills or factories) and logistical problems for distribution networks.
		Long-term climatic changes in mean temperatures and precipitation patterns	Revenues	↑ ↓	Impacts on crop quality, yields and length of harvesting periods resulting in changes to production capacity. Also creates potential new investment opportunities.
		Long-term changes in weather patterns impacts seed production and the ability to meet local supply requirements	Operating costs	↑	Low seed production as a result of weather changes and potential ongoing shift in production areas.
		Failure of farmers to adapt and build resilience to rising temperatures and changes in precipitation patterns	Revenues	↓	Due to decreased production capacity should farmers fail to adapt to climate change affecting their ability to grow crops.
			Costs	↑	Procurement costs to find new suppliers.
			Revenues	↑	Demand for new products and services to help farmers adapt and build resilience during the transition.

RISK/ OPPORTUNITY CATEGORY	INDUSTRY TYPE	PHYSICAL RISKS/ OPPORTUNITIES	POTENTIAL FINANCIAL IMPACT		
			CATEGORY	IMPACT	DETAIL
Chronic		Increased precipitation may cause soft and eroding forest soils and forest roads	Costs	↑	Impact on the ability to harvest and transport wood increases the cost of raw materials.
		Rising mean temperatures increases the risk of water stress and forest fires, as well as the risk of typhoons in certain areas	Revenues	↓	Decreased production capacity as a result of loss or damage to forests and plantations. Reductions in precipitation can create water constraints which limits water use in production mills and result in production losses.
		Increases in mean temperature leading to changes in tree species composition and increased susceptibility of forests to insect and disease outbreaks	Revenues	↓	Decreased production capacity as a result of loss or damage to forests and plantations.
		Tree growth and timber yield in some geographical locations are predicted to increase as a result of gradual increases in temperature, precipitation and CO_2 levels in the atmosphere in some areas	Revenues	↑	Increased production capacity and new investment opportunities.
		Volume reduction in water sources for pulp mills can modify/ concentrate the chemical composition and temperature of water sources	Capital investment	↑	R&D spend needed to adapt to different chemical compositions and higher temperatures of water sources for pulp mills.

4 Risk management: Managing the unique characteristics of climate risk

4 Risk management: Managing the unique characteristics of climate risk

SUMMARY:

- Forum members' climate-related risk management approaches respond to the particular characteristics and challenges associated with climate-related risk.
- They include the need for longer-term assessments, multi-dimensional perspectives and internal, interdisciplinary collaboration.
- The Forum has prepared an illustrative list of key factors and steps that support the assessment of physical risks associated with acute extreme weather events.
- The interconnected and systemic nature of climate-related risk has prompted companies to develop risk responses through collaborative initiatives with peers.

The TCFD recommends that companies disclose information about:

- The climate-related risks to which they are exposed;
- The process used for identifying, assessing and managing those risks;
- Whether the process is integrated into the organization's overall risk management approach.

In some cases, an organization's standard risk management approach might need to be adapted or complemented to effectively assess climate change risks, given their unique characteristics and uncertainties about when, where and to what extent they might materialize.

This chapter draws on interviews with risk managers from Forum member companies in which they share their experience of assessing and managing climate risk, including:

- The role of the risk management function in raising awareness and taking ownership of climate risk;
- Techniques used for risk assessment and how approaches are being adapted and complemented to respond to the particular characteristics of climate change;
- Formulating responses to climate risk as individual companies as well as in collaboration with others;
- Effective communication about climate risk internally and externally.

The quotes included in this section are unattributed comments made by risk managers during interviews conducted for this report. The chapter also includes a specific example relating to the assessment of acute physical climate-related risk associated with extreme weather.

I don't think normal Enterprise Risk Management (ERM) processes are fit for purpose to deal with this complex subject in detail.

The quantification of climate risk is the great unknown, and what to do with the results.

RISK AWARENESS, OWNERSHIP AND COLLABORATION

The risk management function plays a crucial role in raising awareness of risks and coordinating the expertise and knowledge needed to identify and interpret the implications of climate-related risks across the organization. For example, understanding the potential impacts of increased drought frequency and severity relies on different skills from those required to understand changing consumer preferences and technological developments. Depending on the characteristics and implications of the climate-related risk in question, representatives from different functions (e.g. procurement, operations, sustainability, agriculture, forest management, public affairs, insurance, finance, R&D, strategy, planning and control), may need to be involved. For example, market disruption is a strategic risk where a senior leadership representative will take the lead, while regional leaders will take responsibility for physical risks specific to a particular geography. Forum members take a flexible approach to climate-related risk management to ensure appropriate representation from key functions across the business.

Engaging with and securing the support of executives and the board of directors is a critical lever to enhance the awareness, collaboration and ownership of risks. Senior representatives can be crucial advocates of a longer-term, more holistic view of risks. This is important when making connections to strategic business opportunities, such as those that respond to the low carbon transition.

RISK ASSESSMENT

An effective risk assessment process examines the extent to which identified risks impact an entity's strategy and business objectives. Organizations achieve this by:

- Making analytical choices about the most appropriate approach, criteria, data and assumptions for the assessment;
- Identifying the short-, medium- and long-term impacts and effects the risk might have on the relevant entity.

Each market carries out a risk assessment. Often, they can't do much about the climate risks (e.g. drought), apart from being better prepared for it. They flag a risk up the chain asking for corporate action and solutions to address it (e.g. specific drought resistant products). Depending on the risk, we would then have corporate level risk owners for it.

The business is looking holistically at the life cycle, end-to-end of products and solutions. This helps the organization to think with a longer-term perspective. As a result, we have increased collaboration between the functions, embedding resilience thinking.

There's a lot of merit to communications and awareness raising. It is important to move away from very technical language. People take ownership much faster when they know what it (climate risk) means to them. Awareness however builds over time and the right tone at the top helps. If management shows an interest in the topic, people will also devote more attention.

TRADITIONAL RISK ASSESSMENT CRITERIA - IMPACT AND LIKELIHOOD

A range of quantitative and qualitative measures and criteria can be used to estimate, compare and prioritize the severity of risks. Traditionally, the criteria used to assess risk severity have been limited to impact and likelihood. The COSO ERM Framework[20] defines impact as "the result or effect of a risk" and likelihood as "the possibility that a given event will occur". Forum members' likelihood scales include: high (12-24 months), medium (once in 10 years) and low (once in a lifetime). Forum members use a range of impact measures including impact on gross profit, EBIT and relative measures connected to purpose and reputation.

ADAPTING ASSESSMENT CRITERIA TO THE CHARACTERISTICS OF CLIMATE RISK

WBCSD's report, "An enhanced assessment of risks impacting the food and agriculture sector",[21] notes the limitations of traditional risk management approaches for capturing and assessing the complex, interconnected groups of risks that affect companies in the food and agriculture sector. The report shows how companies are broadening risk management approaches.

Forum members are also adapting the criteria they use to assess climate-related risk, taking account of the connections between the macro-economic environment, weather, regulatory and technological developments and market and investment factors. A wide range of factors are considered in the risk assessment process. They include agriculture and forestry subsidy shifts, tax regime changes, technology, innovation and changing demand patterns attributable to climate change. As a result of adding potential policy, technology and market aspects to their risk assessment processes, some Forum members have tentatively concluded that, in the shorter-term, climate-related transition risk could have a much greater disruptive impact than previously anticipated.

Recognizing the time horizons and varied pace of change over which climate-related risks and opportunities might materialize, Forum members have developed approaches for monitoring trends both in real time and over longer time horizons. Marketing and brand professionals use social media, customer feedback and market research to track customer sentiment and changing preferences associated with climate change and sustainability. Public affairs departments monitor regulatory and political developments. From one year to another, impact and likelihood movement can be observed and key developments can be prioritized for deep dive analyses on specific issues such as new technologies. Different parts of the business track emerging risks and opportunities related to the business planning and investment horizons, adding them to "watch lists" where appropriate and monitoring them using criteria including the expected velocity and speed of onset.

To assess risks, we use traditional dimensions of impact and likelihood. However, with climate risk, preparedness and vulnerability may be even more important dimensions to factor in. Scenario analysis seems to be deploying these dimensions usefully.

I find impact vs. likelihood limited. Vulnerability is a helpful aspect to consider as a risk might not have huge financial impact, but we may be vulnerable. Velocity is also useful as if a topic captures the imagination of people it will move quickly. Interconnection is also a big thing - biodiversity is heavily impacted by climate change, they go hand in hand. When it comes to mitigation, does your strategy add up considering all the risks and relationships? If you have a plastics strategy, how does it link to climate?

LONGER-TERM RISK ASSESSMENT USING SCENARIO ANALYSIS

Scenario analysis can support understanding of risks and opportunities beyond normal business planning cycles. Forum member companies are developing scenario analysis linked to risk assessment processes that consider the implications of possible future states related to, for example, regulation (e.g. subsidy shifts affecting key commodities/ products), chronic physical risk (e.g. temperature change affecting growing regions of permanent crops with dependency on limited geographies) and technology (e.g. automation, internet of things and artificial intelligence supporting precision agriculture). Various techniques, including quantitative modeling and/or cross functional discussions, are used to explore future possibilities such as the implications of GHG emissions caps from land use in key geographies and the possible effects of dramatic shifts in diets and lifestyles (see Chapter 5 for further details on scenarios analysis and resilience assessments).

Disclosures about risk management are useful when they:

- Explain the process used, including the range of criteria applied (e.g. threat and vulnerability) and the tools that support identification, assessment, awareness and understanding of climate risks;
- Provide examples of specific risk assessments (e.g. changing consumer preferences, policy developments and extreme weather);
- Describe the risks that have been identified and the time horizons over which they are expected to materialize;
- Estimate the potential impacts of climate risks in qualitative and quantitative terms.

Figure 2: Unilever's disclosure about the use of scenario analysis to assess longer-term climate risks
(Unilever Annual Report and Accounts 2018)

IN FOCUS: CLIMATE CHANGE RISKS AND OPPORTUNITIES

Understanding Impact

Climate change has been identified as a principal risk to Unilever which has the potential to impact our business in the short. medium and long-term.

To further understand the impact that climate change could have on Unilever's business we performed a high-level assessment of the impact of 2°C and 4°C global warming scenarios. The 2°C and 4°C scenarios are constructed on the basis that average global temperatures will have increased by 2°C and 4°C in the year 2100.

Between today and 2100 there will be gradual changes towards these endpoints and we have looked at the impact on our business in 2030 assuming we have the same business activities as we do today. We also made the following simplifying assumptions:

- In the 2°C scenario. we assumed that in the period to 2030 society acts rapidly to limit greenhouse gas emissions and puts in place measures to restrain deforestation and discourage emissions (for example implementing carbon pricing at $75-$100 per tonne taken from the International Energy Agency's 450 scenario). We have assumed that there will be no significant impact to our business from the physical ramifications of climate change by 2030 - ie from greater scarcity of water or increased impact of severe weather events. The scenario assesses the impact on our business from regulatory changes.
- In the 4°C scenario. we assumed climate policy is less ambitious and emissions remain high so the physical manifestations of climate change are increasingly apparent by 2030. Given this we have not included impacts from regulatory restrictions but focus on those resulting from the physical impacts.

We identified the material impacts on Unilever's business arising from each of these scenarios based on existing internal and external data. The impacts were assessed without considering any actions that Unilever might take to mitigate or adapt to the adverse impacts or to introduce new products which might offer new sources of revenue as consumers adjust to the new circumstances.

The main impacts of the 2°C scenario were as follows:

- Carbon pricing is introduced in key countries and hence there are increases in both manufacturing costs and the costs of raw materials such as dairy ingredients and the metals used in packaging.
- Zero net deforestation requirements are introduced and a shift to sustainable agriculture puts pressure on agricultural production, raising the price of certain raw materials.

The main impacts of the 4°C scenario were as follows:

- Chronic and acute water stress reduces agricultural productivity in some regions, raising prices of raw materials.
- Increased frequency of extreme weather (storms and floods) causes increased incidence of disruption to our manufacturing and distribution networks.
- Temperature increase and extreme weather events reduce economic activity, GDP growth and hence sales levels fall.

Our analysis shows that, without action, both scenarios present financial risks to Unilever by 2030, predominantly due to increased costs. However, while there are financial risks which would need to be managed, we would not have to materially change our business model. The most significant impacts of both scenarios are on our supply chain where costs of raw materials and packaging rise, due to carbon pricing and rapid shift to sustainable agriculture in a 2°C scenario and due to chronic water stress and extreme weather in a 4°C scenario. The impacts on sales and our own manufacturing operations are relatively small.

Figure 3: Nestlé's disclosure about climate risks, scenario analysis and responses
(Nestlé Annual Review 2019)

Climate change has been identified as one of the greatest risks to the future of Nestlé. The Group adopted the Taskforce for Climate-related Financial Disclosures (TCFD) recommendations and began implementation in 2019.

The Nomination and Sustainability Committee of the Board of Directors of Nestlé provides strategic guidance on climate-related matters and reports to the full Board, which has overall oversight. Executive responsibility is shared by the Head of Operations and the Chief Financial Officer. In 2019, the Board of Directors approved the Group's long-term climate ambition to achieve zero net greenhouse gas emissions by 2050.

To understand the potential risks and opportunities of climate change, in 2019 the Group conducted a high-level assessment of physical and transitional exposures, focused on coffee, cereals and dairy. Two climate scenarios were considered in terms of global temperature rise by the year 2100: "Business-as-usual" (4–5°C warming) and "Paris Agreement" (warming below 2°C). Potential impacts for the business were considered up until 2030. Both scenarios present strategic risks and opportunities.

We assumed physical impacts on the business are relatively similar for both scenarios up until 2030. Acute physical impacts such as an increase in frequency and severity of extreme weather events have an impact today. Chronic physical risks are more likely to manifest themselves over the longer term weighted to the second half of the century.

Physical risks have a higher probability to impact coffee, with higher temperatures and water shortages compromising quality and reducing availability. This may lead to an increase in raw material costs for the industry, and have economic and social impacts on coffee-growing communities. For wheat and dairy, there is a potential increase in the volatility of regional sourcing due to greater local climate variability but overall we foresee limited impact on global macro yields.

The Group has initiatives in place to support our farmers and our business in mitigating and adapting to climate-related physical impacts. These include providing technical assistance to farmers through our Nescafé Plan and Nespresso AAA Program, enhancing resilience to climate change in our plant breeding programs and improving management of the dairy supply chain. We are scaling up initiatives in agriculture to build farm-level resilience by storing carbon through soil management and land restoration, helping farmers reduce greenhouse gas emissions and halting deforestation.

The analysis indicated that key climate-related risks are likely to be transitional risks up until 2030. Under the Paris Agreement scenario, macro shifts will be required to move to a low-carbon economy, such as policy and regulatory changes (adoption of carbon pricing, shifts in agricultural subsidies, incentives for renewable energy). Investments in technology to adapt to and mitigate climate change will carry uncertainty due to the immaturity of technological solutions. Sector or business level reputation may be impacted (positively or negatively depending on the category) by increased stakeholder concern and shifts in consumer sentiment. Competitor responses may change competitive dynamics and impact on the sector's reputation. This may impact revenue and growth projections, as well as indirectly impact business in a number of areas including community relations, employee attraction and engagement.

The Group is accelerating its climate change efforts to transition to a low-carbon economy. Consumer demand for products with a positive environmental footprint is rapidly increasing and the Group is focused on the opportunities to transform our products in line with the trends. Nestlé will launch more products with improved environmental footprints that contribute to a balanced diet, including more plant-based options, reformulate products using more climate-friendly ingredients and develop alternative packaging materials. The Group continues to increase the use of renewable energy sources enabling investments in new infrastructure such as wind and solar farms.

The work undertaken in 2019 confirms the importance of further understanding critical dependencies and externalities of climate change on our strategy. Climate change time horizons are challenging, as they are significantly longer than political terms, investor outlooks and planning cycles. The transformational shifts in policy and capital allocation required over the next decade to address climate change are in their infancy. The lack of clear transition pathways for climate scenarios may create significant divergence of assumptions. The Group is collaborating with the World Business Council for Sustainable Development's Food, Agriculture & Forest Products TCFD Preparer Forum project to develop sector specific guidance in 2020. This work will be used in our future climate scenario assessments.

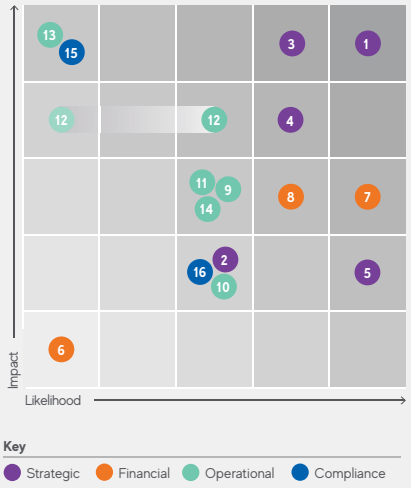
Figure 4: Mondi's disclosure of principal risks, including climate change related risk
(Mondi Integrated report and financial statements 2019)

Over the course of the past year, the audit committee has reviewed the principal risks set out below. In evaluating the Group's risk management and internal control processes, the audit committee has considered both internal and external audit reports and received confirmation from the finance directors of the business units that financial control frameworks have operated satisfactorily. The sustainable development risks are considered throughout our business and consolidated into the principal risks where relevant. These risks have been reviewed by the sustainable development committee during the year.

Key changes in the year

The majority of the Group's most significant risks are long term in nature and in general do not change significantly in the short term. The assessment of principal risks is updated annually to reflect the developments in our strategic priorities and Board discussions on emerging risks. During the year, we enhanced our understanding of the risks and implications related to climate change, demand for sustainable packaging solutions including substitution of plastic packaging and the UK's exit from the European Union.

We recognise investors and other stakeholders are seeking a better understanding of how companies are evaluating and responding to climate change related risks. We have been evaluating the impact and reporting on these risks for a number of years and this year have included climate change related risk as a separate principal risk to provide further clarity on the key impacts on our business and our associated response.



1. Industry productive capacity
2. Product substitution
3. Fluctuations and variability in selling prices or gross margins
4. Country risk
5. Climate change related risk
6. Capital structure
7. Currency risk
8. Tax risk
9. Cost and availability of raw materials
10. Energy security and related input costs
11. Technical integrity of our operating assets
12. Environmental impact
13. Employee and contractor safety
14. Attraction and retention of key skills and talent
15. Reputational risk
16. Information technology risk

We have considered and will continue to closely monitor the potential impact of COVID-19 on our business. We have not seen any impact on the Group to date. The Group's direct exposure to China is limited, with revenues in the country accounting for less than 1% of the total. We continue to monitor its impact on global trade and the macro-economic outlook.

Strategic risks

Climate change related risks

Potential impact

Climate change has the potential to affect our business in various ways. While these may not be severe in the short term, we believe climate change related risks are likely to have a medium and long-term impact on our business. Our manufacturing operations are energy-intensive, resulting in both Scope 1 and Scope 2 GHG emissions. In addition, fibre is the main raw material for our products and forests are an important carbon store, with sustainably managed forests having the opportunity to support a circular bioeconomy. Customers and consumers are increasingly concerned about the consequences of climate change and are looking for solutions produced from renewable materials and reduced carbon footprints. Our climate change related risks relate to transition and physical risks and are described below.

Governments and regulators are likely to take action to curb carbon emissions that may impact our business, such as the introduction of carbon taxes. For example, the EU Parliament recently declared a climate emergency and called on all EU countries to phase out all direct and indirect fossil fuel subsidies by 2020, in addition to encouraging an EU policy to reach climate neutrality as soon as possible, and latest by 2050. In Europe, all of our pulp and paper mills fall under the EU Emissions Trading Scheme (EU ETS) and in South Africa, the government has committed to introduce a carbon tax. In Russia, the strategy for the development of a low-carbon economy is currently under development.

Changes in precipitation patterns and extreme weather conditions such as floods, storms, droughts and fires may impact our plantations and the forests we source wood from and could result in fibre supply chain interruptions and higher fibre costs. Higher temperatures may also increase the vulnerability of forests to pests and disease. Increased severity of extreme weather events may also interrupt our operations. In water-scarce countries, we may see an impact on our production process as a result of limited water availability.

Monitoring, mitigation, and where relevant, independent assurance activities

We focus on measures to reduce our GHG emissions by improving our energy efficiency, optimizing the use of biomass-based fuels in order to reduce our use of fossil-based energy sources, and to decrease carbon-intensive energy sources such as coal. We do this with a combination of capital investments and ongoing efficiency programmes.

We look to source our wood from diverse regions and forest types to mitigate the potential impacts of climate change on our wood supplies, in particular in Europe. In South Africa, we continue to investigate and develop wood species which require less rainfall and are more resistant to pests and disease.

We monitor and measure our impact on climate change. Our reporting on GHG emissions and energy is independently assured and we have set science-based targets for our Scope 1 and Scope 2 emissions. We support WWF Climate Savers programme and the We Mean Business Coalition which aims to catalyse business action and drive policy ambition to accelerate the zero-carbon transition.

We are committed to adhering to internationally accepted recommendations, such as those published by the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD), to investigate and report on climate-related risks and opportunities. We will continue to investigate the financial implication of our mid- and long-term climate-related risks and opportunities using the International Energy Agency's 2°C scenario and a business as usual scenario (RCP8.5).

USER PERSPECTIVE

Users welcome the disclosure of information about how companies are preparing for anticipated changes in the risk environment, including details of scenarios, forecasts and planning assumptions that inform those preparations. For example, investors find it useful to understand what companies anticipate in terms of changes in regulation for waste, land use and circularity.

ILLUSTRATIVE LIST OF EXTREME WEATHER RISK ASSESSMENT AND PRIORITIZATION FACTORS

Given the connection to land, ecology and biological products, the physical risks associated with climate change are particularly relevant for food, agriculture and forest product companies. This section provides a non-exhaustive, illustrative list of factors considered relevant by Forum members when assessing physical risks associated with acute extreme weather events, such as cyclones, hurricanes, floods and drought.

The illustrative factors are adapted from COSO Principles 11 and 12[22] and Chapter 3 of the COSO/WBCSD guidance "Applying Enterprise Risk Management to Environmental, Social and Governance-related Risks"[23]. They are organized into four categories:

a) Assessment and prioritization criteria;

b) Severity measures;

c) Measurement approach;

d) Data, parameters and assumptions.

A) ASSESSMENT AND PRIORITIZATION CRITERIA

The following criteria are useful for assessing and prioritizing the extent of a company's exposure to acute extreme weather risks:

- Impact: the result or effect of extreme weather
- Likelihood: the possibility that extreme weather will occur
- Adaptability: the capacity to absorb and respond to extreme weather events
- Complexity: the scope and nature of the extreme weather event, including the degree of uncertainty and varied impacts
- Connectivity: the connections between extreme weather events and other risks, processes, conditions or situations
- Velocity: the speed of onset or time to impact of an extreme weather event, i.e. how much warning can be given, time horizon of forecasts etc.
- Persistence: the duration of the impact of the extreme weather event
- Recovery: the capacity to return to prior state

B) SEVERITY MEASURES

The following quantitative and qualitative measures are useful for expressing the severity of the risk:

- Financial:
  - Projected or identified cost of business interruption, contingency, repairs and/or upgrades
  - Projected or identified impact on revenue and/or expenditure
  - Write-off, asset impairment and early retirement of existing assets
  - Detailed insurance payments and premiums
- Operational:
  - Number of facilities and business lines exposed/affected
  - Time and duration of impact/potential impact
  - Projected or identified loss or damage to business facility, application and/or supply chain
  - Change in yield/productivity
  - Change in consumer or supplier behavior

C) MEASUREMENT APPROACHES

The following tools and processes are useful for providing an evidence-based approach to measuring and understanding risk severity:

- Expert input/interviews, for example with business segment/unit leads, actuaries, insurers, meteorologists, oceanographers, climate and atmospheric scientists
- Forecasting and valuation using historical data and lookback studies to understand previous impacts and inform estimates of potential future impacts, changing key parameters (e.g. frequency, duration, intensity) within plausible ranges
- Scenario analysis focused on potential impacts of warming on the frequency and severity of extreme weather
- Probabilistic and non-probabilistic models, drawing on natural science and actuarial statistical expertise to explore value at risk and catastrophe evaluation
- Stress tests for assessing sensitivity of key commodities, supply lines, geographies and markets to physical event stresses
- Strenghts, weaknesses, opportunities and threats (SWOT) analysis to understand the organization's position, prospects, preparedness and vulnerability to extreme weather using quantitative or qualitative means

D) DATA, PARAMETERS AND ASSUMPTIONS

Risk assessment relies on the availability and quality of data from key primary and secondary, internal and external sources. An indicative list of potential information sources is shown in Table 3.

Table 3: Potential data sources

INTERNAL SOURCES	Purchase records Historical and projected sales Investment appraisals Resource use (e.g. water, fertilizer) Facility locations Permanent crop/forest location Logistics routes
METEOROLOGICAL RECORDS AND FORECASTS	Precipitation Temperature Wind Frost Ice Snow depth Sea state Storm surges Flooding Surface pressure
GLOBAL MODELS AND STUDIES	Intergovernmental Panel on Climate Change (IPCC) International Institute for Applied Systems Analysis Shared Socioeconomic Pathways database World Bank Climate Change Knowledge Portal OASIS Hub CGAIR (formerly Consultative Group for International Agricultural Research) Food and Agriculture Organization of the United Nations
REGIONAL OR NATIONAL MODELS AND STUDIES	Environmental agencies and national meteorological institutes European Environment Agency UK Environment Agency United States Environment Protection Agency (EPA) United States National Oceanic and Atmospheric Administration (NOAA)
SPECIALIST TOOLS	Aqueduct Swiss Re CatNet UN Environment Global Resource Information Database AON's Catastrophe Insight

RISK RESPONSE

According to the COSO ERM Framework, risk responses fall within the categories of:

- Accept – accept the exposure and take no further action
- Avoid – terminate the activity/ proposed activity giving rise to a risk
- Pursue – convert to opportunity
- Reduce – take action to limit severity
- Share – transfer a portion and/ or collaborate

Forum member companies' responses to risk vary according to their risk appetite and strategic and operational priorities. Risk responses include the development of roadmaps that align with 1.5°C ambitions and investment processes that take account of climate and water criteria. Such processes connect changing climate-related conditions to financial performance over the lifetime of assets or according to agronomic conditions for permanent crops. They also integrate practical responses to risks including irrigation, frost protection, pollinator support, fire prevention and soil protection.

When a risk is identified, the risk owner is required to take mitigation actions to address the risk. Mitigations are assessed in terms of effectiveness (traffic lighting) and cost of such a control, i.e. cost benefit analysis. The approach helps optimization and management discussions.

COLLABORATIVE RISK RESPONSES

Increasingly, the interconnected and systemic nature of climate-related risk has prompted companies to develop risk responses through collaboration. For example, Nestlé and Unilever have joined the IBM Food Trust initiative which provides a digital food supply chain, powered by blockchain, to enable greater transparency across the food ecosystem. Such collaboration increases awareness of sustainability practices including opportunities to maximize shelf life, optimize partner networks and increase recall response efficiency – ultimately helping to reduce food waste.

Collaboration can also work across supply chains. Mondi has developed processes to support sustainable supplier-enabled innovation by building working relationships with selected suppliers to ensure greater transparency around areas of innovation and using contracts to ensure mutual security. Mondi's strategic business review meetings with major suppliers include discussions of innovative market trends and innovation capabilities, with connections to R&D and sales linking, for example, innovation among resin suppliers with sustainable packaging opportunities.

Our responses have largely been corporate initiatives, e.g. reducing CO_2 per ton, water discharge per ton. Maybe we need to think about the environmental and social value - e.g. nutrition and climate. If a product has great nutritional value but poor climate impact, should we still be investing?

Supporting farmer and forester resilience to physical and transition risks is a crucial responsibility and a strategic pillar for food, agriculture and forest product companies. Forum members are investing resources in developing farmer resilience, capabilities, technologies and management practices, including through:

- Climate smart agriculture solutions to help farmers achieve greater productivity, be more resource efficient and become more resilient to risks, shocks and long-term climate variability.
- Adoption of appropriate practices and technologies to support decision-making, for example, systems that warn of extreme weather events.
- Improved crop production and fertilizer management techniques that reduce nitrous oxide emissions and input costs while enhancing soil organic carbon stocks, yields and resilience to drought and flooding, and also sequestering carbon.[24]
- Developing relationships with small- and medium-sized forest owners in the value chain to improve climate adaptation and support them in accessing responsible markets through the achievement of FSC certification.[25]

Figure 5: Syngenta solution example supporting farmer risk management
(Syngenta Sustainable Business Report 2019)

Syngenta is investing in new digital tools and platforms to enable farmers to manage risk and maximize their investment. A good example of this is E-LUMINATE®, an exclusive digital offering that draws upon extensive agronomic data to help farmers make more informed seed selection decisions.

E-LUMINATE® enables our seed advisors to quickly assess field characteristics and choose the best products and management practices on a field-by-field basis. The technology uses GIS-based mapping for immediate assessment of soil characteristics and provides details specific to weed, disease and insect pressures to generate recommendations for seed that performs consistently for each field condition. These seed recommendations reflect actual performance comparisons across varieties, by year and region.

Figure 6: Olam collaborations investing in climate-related mitigation and adaptation
(Olam Annual Report 2018)

Better climate resilience for Mozambican cotton farmers

- Since 2008, Olam Mozambique has been supporting cotton farmers in Lalaua (Northern Mozambique) in Good Agricultural Practices. A lack of water infrastructure and degraded land conditions compound failure of rainfall in drought. In 2016, a pilot project on climate resilience with IDH, The Sustainable Trade Initiative, began in Namachhilo and Palacua.
- IDH explains, "Instead of a single-angled focus such as on the farmer or on cash crop production only, a holistic definition is needed for providing households a variety of tools for empowerment and a greater chance to institutionalise a system change for improved livelihoods". So, in addition to resilience training and infrastructure support, the programme encourages farmers to grow a second crop of vegetables, improving food security, nutrition and income. Read the testimonial from Disciplo Victort here.
- For a deeper overview of creating a sustainable cotton supply chain in Africa, go to here.

Olam Coffee helps develop Cool Farm Tool for reduced GHG emissions in agriculture

- Conventional management of residue (i.e. water, pulp) from washed coffees causes large greenhouse gas emissions (GHGs). Rather than store wet pulp in heaps, Olam Coffee plantations in Laos, Tanzania and Zambia, now return it directly to the field for (i) soil organic matter build up, (ii) improved nutrient recycling, and (iii) decreased GHG emissions. Organic-rich water from the washing station will be irrigated back on to fields for reduced GHGs and mulching.
- Olam Coffee supported research partners (Sustainable Food Lab, CCAFS-CGIAR, NUI-Galway) as part of the Cool Farm Alliance to understand and map the importance of these material flows for GHG emissions. Olam's input helps strengthen the Cool Farm Tool which is the industry's standard for carbon foot-printing.

Halting deforestation in cocoa supply chains

- Olam Cocoa is committed to ending deforestation and forest degradation. To date, the business has achieved 100% traceability of its sustainable cocoa supply chain in Ghana and Côte d'Ivoire, and is on track to achieve full traceability of its direct origination supply chain worldwide by 2020
- Olam Cocoa will now be implementing the Olam Forest Loss Risk Index (see Natural Capital section). As defined in the Olam Living Landscapes Policy, within high risk areas, the response will include a blend of:
  - On-the-ground investigation
  - Detailed mapping of farms in each area using the Olam Farmer Information System, while working alongside Global Forest Watch to detect any illegal activity
  - Farmer support and training
  - Increased monitoring, both spatial and temporal
  - Ceasing business with suppliers operating illegally or who continue (legal) deforestation in contravention of the Olam Supplier Code
- As a founding signatory to the Cocoa & Forests Initiative (CFI), Olam Cocoa was the first cocoa company to sign a Letter of Intent with the Ivorian Ministry of Forests and Water, followed by a Memorandum of Understanding, supporting the preservation and rehabilitation of 460,000 ha of forêts classées Rapides Grah and Haute Dodo.
- In Ghana, Olam Cocoa is implementing a Partnership for Livelihoods and Forest Landscape Management programme in 5 districts around the Sui River with the local authorities, the Ghana Cocoa Board and Partnerships for Forests.
- Read Olam Cocoa's CFI Action Plan (March 2019) on here.

Smallholder farmers are especially vulnerable to physical and transition climate risks, including extreme weather events and rapidly changing market demands. Economically viable and resilient farmer communities are essential to the long-term stability of agricultural value chains and the businesses that rely on them. Companies may also face reputational risks and a threat to their operating license if they ignore the resilience of the communities in which they operate in and upon which they depend. This may include decisions to switch supply origins in the face of changing physical growing conditions with detrimental impacts on farming communities. Agricultural and food producers are under growing pressure to ensure a more equitable distribution of value for farmer livelihoods and rural communities. Introducing cost-effective technology for on-farm data management and to-farm traceability, leveraging and scaling insurance and finance mechanisms, and creating sustainable and longer-term contracting practices all help to share value more equitably through to farmers.

CASE STUDY: Olam – economic inclusion connecting smallholder farmers

Olam sources from approximately 4.7 million farmers around the world. Only around 6,000 can be considered large-scale farms in developed nations like Australia or USA. The vast majority are small-scale farms in developing countries such as Nigeria, Tanzania, India, Vietnam, Colombia and Peru. They grow crops such as cocoa, coffee, cotton and cashew on smallholdings of just 1-2 hectares.

Due to stretched government resources, these smallholder farmers usually have limited access to education and healthcare, little agri-training and poor access to banks and credit to allow them to invest in their farms. As a result, their yields are often much lower than they could be, impacting on family livelihoods. Women farmers face greater barriers than their male counterparts.

This limitation is not just a missed opportunity, it is a business risk. The lower the production of farmers, the greater the risk that Olam may not be able to procure the supply its customers expect. If smallholder production and profits are low, there is a risk that farmers and their children will choose to give up on farming altogether to look for an alternative livelihood. It is in Olam's best interest to help lift smallholder framers out of poverty and empower them for the future.

Olam sources directly from farmer groups and co-operatives and also indirectly through intermediaries. Its tech platform, Olam Direct (OD), was developed and launched in 2017 based on feedback from smallholder farmers who saw pricing and transparency of their existing trade as their single largest concern, owing to the presence of many intermediaries and speculative players. Bypassing these players in the supply chain increases efficiency and reduces speculative play. This enables Olam to provide a higher price to the farmers.

The mobile platform connects farmers directly with Olam to ensure a fair and transparent sourcing process and improved traceability. It was launched to cocoa farmers in Indonesia in 2017. They learned how to check the cocoa price online, indicate intent and transact with Olam. Tips on Good Agricultural Practices (GAP) are also issued, meaning farmers can make more informed decisions about the harvesting and sale of their cocoa to further improve their livelihoods.

As at the end of December 2018, 40,000 Indonesian cocoa farmers have participated in Olam Direct. This is an increase from 5,000 farmers registered at the end of 2017. Olam Direct has also had wider rural benefits with the creation of more than 1,000 cocoa micro-collectors earning a stable income, many of whom were previously working as very small intermediaries lacking stable income. In addition, 80+ Collection Centers have opened engaging with farmers and providing them with extra income from leasing space. Benefits for Olam include more efficient aggregation and distribution. After successful implementation in Indonesia, pilot trials in Peru, Cameroon, Cambodia and Guatemala have begun.

5 Strategy: Climate-related transition and mitigation opportunities

5 Strategy: Climate-related transition and mitigation opportunities

SUMMARY:

- Forum members are pursuing and reporting on opportunities to develop solutions and products that support the low carbon transition. They include technology-enabled agricultural and forestry practices, investment in natural climate solutions, healthy and sustainable food products and circular bio-based solutions.
- Disclosures about climate-related opportunities often include case studies on specific solutions and products and key messaging relating to the potential impact of opportunities.
- Some disclosures are beginning to include financial plans, such as, R&D expenditure and potential financial performance, identifying development of sales, EBIT, expenditure, market size and growth.

The TCFD recommends that companies disclose information about the impact of climate-related risks and opportunities on the organization's businesses, strategy and financial planning, where such information is material. This recognizes that an effective response to climate change involves both management of risks and pursuit of opportunities to build strategic business resilience.

Opportunities for food, agriculture and forest products companies include:

a) **Technologies that can help enable the low carbon transition**, including transformative agricultural and forestry practices and investment in natural climate solutions.

b) **Market opportunities for products and services that enable customers to make low carbon choices**, including food products for healthy people and planet and circular bio-based solutions.

c) **Minimizing food loss and waste across the system**.

The examples provided below show how Forum members are integrating climate related opportunities into their decision-making and disclosure. The extent and type of opportunities companies can leverage depends, in part, on the type and speed of action taken by other stakeholders. Fast action to address climate change might exacerbate transition risks and, in turn, create the ideal enabling environment for companies to capitalize on the associated opportunities. By contrast, slower action by others might leave business facing more serious physical risks from climate change, requiring additional investment.

Individual businesses' plans and actions to adapt to the transition are complex, detailed, varied and at different stages of development. Under the circumstances, companies must balance the relevant and most material information when they decide what to include in climate-related financial disclosures in response to the TCFD's recommendations.

USER PERSPECTIVE

Disclosures about climate opportunities and transition plans are useful when they explain:

- How food, agriculture and forest products companies are leveraging opportunities to contribute to the Paris Agreement targets together with details of research, guidance (e.g. Food and Land Use Coalition (FOLU), EAT-Lancet Commission, IPCC, WBCSD CEO Guides) and assumptions that inform their transition plans.
- How business strategies and operations are aligned with societal expectations, challenges and trends. This includes climate change and other trends such as digitalization and demographic change.
- How companies are creating value from the low carbon transition through growth, cost optimization and risk/opportunity management.
- Plans for the future and information related to the expected resilience of the business model over time, for example:
    - The proportion of low carbon products, e.g. animal proteins products vs plant-based protein products.
    - Earnings and returns associated with high impact businesses.
    - Targets and progress made to shift product portfolio to low carbon/low impact alternatives.
    - Allocation of capital to innovation and product diversification, allowing users to assess whether capital expenditure is aligned with the goals of the Paris Agreement.
    - Whether and how investments are being made upstream in current supply chains and/or in new product lines for customers.
    - How opportunities from climate change are leveraged.

A) TECHNOLOGIES THAT CAN HELP ENABLE THE LOW CARBON TRANSITION

I) TRANSFORMATIVE AGRICULTURAL AND FORESTRY PRACTICES USING TECHNOLOGY, POLICY AND TRAINING

Companies, including Forum members, are exploring opportunities offered by transformative agricultural production technologies. These include drones, traceability systems, satellite monitoring, farm analytics and precision farming techniques, nitrogen-efficient and heat-tolerant crop varieties, zero-tillage and integrated soil fertility management methods.[26]

Disclosures relating to a company's innovation, research and new practices are useful where they provide insights on:

- The variety of approaches taken by the company to pursue mitigation and adaptation options
- The aims and objectives of collaborations, advocacy and engagement
- Patents for mitigation and adaptation technologies
- Resources (financial, human and functional) allocated to climate mitigation and adaptation research
- New ways of working that respond to climate-related challenges
- The contribution and impact of solutions

Companies in both agricultural and forestry industries are implementing zero-deforestation policies. These typically forbid the degradation or conversion of valuable ecosystems, such as High Conservation Value (HCV) and High Carbon Stock (HCS) areas, as well as planting on peat or the use of fire to clear land. Disclosures include information about how such policies are being implemented within wider Responsible Sourcing programs together with targets for sourcing 'deforestation free' and/or certified products. Companies are increasingly expected to report on the progress of such commitments, with some investing in platforms and tools to trace products back to source. Other companies are using satellite monitoring to observe land use change as a result of deforestation in their supply chains.

Figure 7: Syngenta's description of crop protection beyond chemistry: the digital revolution and new technologies
(Syngenta Sustainable Business Report 2018)

Increasingly, we're an agricultural technology business. We bring together chemistry, biology, digital technologies, new monitoring and application techniques, biologicals – and even new breeding techniques – to create novel solutions.

Our newly-formed Digital Agriculture Solutions group is collaborating with research and development, Syngenta Ventures, and our commercial, production and supply functions to create innovative new tools for growers. And, in 2018, we made two further significant tech acquisitions:

- Strider®, a Brazilian company providing operational management solutions for farms, from monitoring machinery and pest control to satellite imaging of crops. It will help us to bring growers new ways to manage on-farm information.
- FarmShots™, a US company that processes high-resolution field images from satellites to assess plant health, helping farmers, agronomists and retailers to spot field issues such as diseases, weeds and other pests. It will accelerate our development of farm management and crop decision-making tools.

Digital technology is giving us new ways to turn data into meaningful information – and to put it into customers' hands. For example, daily access to mobile technology plays an important role in the modernization of agriculture in China, where it enables us to reach extensive retailer and grower networks across the country.

Our Retailer Hub app has the potential to service over 500,000 retailers, providing agronomy information, training and support. And our Grower Club app brings growers agronomic support as well as advice on our crop protection products and seeds, weather forecasts and pricing information; it also connects users with retailers in our network.

Precision agriculture is allowing farmers to use crop protection with unprecedented efficiency and economy. Advances in sensor technology, satellite and drone imaging, and data science provide increasingly sophisticated information to help growers manage their crops sustainably, from planting through to harvest. Combined with precision application technology and advanced product formulations, this data revolution will help growers to maximize benefits and minimize impacts from farm inputs such as fertilizer and crop protection products.

Better application technologies are further reducing the volume of product required per hectare and improving control of drift and overspray. Drone spraying is now feasible even for smallholders, and in 2018 farmers used drones to treat an estimated 20 million hectares in China alone. Where regulations limit drone use, autonomous row-walking robots could deliver similar efficiencies.

Figure 8: Olam's disclosures around climate related opportunities
(Olam Annual Report 2018)

Climate change is already impacting agriculture. Equally, agriculture is a major cause – 10-12% of all manmade GHG emissions. Even a 1.5°C increase in global temperatures will require radical and urgent transformation of all systems at an unprecedented scale. Although the challenge is enormous there are some reasons for Olam to be positive:

1. Speed of digital and tech innovation

Advances in precision agri technology for large-scale farmers, and mobile platforms such as Olam Direct, as well as access to an increasing number of weather stations in emerging markets for small-scale farmers, are giving the tools to both mitigate and adapt to impacts. Satellite technology provides better data to address negative practices like illegal deforestation (although globally rates of deforestation are still of significant concern).

2. Better agronomy that saves money

It is recognised that even simple changes in agronomy practices can increase yields while reducing fertiliser use – benefitting both the climate and the farmer, Sustainable Rice Platform (SRP) rice being one example.

3. Increasing demand drivers

Consumer expectation that products are sustainably sourced drives demand from multi-national customers who equally need to protect their supply chains and satisfy publicly declared targets e.g. around the UN Sustainable Development Goals. AtSource is our vehicle to drive increased demand.

4. Increased access to finance

While green finance is often seen as niche, there are encouraging signs. Olam is leveraging its sustainability strategy to access company-wide climate/sustainability linked financing (reduced costs of capital), and funding (for AtSource Plus and AtSource Infinity). We are exploring voluntary carbon credit generation (through upstream assets and Living Landscape Policy linked programmes), and lower insurance premiums. Such products will encourage Olam to invest more in sustainable solutions with greater impact potential.

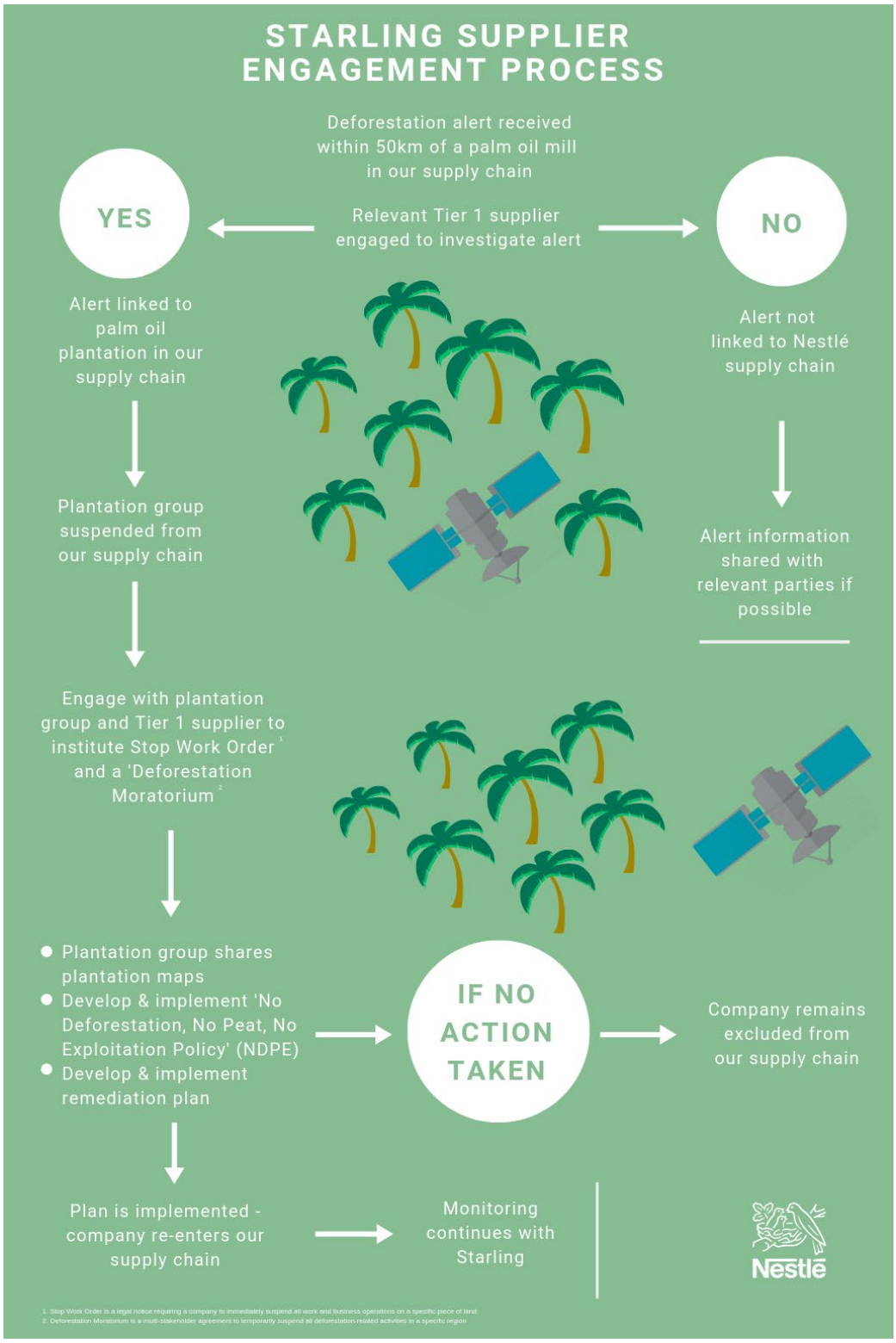
5. Country commitments galvanise action

Of 162 pledges to the Paris Agreement for Climate Action, 104 countries intend to make agricultural GHG emission reductions and 126 list agriculture as a priority for adaptation.

6. Natural Capital accounting improving

While there is currently no standardised methodology for impact valuation, Olam and others are making considerable progress. See the Integrated Impact Statement.

Figure 9: Nestlé's use of satellite monitoring technology as part of its supplier engagement process around no deforestation
(Nestlé website)



CASE STUDY: Syngenta's strategic investments to accelerate innovation in a changing world

INVESTMENT DECISION-MAKING

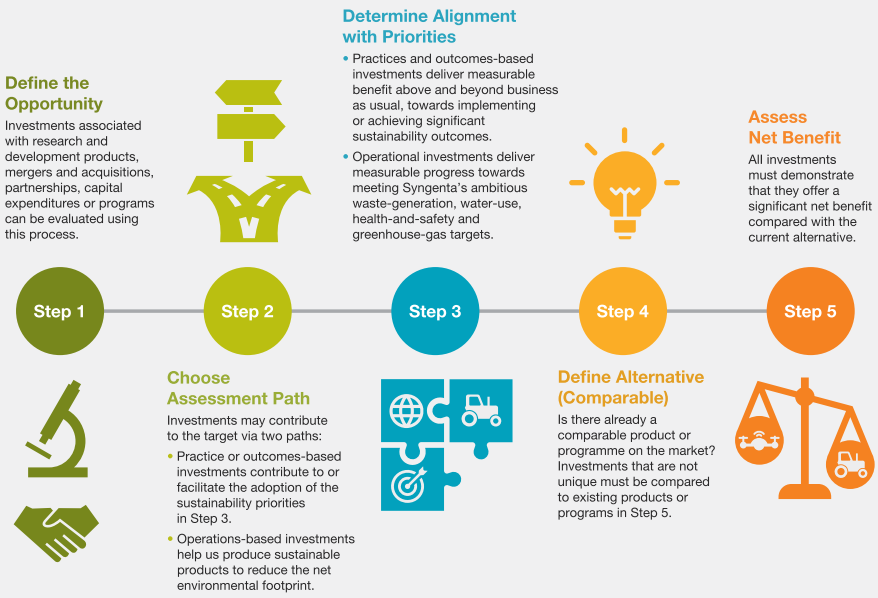
Syngenta recently announced a USD $2 billion investment over the next five years to help farmers prepare for and tackle the increasing threats posed by climate change. Farmers today need to manage climate change, soil erosion and biodiversity loss, as well as changing consumer expectations and views on agricultural technology.

Syngenta's announcement came after six years' experience working with its Good Growth Plan, and more than 150 listening sessions with stakeholders from across the food value chain around the world, which have given Syngenta a much better understanding of what society expects from it and what sustainable agriculture means to different groups. Syngenta believes that accelerating innovation for a more sustainable agriculture sector is a strategic investment that makes business sense and will drive future growth.

The investment covers R&D of products, mergers and acquisitions, partnerships, capital expenditures and initiatives such as its commitment to reduce the carbon intensity of its operations by at least 50% by 2030 – a target validated by the Science Based Targets initiative (SBTi).

The USD $2 billion investment will be directed towards programs with clearly differentiated benefits or breakthrough technologies that will enable a step change in agricultural sustainability, such as improved land use, soil health and integrated pest management. The process and associated criteria described in Figure 10 was developed in collaboration with The Nature Conservancy (TNC) and will be used for the assessment of investment.

Figure 10: Syngenta's Five Step Assessment Process for Sustainable Investments
(Syngenta website)



RESTORING DEGRADED PASTURELAND

Examples of the investments Syngenta will make include the Reverte program in Brazil, where Syngenta is working alongside partners to enhance the sustainable growth of agriculture by promoting integrated cattle/crop farming in degraded areas of the Cerrado biome. Through a holistic approach involving best agronomic practices, financial tools and input protocols, Reverte will help farmers and cattle holders improve the productivity of degraded pastureland.

Today, some 18 million hectares of Cerrado areas are in some stage of degradation – meaning that more area than necessary is used to deliver the needed ecosystem services. In the first five years of implementation, the initiative has the potential to reach one million hectares. Reverte allows farmers to sustainably expand agriculture into lands that are already open without tree cover, but uncultivated due to soil degradation. The initiative aims to demonstrate the economic viability of reclaiming land rather than opening new areas for cultivation, thereby contributing to the preservation of native vegetation. The goal is to increase farmer productivity in the short term to enable return on investment and prevent further degradation.

With this aim, Syngenta, TNC and other partners are integrating different tools including special financing to support farmer's initial investment needs, seed varieties adapted to local conditions and soils, agronomic practices that enhance soil conditions and digital tools to allow growers to control and monitor their improvements on soil conditions. Land recovering brings benefits to both Syngenta and the farmer. For Syngenta, it opens new sustainable market segments and, for the farmer, it provides the opportunity to expand agriculture through regenerative and climate resilient farming practices such carbon sequestration, soil recovery and water efficiency.

II) INVESTING IN NATURAL CLIMATE SOLUTIONS

Measures to stop deforestation, improve soil health,[27] support natural carbon sinks, restore damaged habitats and implement climate smart agriculture practices are increasingly referred to as 'Natural Climate Solutions' (NCS).[28] NCS remove and store carbon and other greenhouse gases by enhancing, restoring or protecting natural sinks – like wetlands and peatlands - or by reducing emissions from land-use change. Research shows that investments in NCS could deliver up to one-third of the emissions reductions needed between now and 2030 to limit global warming to 2°C.[29]

Forum members are exploring opportunities to invest in conservation, restoration and improved land management of forests, grasslands, agricultural lands and wetlands to meet their climate change mitigation commitments. Other important benefits include supporting biodiversity, sustainable livelihoods, rural transitions and food security – all essential for the long-term viability of their businesses. The carbon sequestered from sustainably managed forests may also be used to generate and sell carbon credits on voluntary and compliance carbon markets.[30]

However, there are accounting and disclosure challenges associated with NCS. Methodologies for measuring carbon avoidance and removal have not yet reached consensus and the absence of an agreed method for quantifying the benefits associated with the bioeconomy impedes reliable assessment of the opportunities it presents (see Stora Enso case study below). In the meantime, companies should be clear about the methodologies they have used to calculate carbon removals or emissions avoided and how such efforts sit within a wider climate strategy.

storaenso

CASE STUDY: Stora Enso's experience estimating the substitution potential of its product portfolio in enabling the low carbon transition

The forest products sector is central to the transition towards a low carbon and a circular future rooted in renewable, natural resources – also known as the bioeconomy (as illustrated in the Forest Sector Sustainable Development Goals (SDGs) Roadmap).[31]

The contribution of a circular bioeconomy to a net-zero society is increasingly understood and documented and has been central to Stora Enso's strategy for some time. However, the quantification of the climate benefits of the bioeconomy is still lacking, preventing the ability to tie it to market forecasts and clearly demonstrate the strategic opportunity to stakeholders. There is a need for a globally accepted emissions accounting standard that covers aspects such as land use, land use change, carbon removals, sequestration and product substitution.

In the absence of such a standard, there is urgent need to quantify the opportunity of a circular bioeconomy based on renewable raw material. Stora Enso has started to use peer reviewed substitution factors[32, 33] to estimate the substitution potential of its product portfolio. In its approach, it conservatively assigned a bioenergy substitution factor to products such as paper, board and other biomaterials, and a wood products substitution factor for products that serve the construction sector. Using this approach, Stora Enso has estimated that the annual substitution potential of its product portfolio is about 21 million tons CO2-e, based on 2018 production volumes. This corresponds to approximately one third of Finnish emissions in 2018. To put this into perspective, Stora Enso's global scope 1, 2 and 3 emissions for 2018 were approximately 11 million tons of CO2 eq.

In managing this business opportunity, Stora Enso concentrates on finding renewable and recyclable solutions that can substitute fossil-based and non-renewable materials in packaging, building construction and industrial intermediate chemicals. This means innovating bio-based solutions to offer alternatives to plastics, concrete, glass, metal and other non-renewable materials. Its R&D expenditure in 2018 was EUR 149 million. In that same year, 9% of the company's sales came from new products and services. Its target is for 15% of sales to come from new products and services. In 2019, the company introduced an internal assessment tool that ensures that sustainability is considered at all stages of R&D.

THE GREENHOUSE GAS PROTOCOL AND LAND USE

The GHG Protocol is a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs), governments and other stakeholders convened by the World Resources Institute (WRI) and WBCSD. The GHG Protocol supplies the world's most widely used GHG accounting standards. It recently announced that the process to develop new standards or guidance on how companies should account for aspects such as land use, land use change, carbon removals and sequestration has started. This will be a critically important piece of work to help articulate the benefits of the circular bioeconomy.

B) PRODUCTS AND SERVICES THAT ENABLE CUSTOMERS TO MAKE LOW CARBON CHOICES

I) FOOD PRODUCTS FOR HEALTHY PEOPLE AND PLANET

Food and agriculture companies are exploring product formulations that maximize opportunities to meet growing consumer demand for nutritious, healthy foods that observe planetary boundaries. The growth in consumption of plant-based proteins is expected to result in total market value exceeding USD $100bn by 2030, up from approximately USD $2bn in 2018.[34] Among Forum members, Nestlé is adding more plant-based products to its portfolio in response to increased demand. They are also part of the Protein Challenge 2040, which brings companies and civil society organizations together to promote a more balanced approach to the way in which proteins are produced and consumed.

Disclosures about products and services that respond to climate-related issues are useful when supported by accompanying narrative to explain the product rationale, climate-related outcomes to which it contributes and the timescales over which the benefits are likely to manifest. Companies may also consider providing financial plans such as R&D expenditure and potential financial performance, identifying development of sales, EBIT, expenditure, market size and growth.

Figure 11: Example of Nestlé's products contributing to healthy sustainable diets and zero net greenhouse gas emissions
(Nestlé Annual Review 2019)

Acting on climate change

The impacts of climate change are already apparent. It is a global issue that will affect everyone. We are innovating to reduce our environmental footprint, in line with our commitment to achieve net zero carbon emissions by 2050. This supports the ambitious 1.5° C target outlined in the Intergovernmental Panel on Climate Change's latest report. To thrive, businesses must be resilient to the risks of climate change. We conducted a high-level assessment of physical and transitional risks for several of our key commodity supply chains using a number of climate scenarios.

Garden Gourmet

Launching more plant-based products with a better environmental footprint is a key part of our strategy to achieve zero net greenhouse gas emissions by 2050.

II) THE CIRCULAR BIOECONOMY

The bioeconomy refers to the consumption of biological resources for the production of food and feed, products and energy. The circular bioeconomy represents a shift away from fossil fuel-based products towards low carbon, sustainable products that capture maximum value from biological resources. In a circular bioeconomy, biological resources are renewable, sustainably managed, recovered and reused as much as possible.

The circular bioeconomy presents a business opportunity that is valued at USD $7.7 trillion until 2030.[35] As a key source of input biomass, the opportunity is particularly pertinent for forestry companies. Forest products – if produced sustainably – can provide solutions to pressing environmental challenges including climate change, resource scarcity, food loss and waste, land use change and biodiversity loss.

Widespread adoption of sustainable forest products would bring resource efficient bio-based and circular business models to scale. Enhanced use of wood fiber products in the energy, building materials and construction sectors, for example, represents a huge opportunity for businesses to support climate change objectives by storing carbon in buildings and lowering material manufacturing and processing emissions. Similarly, recyclable and biodegradable fiber-based packaging is seeing an increase in demand, particularly as consumers turn away from single-use plastic products.

The bioeconomy presents companies with the opportunity to enter new markets and customer segments, reduce regulatory risks and increase competitive advantage, attracting new customers and retaining talent (see Figure 12 below).

Figure 12: The circular bioeconomy opportunity for businesses
(WBCSD's CEO Guide to the Circular Bioeconomy 2019)

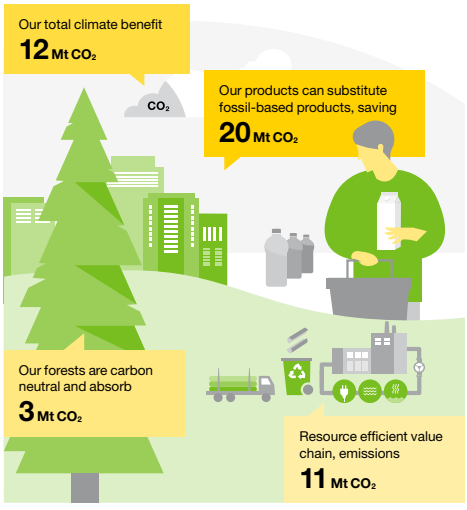
ENTER NEW MARKETS AND CUSTOMER SEGMENTS: The circular bioeconomy can help improve **financial performance** and company growth rates by e.g., creating **new markets**, accessing **new customer segments**, sourcing responsibly and enabling **new value chains.**

MITIGATE REGULATORY AND SOCIETAL RISKS: Companies can actively **reduce regulatory risks** of upcoming regulations in areas such as climate change or waste management. Companies can **be at the vanguard** in societal shifts towards material bans or investors' demand.

PROVIDE COMPETITIVE ADVANTAGE: Companies can do business with less environmental impact. This will give competitive advantage, **attract and retain talents and new customers.**

Figure 13: Stora Enso's climate-related opportunities
(Stora Enso Annual Report 2019)

Substituting materials from finite resources is our key competitive advantage



Best climate benefit comes from combining forest-based products and sustainable forestry with a resource efficient value chain. › Read more about the calculation method.

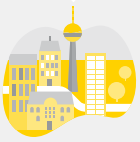
As a company, Stora Enso contributes to a better climate. Trees in our sustainably managed forests absorb CO_2 from the atmosphere and when harvested act as a store. Carbon stays in the fibers when they are made into products, and even through recycling. Carbon storage can be increased by substituting materials from finite resources with renewable alternatives. This is a significant and growing opportunity for us. By substituting fossil-based materials, Stora Enso's products saved an estimated 20 million tonnes of CO_2 in 2019 which is comparable to the average annual CO_2 emissions of 5.1 million cars.

Our business is a net contributor to prevent global warming.

Fiber-based products have a lower carbon footprint

Subsititute plastic trays

Trayforma paperboard trays for ready-meal packaging offer up to 64% lower carbon footprint than plastic trays.



If all plastic trays in Germany were replaced with Trayforma, the savings in CO_2 emissions would equal to heating all houses in Berlin in January.

Substitute plastic fish boxes

EcoFishBox by Stora Enso offers up to 30% lower carbon footprint than a traditional polystyrene fish box.

Switching to EcoFishBox in the Nordics would save fossil CO_2 emissions equal to the annual emissions of 76 000 cars.

Substitute plastic PET bottles

In Europe, a fiber-based beverage carton has up to 45% lower carbon footprint than a PET plastic bottle.*

* According to studies made by Ifeu for SIG Combibloc

Figure 14: Mondi's EcoSolutions examples contributing to the bioeconomy
(Mondi Sustainable Development Report 2019)

Members of WBCSD's Forest Solutions Group (FSG) have developed messages that describe the benefits of low carbon, circular fiber-based products. These include making the case for substituting non-renewable and fossil-based materials with fiber-based materials and promoting the role of forests and forest products as carbon sinks. Messaging is often supported by quantitative evidence of low carbon and circular impact, provided by product life cycle assessments and environmental product certificates or labels.

However, FSG members acknowledge several challenges associated with such efforts. These relate to the limitations in accounting mechanisms for land use, land use change, carbon removals, sequestration and product substitution. Responding to investor interest, some members also provide descriptions of financial plans and potential financial performance associated with low carbon, circular fiber-based products.

Some go further and identify development of sales and EBIT, expenditure, market size and growth and sensitivities. Disclosure of R&D expenditure, processes, case studies and collaborations also form a key part of investor-facing communications. For example, International Paper describes re-use and recycling research activities[36] and the Navigator Company describes strategic alliances with universities and collaboration with innovative technology partners.[37]

FSG members develop low carbon transition opportunities by undertaking long-term forward-looking analyses which draw on the work of several groups including the International Energy Agency, World Economic Forum (WEF), 2 degrees investing initiative, Transition Pathway Initiative, and the Shared Socioeconomic Pathways. For product opportunities, FSG members look to market studies and forecasts from organizations such as Hawkins Wright, Smithers Pira, Price Hanna and Plastics Insight.

Challenges remain around data availability and granularity, consensus on the time horizons over which opportunities should be assessed and consistent application and interpretation of models, scientific research and market studies.

C) MINIMIZING FOOD LOSS AND WASTE ACROSS THE SYSTEM

Roughly 1.3 billion tons of food produced for human consumption is wasted or lost across food supply chains every year.[38] This is equivalent to approximately one-third of all food produced globally. Food loss and waste occurs at multiple points across value chains and varies geographically. In sub-Saharan Africa, for example, 76% of total food loss occurs on the farm or in storage after harvest, and just 5% is wasted by consumers. Conversely, in North America, 61% is wasted at the consumer level and 23% is lost to pests and disease or in storage.[39] When food is wasted, the energy and water required to grow, harvest, transport and package it is lost. Wasted food also produces methane, a potent GHG, when it rots. WWF estimates that eliminating food waste would avoid 11% of global GHG emissions that arise from the food system.[40]

Reducing food waste and loss represents a potential USD $700 billion opportunity for businesses.[41] Research has shown that, for every $1 invested in food loss and waste reduction, the median company site realized a $14 return.[42] Better data collection through end-of-life product management practices provides companies with the ability to identify the points in the value chain at which losses occur. Companies can use this data to estimate losses and set targets. The data can also be used to improve consumer awareness and encourage behavioral changes to reduce food waste. Companies that understand where operational losses occur can make substantial savings and emissions reductions. Savings can be invested in the development of more efficient supply chain practices, such as better storage or supply chain infrastructure. Sustainable packaging solutions can also help prevent food losses from the point of harvesting through to transport and display. High quality, sustainable packaging can also help increase shelf life by reducing oxygen exposure, for example, thereby reducing food waste.

The Food Loss and Waste (FLW) Accounting and Reporting Standard[43] provides requirements and guidance for quantifying and reporting the weight of food and/or associated inedible parts removed from the food supply chain. The standard terminology and requirements support consistency, comprehensiveness, comparability and transparent disclosure of FLW inventories. Quantifying FLW is an important foundation for efforts to deliver a diverse array of benefits, including avoiding GHG emissions. Business are encouraged to report the physical amount of FLW expressed as weight along with tracking or reduction targets, the inventory scope (time, material type, destination, boundary etc.), quantification methods (including sampling and scaling), assessment of uncertainty and an assurance statement.

Figure 15: Nestlé's targets to reduce food waste across their value chain
(Nestlé website)

Ongoing

As a member of Champions 12.3, accelerate progress toward halving food waste by 2030.

In progress

Our result: We are implementing actions to reduce food losses across our value chain.

By 2020

Achieve zero waste for disposal in our sites.

In progress

Our result: Volume of waste for disposal reduced by 91.6% (since 2008).

By 2020

Make date labels understandable to our consumers to reduce food waste at consumption stage.

In progress

Our result: We continue to develop initiatives to make food date labels more understandable for consumers.

Figure 16: Unilever's Hellmann's brand tackling food waste
(Unilever website)

On the side of food: too good to be wasted

We're on the side of food – and believe it's too good to be wasted. Our Hellmann's brand is championing the true value of food, tackling food waste through behaviour change campaigns and innovative recipes.

Food waste in Brazil is no throwaway topic. 61% of Brazilians dispose of unused food weekly, with 78% reporting "fridge blindness" (the inability to see the possibilities in your fridge) as a contributory factor. To tackle this, the Hellmann's team launched a campaign in 2018 to inspire people to turn their leftover ingredients into delicious meals. The team kicked off the campaign with the launch of the first-ever "Bring your own food" restaurant: a pop-up eatery proving that virtually any left-over ingredients in the fridge can be turned into an excellent meal, with the help of Hellmann's mayonnaise.

The pop-up eatery went live in August 2018 and, unlike other restaurants, there were no menus, no prices, no restaurant food. The eatery simply offered just delicious possibilities hiding in people's fridges. The event generated widespread coverage across the press, bloggers, vloggers and consumers, showcasing the movement against food waste. The campaign also encouraged people to share recipes and tips on social media with the Unilever campaign hashtag "#foodhasvalue."

Several years ago, our Hellmann's brand decided that a traditional rule among ketchup producers needed to be broken: if a tomato wasn't red, it wasn't going in. But selecting only red tomatoes meant that up to 10% of the harvest was discarded. So instead of separating the fruit as usual, our tomato supplier Agraz adapted its process so red and green tomatoes could be processed together. The result was Hellmann's Red and Green Tomato Ketchup, launched in April 2017, which has received positive consumer feedback. The innovation is potentially preventing around 2.5 million tomatoes being wasted each year.

6 Strategy and governance: Business resilience and decision-making

6 Strategy and governance: Business resilience and decision-making

SUMMARY:

- Forum members' existing disclosures show climate change considerations have been integrated into governance oversight, risk assessment, mitigation and adaptation approaches. Climate change is also considered in innovation efforts and investments in new product R&D, as well as services and solutions that leverage opportunities.
- Forum members are starting to use scenario analysis to understand business resilience in the face of potential climate-related impacts and against different transition pathways.
- Long-term assessments are limited by data gaps connected with certain geographies, commodities and markets.
- Scenario analysis is supporting the processes members are using to make complex decisions about climate impacts, dependencies and tradeoffs.

In part C of its recommendations on disclosures about strategy, the TCFD encourages companies to "describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario." There is no universally agreed definition of climate resilience, or what it means for an organization's strategy to be resilient to climate change. The TCFD's Final Report states that "the concept of climate resilience involves organizations developing adaptive capacity to respond to climate change to better manage the associated risks and seize opportunities including the ability to respond to transition risks and physical risks."

Forum members have elaborated on the TCFD's definition and interpret **climate resilience** as a dynamic state of preparedness for a range of different futures in pursuit of a particular state in which society lives and flourishes within the planet's climatic boundaries. Forum members' vision of a resilient state for food, agriculture and forest products envisages food security and nutrition for 9+ billion people by 2050 and sustainable forest management that balances the enhancement and restoration of natural carbon sinks.

Strategic resilience refers to the way in which a company's strategy supports and prepares for the achievement of a resilient state under different climate scenarios. Strategic resilience is threatened by shocks and stressors that affect the infrastructure, assets, plans, supply chains, products, processes and finances on which the company depends to succeed, and that support high-level objectives. Climate-related shocks and stressors for food, agriculture and forest products include biophysical, socioeconomic and policy-related changes. Strategic resilience prepares for, and is responsive to, these shocks and stressors. It is developed and demonstrated at a company level by:

- The **integration of climate considerations in corporate governance processes** and decision-making techniques, including via **the use of scenario analysis** (as this chapter demonstrates);
- **Risk assessment, mitigation and adaptation** approaches that limit and manage the impact of stressors and shocks (see Chapter 4);
- **Innovation and R&D of new products, services and solutions that** leverage opportunities associated with climate change (see Chapter 5).

GOVERNANCE AND OVERSIGHT

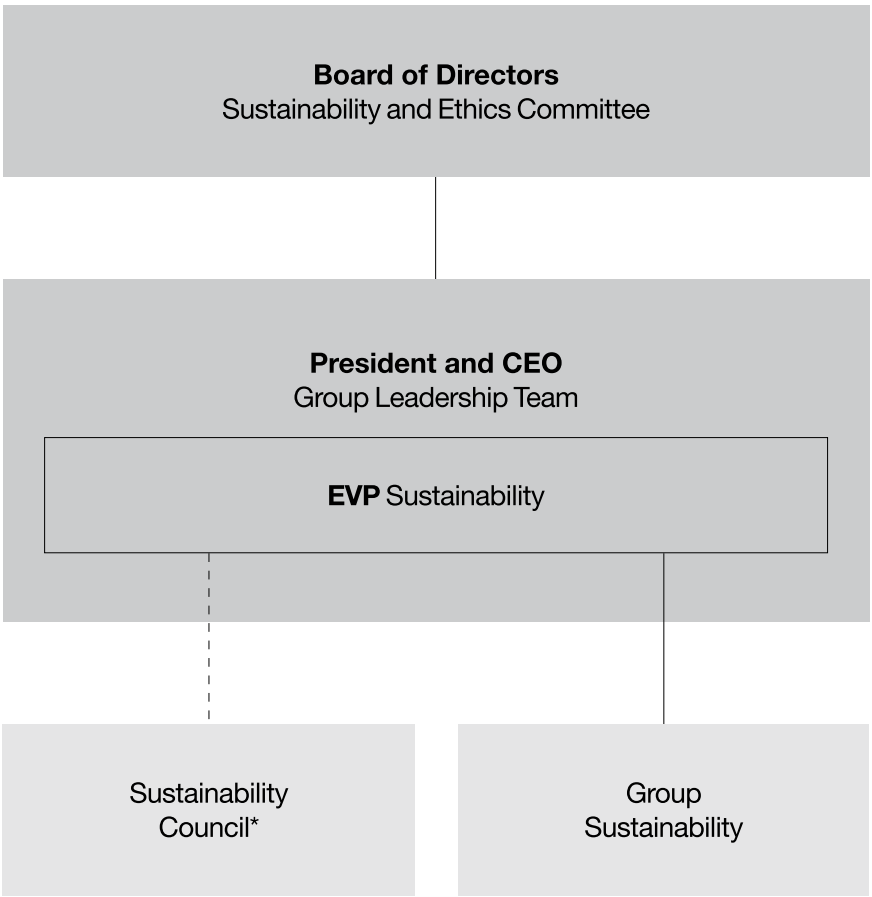
Forum members are currently demonstrating preparedness through disclosures about the way in which climate-related issues are integrated into their governance, strategic, financial and operational decision-making processes.

Figure 17: Unilever's statement on accountability for the management of climate-related risks and opportunities
(Unilever Annual Report and Accounts 2018)

The Boards take overall accountability for the management of climate change risks and opportunities with support from the ULE and the USLP Steering Team. Chaired by Keith Weed in 2018. the USLP Steering Team includes nine members of the ULE and meets five times a year. During 2018 there were numerous agenda items on topics related to climate change including our overall climate strategy and our renewable electricity target.

For management employees (including the ULE). incentives include fixed pay. a bonus as a percentage of fixed pay and a long-term management co-investment plan (MCIP) linked to financial and USLP performance. The USLP component accounts for 25% of total MCIP award. The sustainability component of MCIP includes consideration of our progress against climate change. water and palm oil targets. which among others. underpin our climate strategy.

Figure 18: Stora Enso's sustainability governance organizational structure
(Stora Enso Annual Report 2019)



* Stora Enso's operational sustainability work is steered by our Sustainability Council, which includes members from our divisions, Sourcing and Logistics function, and subject matter experts from our Group Sustainability team.

– – EVP Sustainability chairs the Sustainability Council. Members of the Council report directly to their respective EVP.

Disclosures about the integration of climate considerations into governance processes are useful when they include information that:

- Explains when and how climate change has been a major factor in strategic board decisions. For example, the use of a carbon price in capital appraisals, strategic changes to product portfolios, and acquisitions or divestments motivated by climate considerations;
- Identifies where remuneration aligns with metrics used to assess material climate-related risks, opportunities and targets;
- Provides clear evidence of climate-specific responsibilities among board members and management;
- Describes organizational structures and reporting lines for the governance of climate change;
- Explains the competencies of board members to make robust and well-informed decisions on climate change.

SCENARIO ANALYSIS

As recommended by the TCFD, Forum members are starting to explore the use of scenario analysis to understand potential business implications and performance in a range of possible future states. Forum members typically use at least two scenarios for this purpose, ranging from those indicative of a 1.5-2°C temperature increase to a scenario that anticipates 4-6°C of warming. Forum members use public reference scenarios, namely the International Energy Agency's 2 Degrees Scenario (2DS) and 450 scenario and the IPCC's Representative Concentration Pathways 2.6 and 8.5 scenarios (RCP2.6 and RCP8.5).

Forum members are at different stages developing their scenario analysis practices and this is reflected in current disclosures. Given the diversity of the products they make and the geographies in which they operate, members have typically begun by conducting scenario analysis 'pilots' focused on key material or at-risk commodities or geographies.[a] Forum members commonly use a combination of the variables listed in Tables 4 and 5 as inputs when conducting scenario analysis.

Table 4: Low carbon transition scenario attributes:

VARIABLES TO CONSIDER	ATTRIBUTES
Commodities and Raw Materials	Price Availability/yield Quality Nutritional value
Policy	Carbon pricing Targets for renewable energy Greater regulation of hydrofluorocarbons Circularity regulation Transport policy (e.g. IMO targets) Food loss and waste regulation
Technology	Adoption of new technologies and products Electric vehicle use Operational and material efficiency Deployment of carbon capture and storage/ usage
Market changes	Reputational concerns Dietary changes Demand for renewable materials
Energy and Resource Efficiency	GHG emissions Energy demand Renewable energy share in power generation Fossil fuel share in power generation Bioenergy demand Electrification (electricity share in final energy demand) Energy efficiency/intensity
Low Carbon Land Management	Zero deforestation Sustainable forest management Low carbon land management Adoption of sustainable agricultural technologies
Social	Financial inclusion Productivity Migration Access to water, sanitation and hygiene (WASH) Demographics (e.g. age, gender) Food/nutrition security

Table 5: Physical climate impacts scenario attributes:

VARIABLES TO CONSIDER	ATTRIBUTES
Acute Physical Impacts	Pests Disease Droughts Wildfires Floods Frost
Chronic Physical Impacts	Water scarcity Soil health Biodiversity impacts Changes to precipitation patterns Sea level rise Changing temperatures
Social	Financial inclusion Productivity Migration Access to WASH Food/nutrition security

[a] Forum members typically focus on origins where the production of a particular commodity is especially dependent on specific geographies and climatic conditions e.g. cocoa 70% of which is grown in Ghana and Ivory coast.

Disclosures about scenario analysis are most useful when they describe the critical input parameters, assumptions and analytical choices for the climate-related scenarios used, particularly as they relate to key areas such as policy assumptions, energy deployment pathways, technology pathways, and related timing assumptions.

Disclosures about the impact of different potential future scenarios on a company are currently stated in qualitative terms. Users of information are interested in quantified estimates of financial impact but recognize that techniques for providing quantitative information are yet to develop and might be restricted by commercial sensitivities.

Figures 19 and 20 illustrate how the potential business impacts of two specific attributes (carbon price and drought), under different climate scenarios can be assessed and disclosed. Disclosures could express impacts in financial terms (taking into consideration the four major categories of financial impact identified by the TCFD – revenues, expenditures, assets and liabilities, and capital and financing) or non-financial terms.

Figure 19: Illustrative impacts of a carbon price on a company in a 1.5-2°C scenario

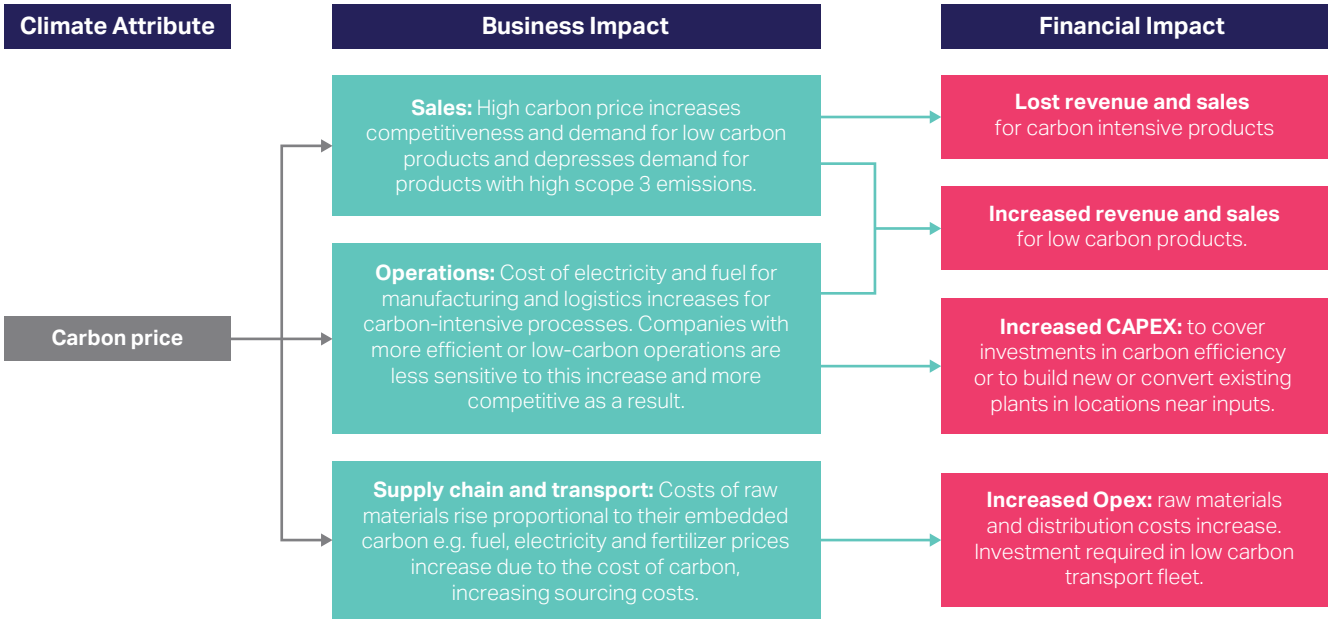
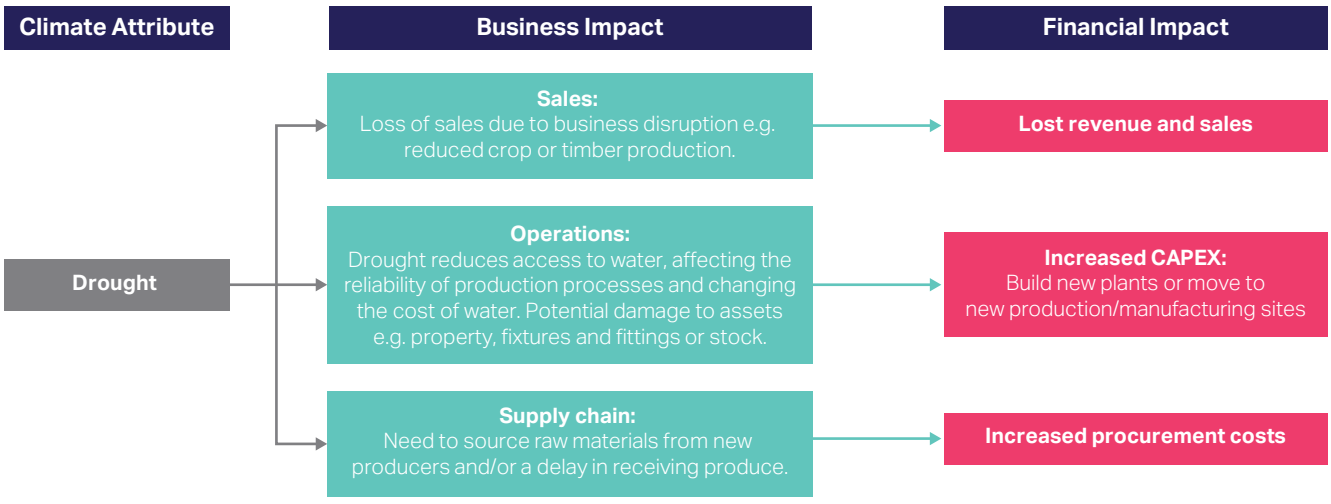


Figure 20: Illustrative impacts of a drought on a company in a 4-6°C scenario



CURRENT DATA GAPS FOR SCENARIO ANALYSIS

Depending on the scope of the assessment, Forum members have found significant data gaps when completing scenario analyses. For example, there is more extensive, quantitative climate data for commodities such as dairy and wheat under different climate scenarios than there is for coffee or palm oil.

Integrated models where climate, crop and commodity sciences are combined with local data, experiences and internal business knowledge are also needed. Current methodologies do not cover entire value chains and most studies are global or regional in nature, yet climate impacts can be very local and affect geographies and sectors differently.

To increase the business relevance of future analyses, more granular data is needed at the local and asset level, while recognizing that predicting weather and climate at that level comes with significant uncertainties. Further challenges identified by the Forum include:

a) The majority of publicly available scenario methodologies do not currently include agriculture or forest products.

b) A lack of data granularity in specific risk pathways or benchmarks for the sectors.

c) The timescales over which strategic resilience is assessed using scenario analysis vary by crop, commodity and geography. For example, tree plantations in the Southern hemisphere grow at a much faster rate than European forests.

d) Discrepancies between observable evidence and scenarios. For example, evidence of extreme weather damage being observed in some European forests was not foreseen in scenarios.

e) Extreme weather is currently very difficult to model, impacting the assessment of physical risks and development of physical scenario analysis.

f) Data and climate models are lacking for particular commodities (e.g. palm oil).

g) The implications of companies moving towards a 1.5°C scenario more quickly than society, and the associated value at risk and relative merits of investment choices, are hard to assess.

h) Establishing the limits of responsibility for end user/ consumer emissions and emissions across the supply chain.

CLIMATE SCIENCE INSIGHTS PROVIDED BY THE UNIVERSITY OF LANCASTER

HOW CAN CLIMATE RESEARCH ADDRESS THE GAPS AND CHALLENGES?

Providing relevant climate and impact data for businesses is a significant challenge for climate science. It is further complicated for sectors like food, agriculture and forest products, whose raw materials, supply chains and operations are in different geographies and exhibit a range of different climate sensitivities. Yet the science *is* making progress. Improved tools and new ways of working can help support this effort, examples of which are outlined below.

1. Advanced data science to improve predictions and projections

Many climate scientists are looking to make better use of existing computer models and observations by leveraging the power of data science. Computer model output and measurements from satellites, weather balloons and ground-based platforms provide a vast amount of information. State-of-the-art statistical, machine learning and artificial intelligence techniques are beginning to provide new understanding and reveal new patterns to aid predictability. For businesses, this could mean improved downscaling techniques to provide projection data at a more granular level, better reliability of simulating high-impact extreme events and improved estimates of uncertainty to better inform risk analyses.

2. Developing new integrated tools

Providing information relevant to decision-makers often means linking chains of computer models. For instance, frameworks to assess future wheat yields may include separate models to simulate the global climate, local weather, crop growth and economics, as well as models or heuristics to describe particular labor market conditions and sensitivities (e.g., how will a workforce be affected by climate change?).

Building such end-to-end frameworks is an ongoing challenge involving several disciplines relevant to the individual models and, increasingly, data scientists, software engineers and other computer scientists. Key issues are related to compatibility of different model outputs and appropriate accounting for uncertainty as we move down the model chain. Nevertheless these model frameworks, when appropriately constituted to address a particular aspect of the business or an entire portfolio, represent the most suitable way to rationalize the overall impacts of future climate change on productivity and profitability.

3. New partnerships to co-deliver relevant research

Meaningful partnerships with business remain the preserve of comparatively few research groups. With effort from both sides, such partnerships need to grow in number and depth so that new experiments, tools and analyses can be co-developed in ways that are useful and impactful for businesses and their employees, customers and investors. This might include working with climate scientists to develop relevant "stories" of the future, as opposed to working with more opaque decadal average temperature changes and probabilities. For instance, a storyline might consider the risk and impacts of consecutive heatwaves and large crop failures over a short period, allowing a business to stress-test its mitigation measures. Working with experts who use or develop future scenarios will also enable businesses to ensure their own scenario analyses are consistent in terms of the climate, economic and regulatory change.

Nestlé
Good Food, Good Life

CASE STUDY: Nestlé's experience using scenario analysis to explore climate-related impacts on the production of wheat, coffee and dairy products

PURPOSE OF THE ASSESSMENT

Nestlé's aim was to understand scenario approaches, time horizons, data requirements and climate-related physical and transition risks and opportunities, with a particular focus on physical impacts across key commodities.

SCOPING, PROCESS AND APPROACH

Nestlé chose two different scenarios – science consistent with the IPCC RCP 8.5 scenario, which considers Business as Usual (equivalent to a 4-5°C warming), and science consistent with the Paris Agreement (1.5°C - 2°C). Its analysis focused on the impacts up until 2100 in selected geographies for three commodities – coffee, dairy and wheat. The commodities and geographies were chosen because of their importance to Nestlé's strategic growth and potential climate-related risks.

Nestlé worked with climate scientists and agricultural, financial and accounting specialists at the University of Lancaster to review and summarize relevant climate, crop and livestock science and literature. Data availability dictated that the analysis considered the following key variables: acute physical impacts such as pests, drought and fires; chronic physical impacts such as rising mean temperature and soil health; crop variables such as productivity, yield, quality, nutritional value and genetic resilience; impacts on farmers; technological developments; and biodiversity impacts.

The work considered macro perspectives (present and future) and allowed Nestlé to understand how the current IPCC climate scenarios are generated and how the science can be translated into potential impacts on commodities. It also highlighted the uncertainty related to the predictability of the climate system at small scales and the need for additional research on resilient crops and agricultural practices.

RESULTS AND DECISION-MAKING

The results of the assessment showed that transition and physical risks could have a variety of material impacts on Nestlé along different time horizons.

Physical risks

The analysis focused upon the main physical risks associated with changing rainfall patterns and temperatures and extreme weather events. Specific commodities face different potential impacts as a consequence of these physical risks, including changing yields and areas viable for growth. For coffee, temperature change may require movements to areas of higher elevation, with subsequent potential deforestation risks.

Wheat yields are likely to increase and decrease in different geographic regions, and the protein content is likely to decline in some geographies. Physical impacts are relatively similar under both scenarios up until 2040 – 2050, after which point critical physical risks and consequences become evident under the business-as-usual scenario.

Transition risks and opportunities

The analysis showed that transition risks, which cover the disruption inherent in the move from the current business-as-usual to a low carbon economy, are not well reflected or covered in the literature. The Nestlé and Lancaster teams highlighted that the current literature on transition risks mentions the financial impact of carbon pricing and uncertainty of timing of technology. They also identified two other transition risks: firstly, the reputational risks for companies that may arise if the public perceives that a company is not adequately contributing to a low (net-zero) economy; and secondly, the investments needed over the next decade to align with a Paris-related scenario which, if not adopted industry-wide, will lead to a competitive disadvantage. If not adopted, a business-as-usual scenario might play out anyway and a new round of investment would be needed to adapt to higher temperatures. Transition risks therefore provide the key difference between business-as-usual and Paris-related scenarios up until 2050. The Nestlé and Lancaster teams recommended more pro-active academic and policy research into this area to guide companies and investors.

LEARNINGS

Time horizons

Time horizons associated with climate change present a unique challenge as risks and opportunities extend beyond normal business strategic planning cycles, which are often focused on the next five years (with an additional five years extrapolated).

Data

Impacts are well documented up until 2050 but data is scarce beyond this timeframe. In particular, transition risks are not well documented in the literature and are largely limited to the financial impact of carbon pricing and the uncertainty of timing of technological developments.

Bringing together multiple actors

There is clear value in academia and the private sector collaborating to develop robust models, clear mitigation action plans and focused adaptation to make business more sustainable. In this way, business benefits from the expertise of scientific specialists to help interpret the literature and data and academia better understand practical application processes and knowledge gaps. Scenarios provide an important opportunity for companies to bring together different actors internally to focus discussion. Within Nestlé, there was a clear benefit to working with professionals from across the business (e.g. risk, finance, sustainability, investor relations, agronomists, nutritionists, legal etc.) as each brings a different perspective and expertise.

CASE STUDY: Unilever's experience of conducting scenario analysis across the business and on a specific commodity

PURPOSE OF THE ASSESSMENT

Unilever wanted to use scenarios to systematically assess climate risk, to understand the overall significance of climate impacts on their business and ensure the resilience of their strategy.

SCOPING, PROCESS AND APPROACH

The assessment focused on understanding the potential impact of climate change on profit and loss (P&L) including revenue, manufacturing and sourcing costs. 2030 was chosen as the time horizon for the assessment for several reasons:

- The TCFD scenario analysis guidance on exposure to physical risks states "organizations typically focus on the consequences of physical risk scenarios over shorter time frames that reflect the lifetimes of their respective assets or liabilities, which vary across sectors and organizations";[44]
- 2030 is a reference date included in several models;
- Unilever's Sustainable Living Plan greenhouse gas and carbon positive commitments are set to this date;
- 2030 is a close enough timescale to be considered for key decisions in internal discussions.

Unilever used two scenarios:

- one focused on global warming limited to 2°C by 2100, looking primarily at transition impacts;
- the other was based on global warming limited to 4°C by 2100, looking primarily at physical impacts.

The assessment drew on several scenarios including physical scenarios (e.g. IPCC RCP 8.5 Scenario) and transition scenarios (e.g. Greenpeace Energy Revolution, IEA WEO 450ppm scenario, IEA 2DS).

In the 2°C scenario, the model assumes that carbon pricing is introduced in key countries and hence there are increases in manufacturing costs and the costs of raw materials such as dairy ingredients and metals used in packaging. Similarly, zero net deforestation requirements are introduced and a shift to sustainable agriculture puts pressure on agricultural production, raising the price of certain raw materials. Under the 4-degree scenario, chronic and acute water stress reduces agricultural productivity in some regions, raising the prices of raw materials. More frequent extreme weather (storms and floods) causes increased incidence of disruption to manufacturing sites and distribution networks. Temperature rise and extreme weather events reduce economic activity and GDP growth and sales levels fall.

Under each of these scenarios, Unilever was assumed to have not responded with any mitigation, adaptation or innovation activity.

Figure 21: Gross Impacts of a 2°C Low Carbon Transition Scenario

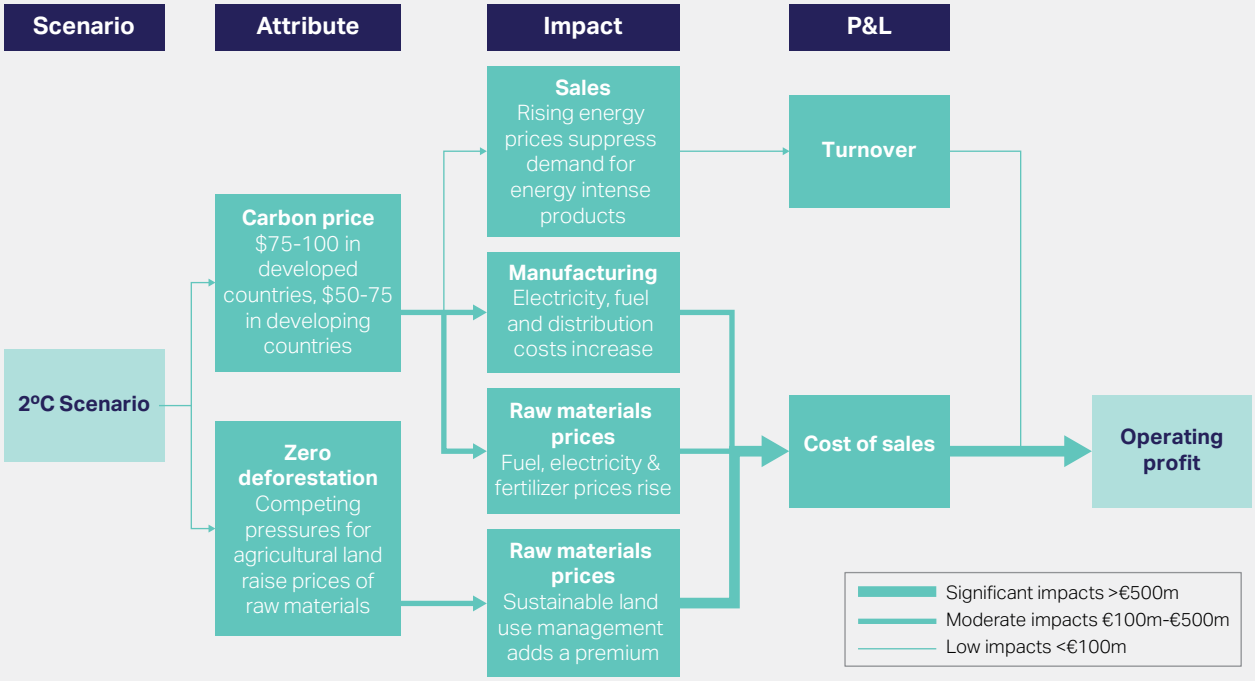
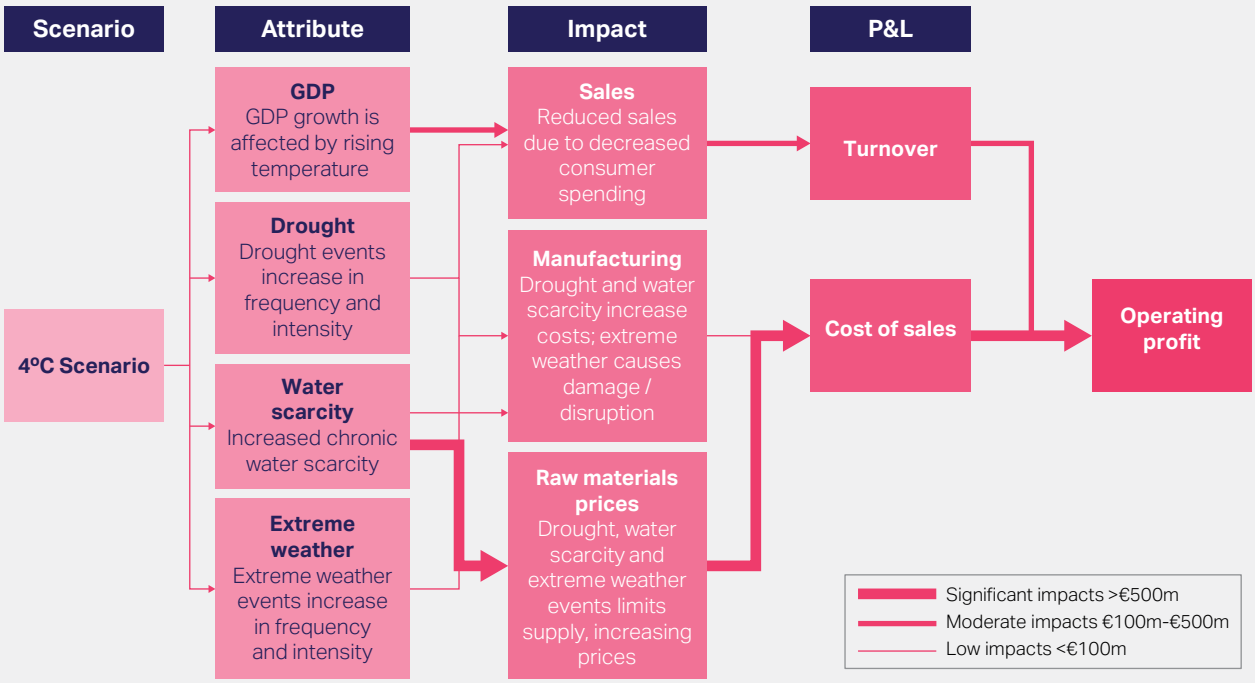


Figure 22: Gross Impacts of a 4°C Physical Climate Impacts Scenario



The results showed that Unilever's overall largest potential impacts were in its supply chain due to rising costs of raw materials and packaging. Carbon pricing and a rapid shift to sustainable agriculture had significant impacts under a 2°C scenario. Chronic water stress and extreme weather were most impactful under a 4°C scenario.

The results were presented to and circulated among key stakeholders internally and the analysis was used as a guide for where key decisions could be impacted. Given the potential financial implications, Unilever wanted to better understand the potential impacts of climate change on its key commodities. The decision was taken to focus on a key ingredient and crop – soy – for which pricing and climate models are available.

To build a pilot model, external and internal data sets were collated and data availability and quality checks carried out. Unilever considered the direct risks from climate change to the price of soybean oil, including changes in yield and supply. The pilot model was developed to include three steps:

1. Estimation of future yields by analyzing external agricultural and climate models in key growing regions.
2. Estimation of the impact on future soy prices as a result of climate-related yield changes.
3. An econometric model was developed, based on an analysis of the soybean oil market and historical trends, to estimate the impact of climate-induced yield changes on future prices. The model considered the importance of co-products e.g. soybean meal, substitution potential e.g. with sunflower oil, and industrial uses of soybean oil, as well as the impact of soybean yield on price.
4. Future yield and price impacts were used to calculate the estimated financial impact, based on forecast purchasing volumes.

RESULTS AND DECISION-MAKING

The pilot analysis showed that soybean yields may initially increase over the 2030- and 2050-time horizon and that subsequent lower prices may lead to small potential reductions in procurement spend on soy. While the results may indicate a low financial risk, Unilever would need to consider a wider range of risk factors when determining its strategic response. Indirect risks from climate change, such as catastrophic events or external policy response and adaptation could also have an impact, but these were not included in the modeling.

LEARNINGS

- *Senior Leadership involvement*: It was crucial to have the support of the CEO and CFO to help obtain resources for the analysis.
- *Preparation:* Preparing data in advance and reviewing what is available is crucial before starting out.
- *Understand the output and how to communicate it:* Scenario analysis isn't designed to provide a forecast, so it should not be presented as one. Executives are used to precise and exact calculations to make their decisions; scenario analysis cannot provide this. However, it does provide a range of possibilities that encourage decision makers to think about things differently. This caveat should be communicated upfront to help senior management understand the information.
- *Cross functional team:* A project team, led by the Finance function with support from other functions, provided a variety expertise and experience.
- *Start somewhere:* It is important to take a pragmatic and practical approach to get started.
- *Keep it simple:* Scenarios become more complicated the more variables there are. Unilever simplified its approach by having two distinct scenarios at first to understand business-wide risks, and applying specific scenarios to address risks and opportunities at the commodity/ingredient level.

CASE STUDY: Mondi South Africa – forestry operations

BUILDING AN UNDERSTANDING OF CLIMATE RISKS AND OPPORTUNITIES ACROSS MONDI'S SOUTH AFRICAN FORESTRY OPERATIONS

For Mondi, climate-related physical risks (e.g. extreme weather patterns, water shortages, floods and other natural disasters) could give rise to interruptions in their business operations and supply chain and make their forests more vulnerable to pests and diseases. More importantly, the Group firmly believes that business has a leading role to play in tackling climate change.

Mondi fully supports the growing demand for improved financial disclosures in relation to climate-related risks and opportunities. The TCFD has outlined its recommendations for more effective climate-related disclosure standards and Mondi continues to build on its approach with a focus on quantifying the implications of potential risks and opportunities.

WHY DID MONDI FOCUS ON PLANTATION FORESTS IN SOUTH AFRICA?

Mondi's strategic approach to improving its understanding of climate risk has been to focus on the three regions where it has pulp and paper mills and forestry operations, namely Europe, Russia and South Africa. South Africa is a key region for the Group, with extensive forestry land and pulp and paper operations. Forests and other natural ecosystems are the best and most cost-effective carbon-capture technology available.

As part of its Group-wide risk management framework, Mondi set out to build an understanding of climate-related risks and opportunities facing the South African forestry business to guide strategy around aspects such as land ownership, tree improvement and management regimes.

SCOPE AND APPROACH TO ANALYZE THE RISKS AND OPPORTUNITIES

In line with TCFD recommendations to choose a realistic scenario and a pessimistic scenario, Mondi uses two core global climate scenarios from the IPCC to analyze climate-related risks and opportunities over a 10–30 year period in line with timescales typically used in the literature:

- The International Energy Agency's 2°C Scenario (2DS), based on limiting global temperature rise to below 2°C above pre-industrial levels under an emissions trajectory that allows CO_2 emissions to be reduced by almost 60% by 2050 compared with 2013;
- The Representative Concentration Pathway's 8.5 (RCP8.5) business-as-usual scenario, which projects the global mean temperature to rise by 2.6 to 4.8 °C by the late 21st century.

Mondi focused primarily on plantation forestry with a review of existing published research and an analysis of algorithms developed by a local research institute on downscaling the core climate scenarios to a local geographic context. This formed the basis for assessing potential growth and resilience impacts and response options across a diverse landscape. Mondi worked with sustainability and technical experts in the field to validate the downscaled scenarios and highlight key risks.

UNDERSTANDING THE OUTCOMES

The results of the analysis suggest a generally warmer environment in the future is likely, with more stable conditions in the east of South Africa where Mondi's plantations are located.

Linking the understanding that Mondi and its research partners have of historical genetic-site relationships, it is possible to link a future rainfall/temperature regime to known plantation forestry species and hybrid tree clones. This highlighted areas where current clones will most probably need to be substituted to mitigate the impacts of a gradual change or extreme increase in growth rate and resilience drivers. Where a viable substitute is not available, tree improvement researchers are provided with structured guidance on future site requirements and can direct their efforts in a more targeted manner.

The analysis has provided local management with a range of possible outcomes to inform decision-making on tree breeding. The Sustainable Development Committee of the Board is updated on tree-breeding activities and climate-related risks. Although it is too early to give a time-specific probability, key risks such as an increased frequency of drought and high rainfall/wind events stand out and can be used when calculating potential financial impacts and initiating response strategies.

WHAT WERE THE KEY LEARNINGS FOR THE MONDI TEAM?

- *Making use of standardized sources*, such as IPCC scenarios, and then working with local experts to translate these at a local level allowed for a more credible analysis, while enabling comparison across other global regions.
- *Existing knowledge* about the response to historical events such as drought/frost or pest and disease occurrence should be applied to modeling. It is easier to devise response strategies when the scenario outcome can be related to a familiar situation.
- *Process-based modeling*, where tree physiology and its relation to the growing site is characterized, provides more relevant outputs than *empirical modeling*.
- *Developing relationships with research institutions* is critical to ensure credibility of the analysis, particularly where science is combined with business analysis.

USING RESILIENCE AND LONG-TERM ASSESSMENTS TO INFORM DECISION-MAKING

Forum members have seen varied potential outcomes from their assessments (see case studies above), ranging from short-term opportunities to severe financial impacts in some geographies and commodities. The capacity to build resilience and develop an effective strategic response depends on the operational context and the criteria used to allocate resources to modified or new approaches. By definition, forestry companies are committed to certain geographies and operate over long time horizons, over which adaptation and mitigation measures can be planned. In contrast, agriculture companies might have greater capacity to explore new growing regions, techniques, crops and crop varieties.

Given the range of results from resilience assessments and the associated implications, companies can face challenges when determining how to use the results to inform strategic decisions and associated disclosures.

Where the results show physical risks, agricultural companies face decisions about:

- Mitigation efforts to protect at-risk crops;
- Adaptation measures whereby current operations could be enhanced or changed using technology or other solutions, depending on local conditions;
- Whether to seek alternative crop origins or substitute crops in the case of severe potential impacts;
- Changes to distribution networks and routes.

The decision-making process takes account of:

- The business case for investment in mitigation and adaptation measures, including the expected economic, social and environmental benefits and minimization of losses;
- Local conditions in areas affected by decisions – including the success and vitality of the environment and local communities, and how conditions can be enhanced;
- Balancing cost/investment considerations with optimizing long-term opportunities;
- A systems-view of connections and dependencies between climate and society, climate and nature, the purpose of the decision-making company, and the role of business in society.

Figure 23: Circular model of resilience for food, agriculture and forest products

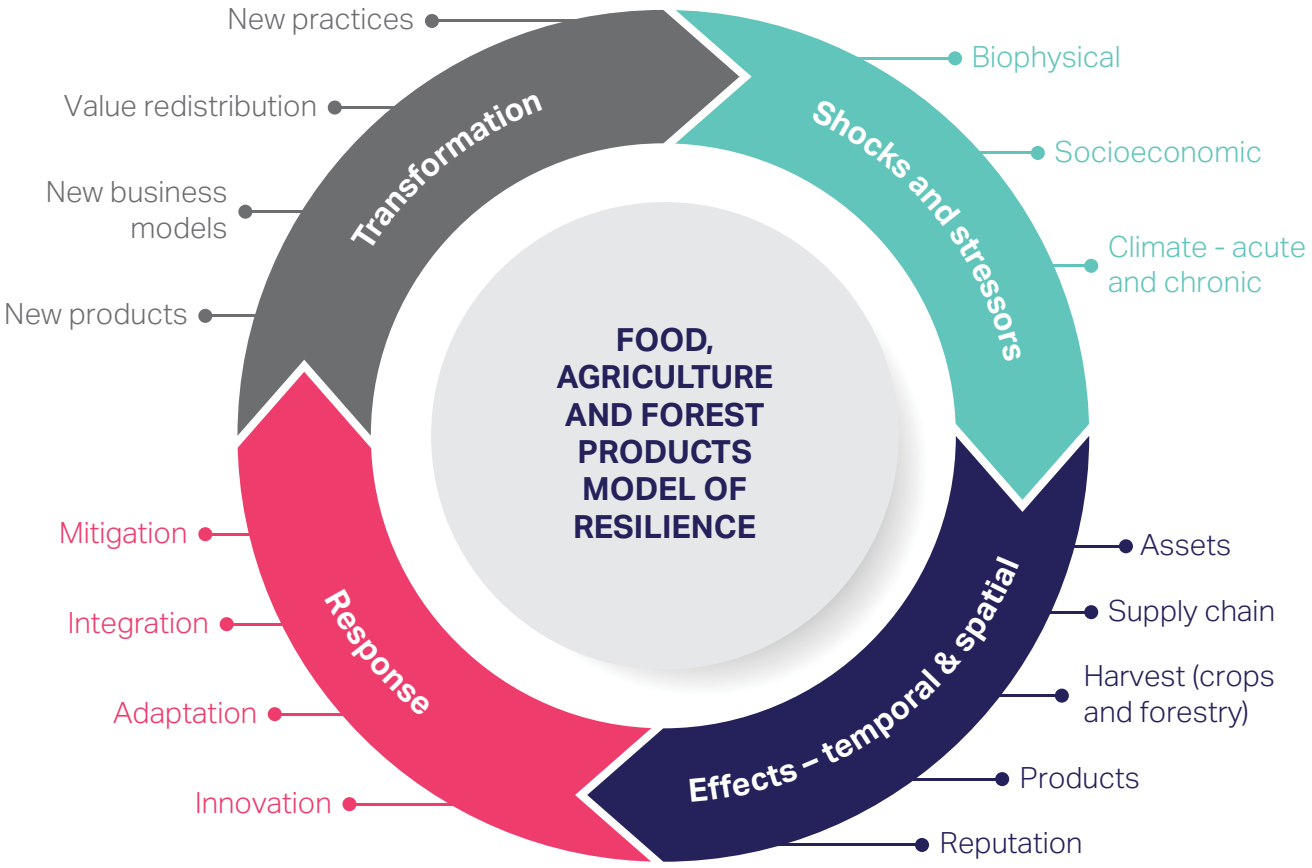


Figure 23 illustrates how business resilience depends on the extent to which a company is prepared to respond to external shocks and stressors through its different response actions, including mitigation, adaptation and innovation. Forum members believe resilience is a continuous process and a dynamic state that requires balance between chosen response actions and acknowledgement of the need for transformation, be it through new products and services or a change to the organization's business model.

Disclosures about decisions made and actions taken in response to scenario analysis demonstrate how well the exercise is being used in practice to inform company strategy. In many cases, decisions will support the continuation of the business, albeit with new adaptations, investments and relationships. In other cases, more transformational changes may be required to achieve climate resilience.

Uncertainty over the timing, scale and impact of climate change under different scenarios presents significant challenges when assessing how to balance adaptation, mitigation and transformative measures, and the associated investments required. Forum members recognize that, in order to be most effective, responses to transition risks must be implemented at the sector level and economy-wide, and that failure to do so might result in a business-as-usual (4-6 degree) scenario playing out and further costs to adapt.

USER PERSPECTIVE

Users are keen to see evidence that companies test their business resilience under a range of different future scenarios, take the long-term risks associated with climate change seriously, and incorporate these factors into strategic business decisions. Investors rely on information from companies about the results of their strategic resilience assessments using scenario analysis and, in some cases, investors corroborate or test this using their own analyses.

Disclosures about scenario analysis are most useful when they describe:

a) the scenarios used;
b) the methodology and assumptions applied;
c) the results of the analysis, including impact where possible;
d) how results have informed decision-making (e.g. investment decisions).

Users are interested in disclosures that indicate the potential financial impacts of climate change on the business under different scenarios. Where potential financial impacts can be quantified, users appreciate contextual detail and explanations about the way in which estimates have been reached.

Despite users' strong interest in understanding the financial implications resulting from scenario analyses, they accept that the quantification of financial impacts presents multiple challenges and that it will take time to develop robust quantification techniques and practices. Until then, disclosures about the implications of scenario analysis for strategic direction are considered useful by investors.

Users value information about strategic decisions that take account of the way the food, agriculture and forest product sectors need to develop over the medium (five to ten year) to long (10+ year) term, for example trends in the development of low carbon products and what could be at risk under a worst-case scenario. Investors are looking for signs through strategic decision-making, capital expenditure, R&D, innovation and governance processes that companies recognize, and are preparing for, risks associated with climate change. Furthermore, investors consider whether there is coherence between Paris-aligned investments and other strategic investments.

7 Metrics and targets: Measuring impact, performance and response

7 Metrics and targets: Measuring impact, performance and response

SUMMARY:

- Metrics and targets reflect how companies measure and monitor their climate-related risks and opportunities. They can be used to demonstrate progress made to implement strategic management, mitigation and adaptation responses.
- Forum members disclose operational metrics, for example GHG emissions, water consumption and energy usage. They also measure the impact of products across their value chains and are exploring climate-related financial metrics.
- Forum members have developed a table of illustrative metrics covering a range of activities from finance and operations to mitigation and adaptation. The intention is to inform discussions and build consensus about the most relevant and useful metrics for disclosure by food, agriculture and forest products companies.

The TCFD encourages companies to:

- disclose metrics used to assess and manage relevant climate-related risks and opportunities in line with their strategies and risk management approaches;
- disclose Scope 1, Scope 2 and if appropriate, Scope 3 greenhouse gas (GHG) emissions, and any related risk;
- describe the targets used to manage climate-related risks and opportunities and performance against targets.

CURRENT EXAMPLES OF METRICS DISCLOSURES

Forum members currently disclose a range of metrics including Scope 1, 2 and 3 emissions, water usage, waste management data and internal carbon prices used for decision-making. Members often provide historical performance data to show progress over time and demonstrate efficiencies in areas such resource use. Carbon intensity (by volume of product or revenue) is disclosed, along with operational energy usage broken down by source.

As well as metrics that reflect the operational performance of their own companies, Forum members increasingly measure the impact of products across their value chains. Several have set targets to reduce product lifecycle impacts. This helps companies understand and monitor risks across the value chain. Examples of metrics used to understand and manage value chain risk include responsible sourcing metrics – for example forest certification of owned and managed lands and percentage of deforestation-free products.

In 2019, as part of its *Reporting matters* initiative, WBCSD conducted an assessment of corporate target-setting specified in the three pillars of Climate Smart Agriculture (CSA) initiative, namely (I) Productivity, (II) Resilience and (III) Mitigation. The results of the assessment of seventeen companies[b] found that, while key CSA issues were often disclosed and considered to be of material importance to business, the majority of companies were not fully disclosing specific targets.[45] The findings were used in the development of the Smarter Metrics Guide to assist companies in setting tangible, measurable, science-based targets in line with food and agriculture systems transformation.[46]

The following extracts from Forum members' public reports show some of the metrics and targets they currently disclose.

[b] A limited number of companies were included in the scope of the review: members of the CSA 100 initiative and/or CSA group at WBCSD.

Figure 24: Unilever's Sustainable Living Plan targets and progress
(Unilever's Annual Report and Accounts 2018)

UNILEVER SUSTAINABLE LIVING PLAN

	TARGET	2018	2017	2016
IMPROVING HEALTH & WELL-BEING BIG GOAL: By 2020 we will help more than a billion people take action to improve their health and well-being. See page 13.				
HEALTH & HYGIENE Target: By 2020 we will help more than a billion people to improve their health and hygiene. This will help reduce the incidence of life-threatening diseases like diarrhoea.	1 billion	653 million	601 million	538 million[Φ]
NUTRITION Target: By 2020 we will double (ie up to 60%) the proportion of our portfolio that meets the highest nutritional standards, based on globally recognised dietary guidelines. This will help hundreds of millions of people to achieve a healthier diet.	60%	48%	39%[∞]	35%
REDUCING ENVIRONMENTAL IMPACT BIG GOAL: By 2030 our goal is to halve the environmental footprint of the making and use of our products as we grow our business. See pages 13 to 14.				
GREENHOUSE GASES Target: Halve the greenhouse gas impact of our products across the lifecycle (from the sourcing of the raw materials to the greenhouse gas emissions linked to people using our products) by 2030 (greenhouse gas impact per consumer use).+	(50%)	6%[θ]	9%[∞]	8%
Target: By 2020 CO_2 emissions from energy from our factories will be at or below 2008 levels despite significantly higher volumes (reduction in CO_2 from energy per tonne of production since 2008).**	≤145.92	70.46[†]	76.77[∞]	83.52[Φ]
WATER Target: Halve the water associated with the consumer use of our products by 2020 (water impact per consumer use).	(50%)	(2%)[θ]	(2%)[∞]	(7%)
Target: By 2020 water abstraction by our global factory network will be at or below 2008 levels despite significantly higher volumes (reduction in water abstraction per tonne of production since 2008).**	≤2.97	1.67[†]	1.80[∞]	1.85[Φ]
WASTE Target: Halve the waste associated with the disposal of our products by 2020 (waste impact per consumer use).	(50%)	(31%)[†θ]	(29%)	(28%)[Φ]
Target: By 2020 total waste sent for disposal will be at or below 2008 levels despite significantly higher volumes (reduction in total waste per tonne of production since 2008).**	≤7.91	0.20[†]	0.18[∞]	0.35[Φ]
SUSTAINABLE SOURCING Target: By 2020 we will source 100% of our agricultural raw materials sustainably (% of tonnes purchased).	100%	56%	56%	51%
ENHANCING LIVELIHOODS BIG GOAL: By 2020 we will enhance the livelihoods of millions of people as we grow our business. See page 14.				
FAIRNESS IN THE WORKPLACE Target: By 2020 we will advance human rights across our operations and extended supply chain, by:				
• Sourcing 100% of procurement spend from suppliers meeting the mandatory requirements of the Responsible Sourcing Policy (% of spend of suppliers meeting the Policy).	100%	61%[‡†]	55%[‡∞]	–
• Reducing workplace injuries and accidents (Total Recordable Frequency Rate of workplace accidents per million hours worked)**.		0.69[†]	0.89[∞]	1.01[Φ]
OPPORTUNITIES FOR WOMEN Target: By 2020 we will empower 5 million women, by:				
• Promoting safety for women in communities where we operate. • Enhancing access to training and skills (number of women). • Expanding opportunities in our value chain (number of women).	5 million	1.85 million[†*]	1.26 million[∞]	0.92 million
• Building a gender-balanced organisation with a focus on management (% of managers that are women)**.	50%	49%[†]	47%[∞]	46%
INCLUSIVE BUSINESS Target: By 2020 we will have a positive impact on the lives of 5.5 million people by:				
• Enabling small-scale retailers to access initiatives aiming to improve their income (number of small-scale retailers).	5 million	1.73 million[*]	1.60 million	1.53 million
• Enabling smallholder farmers to access initiatives aiming to improve their agricultural practices.	0.5 million	0.75 million[*]	0.72 million[∞]	0.65 million

Figure 25: Stora Enso's environment-related KPIs and targets
(Stora Enso Annual Report 2018)

Materials, water, and energy	Number of significant environmental incidents[5]	8	10	Zero significant incidents[5]	Not achieved
	Materials: Process residuals utilisation rate (%)[6]	98%	98%	To be reviewed during 2019	In progress
	Water: Total Water Withdrawal per saleable tonne of board, pulp, and paper (m^3/tonne)	56	56	Decreasing trend	In progress
	Water: Process water discharge per saleable tonne of board, pulp, and paper (m^3/tonne)	26	26	Decreasing trend	In progress
	Energy: Reduction in electricity and heat consumption per saleable tonne of board, pulp, and paper (kWh/tonne)	-4.2%	-4.2%	-15% by the end of 2020 from a 2010 base-year	In progress
Carbon dioxide	Reduction in CO_2 equivalents per saleable tonne of board, pulp, and paper (kg/tonne)	-18%	-21%	-31% by the end of 2030 from a 2010 base-year (Science-based target)	In progress
Forests, plantations, and land use	% of the owned and managed lands in wood production and harvesting covered by forest certification schemes[7]	96%	97%	Maintain the high coverage level of 96%[7]	Achieved

[5] Environmental incidents involving a non-compliance with environmental legislation, a permit or a significant stakeholder concern related to environmental performance.

[6] Utilisation rate for process residuals excluding, for example, tall oil, turpentine, and wood chips.

[7] During 2018 the KPI and target were reviewed to include only lands in wood production and harvesting. Includes joint operations in Latin America.

Figure 26: Mondi's GHG emissions from pulp & paper mills
(Mondi Sustainable Development Report 2018)

GRI parameter	Details	2014	2015	2016	2017	2018	Change 2017-2018 %
Scope 1 GHG emissions	Total t	4,308,655	4,477,666	4,067,788	3,777,282	**3,805,696**	0.8
	CO_2 emission t	36,747	37,969	53,764	83,496	**106,551**	27.6
	CO_2 emission out of C t	4,178,781	4,341,481	3,898,490	3,582,148	**3,578,512**	(0.1)
	CO_2 emission out of CH4 t	10,863	11,452	12,036	12,155	**12,046**	(0.9)
	CO_2 emission out of N2O t	82,265	86,763	91,332	91,366	**88,932**	(2.7)
	CO_2 emission out of ozone depleting substances t	Not available	Not available	12,167	8,117	**19,655**	142.1
	CO_2 emission out of SF6 t	0	0	0	0	**0**	0.0
Scope 2 GHG emissions[10]	market-based t	998,807	777,329	671,247	691,649	**583,031**	(15.7)
	location-based t	1,208,812	1,195,572	1,083,687	806,945	**570,382**	(29.3)
Specific Scope 1 GHG emissions	t CO_2e/t saleable production	0.68	0.71	0.65	0.61	**0.63**	3.4
Specific Scope 2 GHG emissions	t CO_2e/t saleable production	0.16	0.12	0.11	0.11	**0.10**	(13.5)
Scope 3 GHG emissions	Total	2,672,171	2,886,749	2,975,303	3,014,002	**3,240,979**	7.5
	Fuel and energy-related activities (not included in Scope 1 or 2)	435,000	439,291	399,966	385,613	**589,834**	53.0
	Purchased goods and services	1,499,524	1,663,253	1,826,793	1,867,405	**1,853,798**	(0.7)
	Employee commuting	48,705	47,177	48,514	49,469	**49,851**	0.8
	Upstream transportation and distribution	421,137	471,914	435,692	447,613	**483,037**	7.9
	Downstream transportation and distribution	263,869	260,980	260,035	259,998	**253,453**	(2.5)
	Business travel	3,936	4,134	4,303	3,904	**11,007**	181.9
Biogenic GHG emissions	Total	11,514,602	11,985,743	12,752,816	12,954,968	**12,571,767**	(3.0)

10 Market-based method: A method to quantify Scope 2 GHG emissions, based on GHG emissions emitted by the generators from which the reporter contractually purchases electricity bundled with instruments, or unbundled instruments on their own (CDP, 'Accounting of Scope 2 emissions', V3, 2016). Location-based method: A method to quantify Scope 2 GHG emissions based on average energy generation emission factors for defined locations, including local, sub-national, or national boundaries (CDP, 'Accounting of Scope 2 emissions', V3, 2016)

Figure 27: Syngenta's farm productivity, soil health, biodiversity and smallholder related metrics
(Syngenta Sustainable Business Report 2018)

Reporting period October 1 – September 30	Cumulative since baseline 2014	2018	2017	2016
Make crops more efficient[1,2]				
Total number of reference farms		**1,443**	1,459	1,039
Total number of benchmark farms		**2,316**	2,630	2,694
Land productivity increase on reference farms		**13.0%**	10.9%	1.2%
Land productivity increase on benchmark farms		**7.0%**	7.3%	-2.6%
Nutrient efficiency increase on reference farms		**30.2%**	20.3%	1.5%
Reference farms outperforming benchmark farms[3]		**64%**	–	–
Pesticide field application efficiency increase on reference farms		**24.7%**	14.2%	-16.2%
Reference farms outperforming benchmark farms[3]		**38%**	–	–
Greenhouse gas emission efficiency increase on reference farms[4]		**8.8%**	14.0%	7.0%
Reference farms outperforming benchmark farms[3]		**69%**	–	–
Rescue more farmland				
Hectares of benefited farmland (m)	10.8	**3.4**	3.1	1.9
Help biodiversity flourish				
Hectares of benefited farmland (m)	6.4	**0.8**	0.7	3.3
Empower smallholders				
Land productivity increase on smallholder reference farms[1,2]		**21.9%**	21.6%	8.0%
Land productivity increase on smallholder benchmark farms[1,2]		**6.3%**	5.1%	1.6%
Smallholders reached through training (m)		**6.1**	5.6	4.6
Smallholders reached through sales (m)		**13.4**	13.9	16.6

1 Reference farms were selected by Syngenta and are recommended to use Syngenta products and follow optimized protocols. Benchmark farms were randomly selected by a third-party research agency and represent grower practice. Reference and benchmark farms are grouped in clusters. A cluster presents homogeneous agro-climatic conditions and contains reference and/or benchmark farms with similar grower characteristics

2 Policy on land productivity and efficiency reporting was revised in 2017. Starting 2017, the aggregation of the farm data is aligned with harvest seasons to ensure more timely reporting of results. The latest available progress data is 2017 for clusters located in the Northern hemisphere and 2018 for clusters located in the Southern hemisphere. Evolutions are reported for clusters with an established baseline and at least one year of progress data. Figures represent global averages. Details on aggregation, calculation of evolutions and other adjustments can be found on www.data.syngenta.com

3 New KPIs introduced in 2018 to capture the performance of reference farms versus benchmark farms

4 Greenhouse gas emissions are calculated consistent with Cool Farm Tool methodology using available farm data and proxies where farm data was not available. For US farm data, calculation methodology is consistent with Field to Market: The Alliance for Sustainable Agriculture. Details on data inputs, methodology, assumptions and limitations can be found on www.data.syngenta.com

Figure 28: Olam's climate-related goals and objectives
(Olam Annual Report 2018)

Material Area:
Climate Action

Goal	2018 achievements
Increased energy efficiency	
New target: **By 2030, reduce greenhouse gas (GHG) emissions by 50% both in own operations and third party supply chains. Requires reduction of 3.85% per year**	Science based targets developed 2% GHG intensity improvement for Tier 1 processing operations 9% increase in plantation and farming GHG emission intensity 5% increase in carbon sequestered in farming and plantation operations GHG footprint calculator developed for AtSource supply chains **Our progress:** on target
Avoided GHG emissions	
By 2020, all Olam farms, plantations and Tier 1 facilities to have implemented their 2020 GHG reduction plans: **1. Operational efficiency** **2. Avoid High Carbon Stocks for land development** **3. Climate-Smart Agricultural practices.**	Energy strategy developed to focus on 20 plants contributing 80% of Tier 1 processing emissions Climate-Smart operational plans in place at all plantations and farms **Our progress:** on target
Increased share of renewable energy	
By 2020, 25% of energy derived from renewable and biomass sources at Olam's Tier 1 facilities (from 2015 baseline – 15%).	11% of energy derived from biomass and renewables Decrease due to lower quantity of bagasse available from lower sugar cane production in 2017 and reduced consumption of rice husk due to brown rice production Cocoa shell boiler implementation plans in place for 2020 Power Purchase Agreement implemented for Australian Almonds **Our progress:** behind target
Reduced agricultural vulnerability to climate risks for farmers and Olam-managed plantations, concessions and farms	
By 2020, implement the Olam 2020 Climate-Smart Agriculture (CSA) Programme.	Increased implementation of CSA practices e.g. 11% increase in CSA training and 70% increase in conservation training Climate resilience plan in development, to be completed in 2019. **Our progress:** behind target

1. Rice farmer video on methane: https://www.olamgroup.com/products/food-staples/rice/rice-sustainability.html

Figure 29: Nestlé's climate-related objectives
(Nestlé's Creating Shared Value Report 2018)

Progress against our objectives

Ongoing: As a member of RE100, aim to procure 100% of our electricity from renewable sources within the shortest practical timescale.

●●○ In progress 34% electricity purchased from renewable sources.

By 2020: Reduce GHG emissions (Scope 1 and 2) per tonne of product in every product category to achieve an overall reduction of 35% in our manufacturing operations versus 2010.

●●○ In progress 32% reduction in GHG emissions (Scope 1 and 2) by product category since 2010.

By 2020: Reduce GHG emissions per tonne of product by 10% in our distribution operations versus 2014.

●●○ In progress 7.6% reduction of GHG emissions per tonne of product distributed, covered in reporting in our distribution operations, versus 2014.

By 2020: Reduce GHG emissions by 10% in the 100 major warehouses we use versus 2014.

●●○ In progress 38.7% reduction of GHG emissions per tonne of product in the 100 major warehouses we use versus 2014.

By 2020: Expand the use of natural refrigerants, which do not harm the ozone layer and have a negligible impact on climate change, in our industrial refrigeration systems.

●●○ In progress 10 new refrigeration systems using natural refrigerants installed.

The Annex to the TCFD's Final Report provides industry-specific illustrative metrics for food, agriculture and forest products. As TCFD disclosure practice evolves, Forum members recognize the need to categorize, structure and define climate-related metrics to identify decision-useful metrics that respond to the TCFD's principles for effective disclosure. This must reflect varied climate-related risks, opportunities, strategic and management approaches.

The Forum has prepared Table 6 to illustrate a range of climate-related metrics which food, agriculture and forest product companies can consider using in their disclosures. The table includes:

- Illustrative metrics provided by the TCFD for food, agriculture and forest product companies;
- Relevant metrics developed by WBCSD's CSA group and WBCSD's Forest Solutions Group;
- Operational metrics describing resource and energy use and GHG emissions;
- Financial metrics focused on investment, efficiencies and actual or potential financial impact;
- Metrics designed to describe climate-related opportunities and show the benefits of actual or prospective mitigation and adaptation measures;

- Metrics designed to illustrate preparedness against climate-related physical risks including efforts to support and enable smallholder and farmer resilience.

Given the different priorities of companies across sectors and value chains, it is important to note that companies are not expected to report on all metrics provided in the table, but to evaluate the possibilities and report on those that are most relevant and material.

Certain measures are challenging and others will benefit from the agreement of common calculation methodologies. For example, Forum members acknowledge the difficulty of measuring Scope 3 emissions across value chains. Methodologies to measure and report on carbon sequestration and removal are also at an early stage. The Forum supports efforts to achieve consensus on how to calculate and report on avoided carbon, carbon sinks and removals. Such metrics demonstrate the contribution and role of key sectors and activities in the low carbon transition. Several metrics do not yet have universally accepted definitions. Companies which choose to disclose against these metrics should explain how they define the metrics and associated terminology according to their business reporting.

Table 6: Illustrative climate-related metrics for food, agriculture and forest product companies

Industry types key


Input providers


Food and agriculture producers and sellers


Forest products

CATEGORY	POSSIBLE METRICS	UNIT OF MEASURE	INDUSTRY APPLICABILITY
GHG emissions	Scope 1 emissions[c]	tCO2e	
	Scope 2 emissions[d]	tCO2e	
	Scope 3 emissions	tCO2e	
	Carbon emissions intensity (e.g. by amounts of sales or tons of product)	tCO2e/(industry specific denominator)	
	Reduction in GHG emissions over a specified period, compared to emissions at the start of that period	Percentage	
	Science-based reduction targets (e.g. reduction target across Scope 1, 2 and 3 to limit global warming to 1.5-2°C)	Percentage	
	Carbon sequestration above and below ground (in soils, forests etc.), carbon stock (tC/ha) over time[e]	tCO2e (per hectare if relevant)	
	Avoided emissions, substitution/contribution potential[f]	tCO2e	

[c] Break down by non-mechanical, land use and mechanical where possible.
[d] Emissions from purchased electricity, heat, steam, and electricity consumed.
[e] Methodologies for carbon sequestration are in early stages and require industry consensus.
[f] Methodologies to accurately report on carbon avoided or avoided emissions require industry consensus.

CATEGORY	POSSIBLE METRICS	UNIT OF MEASURE	INDUSTRY APPLICABILITY
Energy	Total energy consumed (by source e.g. percentage from coal, natural gas, electricity, oil and renewable sources)[g]	GJ Percentage	
	Total energy intensity (by tons of product, amount of sales, number of products etc.)	GJ/(business factor)	
	Renewable energy sold	GWh	
Water use and stewardship	Water withdrawn and consumed in regions of high or extremely high baseline water stress	Percentage	
	EBITDA/revenue associated with water withdrawn and consumed in regions of high or extremely high baseline water stress	Percentage	
	Capital assets and suppliers committed in regions of high or extremely high baseline water stress	Percentage	
	Cropping area with enhanced soil water retention, irrigation or improved drainage	Percentage	
Innovation and markets	Investment (Capex, R&D) in low carbon solutions (e.g. equipment, assets, products, services)[h]	Currency	
	Low carbon R&D success rate[i]	Percentage	
	Revenues/savings from investments in low carbon alternatives	Currency	
	EBITDA from low carbon operations/products/services/solutions	Percentage	
	Patents for low carbon products/technologies/solutions	Number of patents	
	New low carbon product/service/solution target	Number Percentage (of sales)	
	Low carbon products/services/solutions	Number	
	Growth potential of low carbon products/services/solutions	Percentage	
Farmers and smallholders	Investment in climate adaptation measures (e.g. soil health, irrigation, technology)	Currency	
	Improvements in productivity (e.g. working hours/ways of working/quality of work to output)	Percentage	
	Products traceable back to source[j]	Percentage	
	Input efficiency improvement (e.g. through more targeted application of fertilizers and plant protection products)	Percentage	

[g] Knowing a company's energy breakdown informs the extent of the transition required and the potential associated costs.

[h] Several variables can influence earnings, including economic cycle, weather, pricing, market dynamics and commodity prices.

[i] Companies should disclose how they define a "low carbon" product, solution etc.

[j] Where possible companies should seek to measure outcomes and impacts as well as activities.

CATEGORY	POSSIBLE METRICS	UNIT OF MEASURE	INDUSTRY APPLICABILITY
Farmers and smallholders	Enhancement of farmer resilience (e.g. through training and capacity building to support resilience/adaptation, implementation of forecasting or early warning systems, development of verifiable climate smart agriculture activities, farmers with insurance etc.)	Number of farmers Percentage of farmers supported	
	Farmers lifted to living income	Percentage Number	
Land use and management	Zero deforestation commitments and regular reporting of progress across key commodities	Percentage	
	Land protected or protected areas (e.g. as High Conservation Value (HCV) or High Carbon Stock (HCS))	Percentage	
	Improvements in productivity (e.g. food production increases, yield improvement)[k]	Percentage	
	Investment in reforestation, afforestation or restoration of degraded land[l]	Currency	
Forest management	Sustainably managed forests (using an internationally recognized sustainability standard)[m]	Percentage	
	Forest products from sustainably managed forests (using an internationally recognized sustainability standard)	Percentage	
	GHG balance baseline calculated for above-ground carbon pools, based on growth-yield curves for species per m3/year/ha, carbon convertible	tCO2e/yr or ha	
Resource management	Solid waste sent to landfill (against total waste generated)[n]	Percentage	
	Circular inflow and outflow[o]	Percentage	
	Recovery potential and actual recovery of materials[p]	Percentage	
	Food lost and wasted across the value chain	Kilograms/tons Percentage	
Physical impacts	Sites exposed to material physical climate impacts (e.g. % cropping area with susceptible crops/varieties, % cropping area or number of production sites in flood plains)	Number of sites Percentage of sites	
	Proportion of supply chain where science-based climate risk assessments have been conducted	Percentage	

[k] Productivity measures can be impacted by many variables (particularly for crops grown by smallholders). Where possible companies should seek to measure outcomes and impacts as well as activities.

[l] Based on the UNCCD Land Degradation Neutrality Concept.

[m] Sustainable Forest Management - Stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.

[n] Loss and waste measurements show an understanding of hotspots in the value chain regarding utilization of natural capital and wastage of financial capital. Value chain traceability and transparency are key.

[o] Renewable (or non-virgin) inflow used at a rate in line with natural cycles of renewability. Outflow demonstrably recovered or that is designed and treated in a manner that ensures products and materials have a full recovery potential and extend their economic lifetime after their technical lifetime.

[p] The % recovery potential reflects the capability of your organization to design or treat its materials to ensure it can bring the materials back into the value chain after the technical lifetime of the products, on a technical, material level. The % actual recovery captures the amount of materials actually recovered after they leave the organization's boundaries.

CATEGORY	POSSIBLE METRICS	UNIT OF MEASURE	INDUSTRY APPLICABILITY
Physical impacts	Projected change in production, volumes, revenues, operational expenditure or capital expenditure due to physical climate-related risks	Percentage Currency	
	Value-at-risk from probabilistic estimates (for example, 1:100 or 1:200) of extreme weather event disruption to operations or production, key suppliers, customers or markets	Currency	
	Annual average losses from physical climate-related impacts	Currency	
	Investment in climate adaptation measures (e.g. soil health, irrigation, technology)	Currency	
Carbon price	Internal carbon price used	Currency	
	Emissions covered by an ETS/carbon taxation regime	Percentage	
	Total cost of carbon tax paid	Currency	

USER PERSPECTIVE

Disclosures are particularly decision-useful when they include mitigation targets and supporting activities so that users can assess progress towards long-term goals over time. Information is useful about:

- Scope 1, 2 and 3 GHG emissions. Users acknowledge that calculating scope 3 emissions is a challenge but accept that progress has been made. Time-bound targets for all scopes of emissions are valued by users.
- Targets that help the user understand mitigation activity, distinguishing between targets pertaining to different activities, products and commodities where necessary. Information about the method used for setting targets is also useful, for example by reference to company-determined methods or science-based targets.
- Other operational metrics, including:

  a) water usage
  b) energy intensity
  c) waste management and material use efficiency
  d) deforestation
  e) food waste
  f) biodiversity
  g) carbon sequestration.

Some users of information take these metrics into account as part of their modeling to estimate climate impacts such as carbon avoided on the basis that the impact is key to structural growth.

Users value information that demonstrates responsible sourcing certification, traceability, supply chain management, transparency and targets, including:

- The volume or percentage of certified commodities;
- Wood product certification and traceability to source (refinery, mill, plantation etc. level);
- Responsible sourcing targets, however, this should be time bound and comprehensively cover risks to commodities across the supply chain.

8 Conclusion: Collective responsibility and opportunity for enhancing disclosure

8 Conclusion: Collective responsibility and opportunity for enhancing disclosure

The Forum is supportive of the TCFD's ambition and recommendations. Members recognize the crucial role the food, agriculture and forest products sector must play in the low carbon transition and they are committed to enhancing their financial climate-related disclosures. Members value disclosure as a vital input to decision-making and are working towards providing climate-related financial information that will support informed and efficient capital-allocation decisions by management and investors.

Forum members call for other companies to join them on this journey. As this report demonstrates, there is already evidence of effective climate-related financial disclosure practice across food, agriculture and forest products companies. Forum members are demonstrating how climate-related issues are being managed across internal governance and risk management processes and how strategic changes to maximize potential opportunities associated with the low-carbon transition are being disclosed.

Practical steps that could further enhance climate-related financial disclosure include:

- **Integrated risk management:** Climate-related risks have unique characteristics and challenges that require assessment according to a wide range of criteria, techniques, perspectives and approaches – as discussed in Chapter 4. Climate-related financial disclosure and underlying preparatory work could be enhanced through development of robust methods to assess and respond to dynamic, multi-faceted and uncertain climate risks.
- **Scenario analysis and decision-making:** The Forum acknowledges that further work is needed on the application of scenario analysis as a key tool for supporting complex decision-making. Consistent approaches are needed to identify key assumptions and inputs and the resulting implications of scenario analysis – including impacts, dependencies, tradeoffs, and decisions.
- **Financial focus:** Current financial disclosures include R&D expenditure on and investment in climate effective strategies, products and services, associated expected financial performance including sales, EBIT, returns, market size, and growth and financial sensitivity to particular variables. More work is needed to define what is meant by climate-related financial disclosure and how such disclosures should be prepared, presented and interpreted by users.
- **Value chain perspective:** While individual corporate action is vital, the most effective and scalable climate solutions will be reached through collaboration between companies, their customers and suppliers. Disclosures can describe and explain the contribution made by such collaboration and the enabling role of a given company in a wider system.

As this report shows, Forum member companies are developing and implementing a wide range of measures and practices to adapt to and prepare for climate change. They include technological innovation, resource efficiency, carbon sequestration, traceability, new product R&D, investment, resilience assessment and planning. As individual corporate efforts continue to advance, the commensurate actions of partners, supply chains, regulators and investors will be vital given that climate change cannot be addressed by any one company, sector or agency.

While disclosure practice continues to evolve, the uncertainty around policy support for, and investor interpretation of, planned climate action can affect the quality and type of climate-related financial disclosures. Forum members call for a coherent response from policy makers and investors to clarify the policy and financial context in which food, agriculture and forest product companies, and companies in other sectors, operate. Greater certainty around market context, supported by quality dialogue and clear signals from regulators and investors to incentivize or discourage actions, will ultimately manifest in enhanced climate disclosure and action to address climate change.

Forum members call on policy makers and investors to take action, as explained below.

POLICY

Forum members contend that regulatory and policy approaches are some of the biggest drivers of change needed to address the climate crisis. A wide range of policy domains affect the way in which food, agriculture and forest product companies operate. These include policy on trade and taxation, packaging, transport, waste, chemicals, land use regulations and other topics.

Forum members strongly welcome climate-neutral strategies and green deal developments. However, it is difficult for companies to assess and respond to transition risks when the policy landscape is unstable and varies between jurisdictions, and where nationally determined contributions are not aligned with global climate policy goals.

Forum members believe that a coherent set of measures – including incentivization of sustainable product development through tax relief subsidies and public procurement for example – could influence how businesses operate across entire value chains.

Forum members call on policy makers to provide clear, long-term frameworks – aligned with science on climate, agriculture, food and forestry – to build a stable and enabling environment in which companies can plan and operate.

INVESTORS

Climate-related financial disclosures prepared according to the TCFD's recommendations are intended to enable financial market participants to make informed assessments of risk and to facilitate decisions about the allocation of financial capital.

In his recent letter, Larry Fink, Chairman and CEO of Blackrock – the largest money-management firm in the world – acknowledged that "in the absence of robust disclosures, investors will increasingly conclude that companies are not adequately managing climate risk".[47]

Forum members welcome the insights shared by investors during informal discussions summarized in this report. As climate risks intensify and new opportunities and assessment methods emerge, Forum members encourage further clarification from investors around their expectations of companies' assessment, management and disclosure of climate-related risk and opportunities.

The role of food, agriculture and forest products companies is changing and expanding. New business opportunities are emerging and companies are exploring new ways of working. As the low carbon transition continues at pace, the relationship, knowledge and understanding shared by preparers and users of information must be enhanced and strengthened.

The continued development of climate-related financial disclosure requires greater collaboration to explore the ways in which thinking, criteria and decision-making techniques are likely to change over time. Further improvements in climate risk assessment, strategic scenario building and decision-making will drive market action to support the transformational change we need.

9

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9 References

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Our member companies come from all business sectors and all major economies, representing a combined revenue of more than USD $8.5 trillion and 19 million employees. Our global network of almost 70 national business councils gives our members unparalleled reach across the globe. WBCSD is uniquely positioned to work with member companies along and across value chains to deliver impactful business solutions to the most challenging sustainability issues.

Together, we are the leading voice of business for sustainability: united by our vision of a world where more than 9 billion people are all living well and within the boundaries of our planet, by 2050.

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World Business Council
for Sustainable Development

Maison de la Paix
Chemin Eugène-Rigot 2B
CP 2075, 1211 Geneva 1
Switzerland

www.wbcsd.org