Draft sector guidance
Food and agriculture

December 2023
For market consultation and feedback

SASB sectors:
Agricultural products (FB-AG)
Meat, poultry & dairy (FB-MP)
Processed foods (FB-PF)
Food retailers & distributors (FB-FR)
Restaurants (FB-RN)

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T N F D Taskforce on Nature-related Financial Disclosures

Contents

Draft for consultation

This sector guidance is a draft for consultation with market participants and other interested stakeholders. The Taskforce welcomes feedback via the TNFD website by 29 March 2024.

Feedback will be reviewed by the Taskforce and final sector guidance issued by the TNFD by 30 June 2024.

Introduction

In September 2023, the TNFD published its recommendations for disclosure of nature-related issues. Accompanying those recommendations is a set of additional guidance, including Guidance on the identification and assessment of nature-related issues: The LEAP approach. The TNFD recognises that there can be significant differences across sectors for corporates applying the LEAP approach. It has published this additional guidance to help agriculture and food sector participants apply the LEAP approach to their context. The overall structure of the LEAP approach is set out in Figure 1. This guidance follows that structure and Table 1 sets out the elements of LEAP for which this document provides additional guidance.

The Taskforce also recognises that investors and other stakeholders require quantitative information to compare performance of nature-related issues within sectors. To facilitate that sector-level analysis, this guidance also includes recommended sector-specific disclosure metrics for the food and agriculture sector, including guidance on the application of the core global disclosure metrics and core and additional sector disclosure indicators and metrics. These complement the disclosure indicators and metrics outlined in Annexes 1 and 2 of the TNFD recommendations.

What this guidance covers

This guidance covers organisations with business models or value chains in the food and agriculture sector (Box 1). For simplicity, all organisations in these industries are referred to as 'food and agriculture sector organisations' in this guidance.

Box 1: Industries in scope of this guidance

Agricultural products (FB-AG)

Meat, poultry & dairy (FB-MP)

Processed foods (FB-PF)

Food retailers & distributors (FB-FR)

Restaurants (FB-RN)

Under the Sustainability Accounting Standards Board (SASB) classification, food and agribusiness fall under the Food and Beverage thematic sector. This sector guidance covers:

- **Agricultural products:** The agricultural products industry is engaged in processing, trading and distributing vegetables and fruits, and producing and milling agricultural commodities such as grains, sugar, consumable oils, maize, soya beans and animal feed;[1]
- **Meat, poultry and dairy:** The meat, poultry and dairy industry produces raw and processed animal products, including meats, eggs and dairy products, for human and animal consumption. Key activities include animal raising, slaughtering, processing and packaging;[2]
- **Processed foods:** The processed foods industry includes organisations that process and package foods such as bread, frozen foods, snack foods, pet foods and condiments for retail consumer consumption;[3]
- **Food retailers and distributors:** The food retailers and distributors industry consists of organisations engaged in wholesale and retail sales of food, beverage and agricultural products. Store formats include retail supermarkets, convenience stores, warehouse supermarkets, liquor stores, bakeries, natural food stores, specialty food stores, seafood stores and distribution centres;[4] and
- **Restaurants:** Organisations in the restaurants industry prepare meals, snacks and beverages to customers' orders for immediate on- and off-premises consumption.[5]

This guidance is a supplement to the TNFD's Guidance on the identification and assessment of nature-related issues: The LEAP approach and should be read in conjunction with that guidance. Organisations in the food and agriculture sectors should also refer to the TNFD biome guidance, particularly the guidance on intensive land-use systems.

1 SASB (2018) Agricultural Products.

2 SASB (2018) Meat, Poultry & Dairy. Aquaculture is covered in separate TNFD sector guidance.

3 SASB (2018) Processed Foods.

4 SASB (2018) Food Retailers & Distributors.

5 SASB (2018) Restaurants.

Figure 1: The TNFD approach for identification and assessment of nature-related issues – LEAP

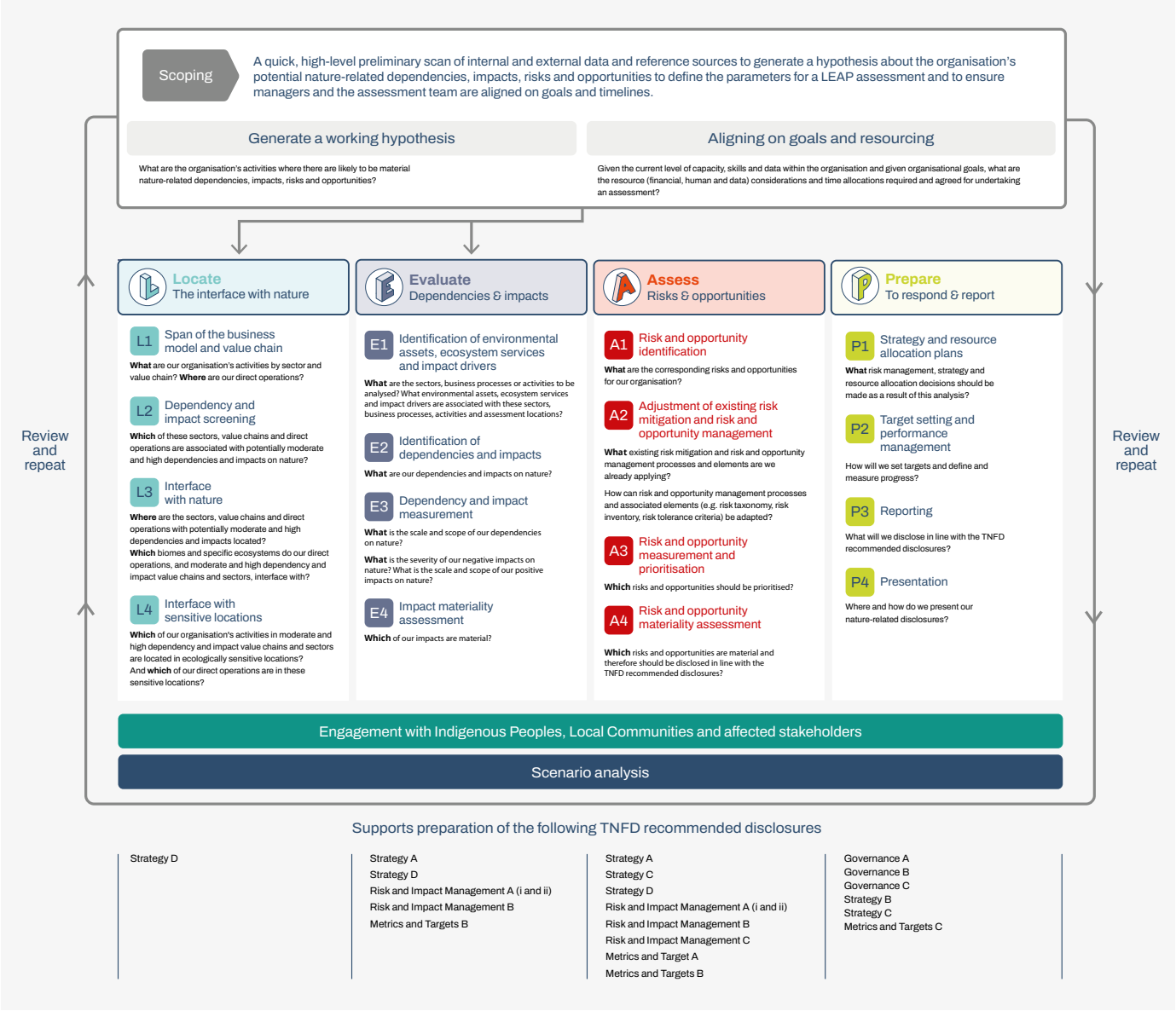


Table 1: Areas of LEAP with additional guidance for this sector

Scoping	✓						
L1	✓	E1	✓	A1	✓	P1	✓
L2	✓	E2	✓	A2		P2	✓
L3	✓	E3	✓	A3		P3	
L4	✓	E4		A4		P4	

Sector background

The global food system is critical for the prosperity of people around the world, whether they are producers or consumers of food. Agribusiness accounts for 12% of global GDP and over 40% of all jobs.[6] At the same time, agriculture has historically driven 70% of losses in terrestrial biodiversity and been the single biggest contributor to the deforestation of natural habitats.[7] The agricultural sector is entirely dependent on natural ecosystems for its productivity and economic viability.

Fertile soils, pollination services, water supply and agrobiodiversity are critical for the long-term productivity of agricultural land, yet the volume and quality of ecosystem services, and the resilience of the environmental assets that agriculture relies on, are under threat around the world.

- 75% of global food crops depend on animal pollination,[8] and diverse wild pollinator species are necessary for crop growth even when managed bees are present in high numbers. 37% of European bee species are in a state of decline.
- Soil fertility is foundational for agricultural production and soil erosion can lead to a 50% decline in crop production per unit area of farmed land. 33% of global soils are already degraded.[9]
- Food production is also highly dependent on predictable rainfall patterns and the resilience of water sheds and river systems. Farms account for 70% of total global water consumption, of which 40% is lost to the environment due to poor irrigation and poor water management.[10] For example, the drying up of the Po River in northern Italy in 2022 is estimated to have impacted over 30% of Italy's agricultural sector output.[11]
- Post-harvest practices, particularly during food transportation and the disposal of food waste, generate significant carbon dioxide (CO_2) and methane (CH_4) emissions.
- Each year, approximately one-third of all food produced for human consumption in the world is wasted.[12] Upstream food loss, which includes production, post-harvest handling and storage, represents 54% of total waste.[13] Downstream waste, which includes processing, distribution and consumption, accounts for 46% by volume. Food that is produced and that has not been consumed by humans also wastes the land, water, fertiliser, compost and other resources used for its production.

6 Strauss, T. (2022) How can we protect food systems against global shocks? Here's what business leaders say. World Economic Forum.

7 WWF (2021) Farming with biodiversity – Towards nature positive production at scale; FAO (2021) Agricultural expansion drives almost 90 percent of global deforestation.

8 IPBES (2016) Pollinators vital to our food supply under threat.

9 FAO (2015) Status of the world's soil resources.

10 World Bank (2022) Water in agriculture.

11 Porterfield, C. (2022) Italian Drought Puts One-Third Of National Agriculture Production – Like Tomatoes And Olive Oil – At Risk. Forbes; Montanari, A. et al. (2023) Why the 2022 Po River drought is the worst in the past two centuries. Science Advances 9 (32): eadg8304.

12 The World Counts (2023) Wasted food statistics.

13 Bhatia, L. et al. (2023) Food waste utilization for reducing carbon footprints towards sustainable and cleaner environment: A review.

The close coupling of nature and agriculture not only means that the agricultural sector is a driver of negative ecosystem impacts, but that it also holds the key to the transition to nature-positive outcomes. For example, farmers are key managers of the world's soils, which contain 2.3 times more carbon than the atmosphere and 3.5 times more carbon than all living terrestrial plants.[14] Agricultural practices play an important role in increasing soil carbon storage capabilities. The deployment of emerging practices, such as regenerative agriculture, agroecology with rotational grazing practices, and technologies like soil sensors, high frequency imagery and autonomous equipment, have the potential to improve returns while reducing the negative nature-related impacts of food production.

14 Yang et al. (2019) Soil carbon sequestration accelerated by restoration of grassland biodiversity, in Dondini, M. et al. (2023) Global assessments of soil carbon in grasslands: From current stock estimates to sequestration potential.

Scoping a LEAP assessment

Working hypothesis generation:

What are the organisation's activities where there are likely material nature-related dependencies, impacts, risks and opportunities?

Goals and resourcing alignment:

Given the current level of capacity, skills and data within the organisation and given organisational goals, what are the resource (financial, human and data) considerations and time allocations required and agreed for undertaking an assessment?

For the food and agriculture sector, many of the most significant nature-related dependencies, impacts, risks and opportunities are likely to occur at the primary production stage, so this should be a priority for investigation. This can be challenging, depending on an organisation's business model and its position in the value chain. Many organisations in the agricultural sector operate in complex webs of supplier networks. Large-scale, listed companies in the food sector do not typically own or operate farms, but purchase agricultural products from growers (either directly or indirectly) and undertake value-adding activities such as processing, milling, distributing and trading. This is particularly true of the production of animal protein.[15]

The assessment of downstream nature-related issues is also affected by the ever-changing customer base.

The variety of business models and supply chain relationships means that supply chains can be relatively opaque. Over time, food and agriculture organisations will need to build the processes and capabilities to collect more nature-related data from their supply chain partners, both upstream and downstream. For example, organisations may find it useful to leverage existing supply information requests related to their climate and modern slavery value chain assessments and review and update standard supply contract terms to include the provision of data for nature-related issues. There may also be opportunities to partner with other organisations in the sector (including supply chain partners) to collaboratively assess nature-related issues across the value chain.

In the interim, food and agriculture organisations may find it useful to apply a phased approach to assessing and disclosing nature-related issues within the value chain, increasing their value chain coverage and the breadth and depth of the data captured, assessed and reported as the organisation's nature-related assessment capabilities develop. Organisations should prioritise the areas of the value chain where material dependencies, impacts, risks and opportunities have arisen, or are assessed as most likely to arise (see guidance for the Locate phase).

Tools that are likely to be helpful for initial scoping and component L2 of the Locate phase include:

- ENCORE;
- SBTN's High Impact Commodities List (HICL) and Materiality Screening Tool; and
- WWF Biodiversity Risk Filter.

15 SASB (2018) Meat, Poultry & Dairy.

Locate the organisation's interface with nature

This section provides additional information to help food and agriculture sector organisations with the Locate phase of the LEAP approach.

L1: Span of the business model and value chain

Guiding questions:

What are our organisation's activities by sector, value chain and geography? Where are our direct operations?

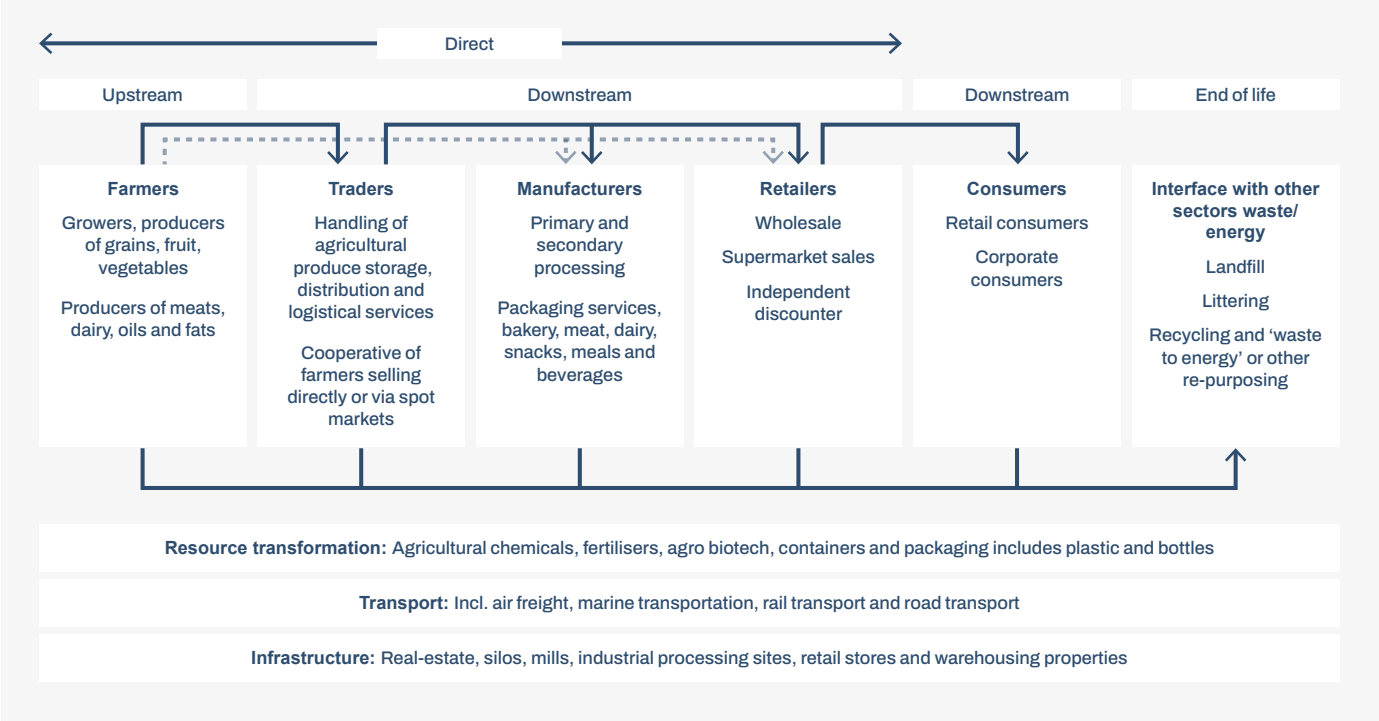
The agricultural products and meat, poultry and dairy value chains are highly complex, with a large number of actors involved. Primary producers will often sell to a trading company or farmer cooperative, which aggregates the products for customers such as distributors, wholesalers, packed and processed food manufacturers and retailers further down the value chain. Consumers and the end of life for these products are downstream for all organisations in this sector. Figure 2 provides an outline of the value chain participants.

Traders and food manufacturers largely outsource animal protein production to third-party producers. The exact structure of any given value chain is determined by the specific animal protein. For example:

- Chickens are typically owned by companies but raised by third parties;
- Cattle are typically purchased on a spot-market; and
- Hogs are typically both grown by company-owned operations and purchased from independent producers through supply contracts.[16]

16 SASB (2018) Meat, Poultry & Dairy.

Figure 2: Illustrative food and agriculture value chain



Source: Adapted and expanded from Capitals Coalition (2023) Primer – TEEB for agriculture and food: Operational guidelines for business.

As all value chain participants integrate upstream agricultural commodities in their business models, all sector participants will need to include upstream farmers in their value chain mapping. Organisations should list their commodities as part of their value chain mapping.

Organisations in the processed foods, food retailers and distributors, and restaurants industries should map value chains with:

- Agricultural products;
- Meat, poultry and dairy; and
- Processed foods and downstream industries.

Organisations in the meat, poultry and dairy industry should additionally map the animal feed value chain.

Organisations should also include the three SASB sub-industries of resource transformation, transport and infrastructure (illustrated in Figure 2) on their value chain map. Organisations should refer to the TNFD guidance for these sectors where available.

L2: Dependency and impact screening

Guiding question:

Which of these sectors, value chains and direct operations are associated with potentially moderate and high dependencies and impacts on nature?

Figure 3 and Figure 4 show the primary impact drivers of the food and agriculture industries and the ecosystem services on which they most depend. Organisations can use these tables as initial filters to develop lists of activities with potentially high dependencies and impacts.

In addition, organisations in all food and agriculture industries should prioritise:

- Developing lists of key commodities produced or procured;
- Identifying value chains of any deforestation risk commodities, consulting SBTN's High Impact Commodities List (HICL) and/or EU deforestation-free regulation; and
- Mapping activities upstream in markets with high air pollution concentration and/or high degrees of eutrophication, referring to the UNEP global air pollution data platform.

Organisations in the processed foods, retailers and restaurants industries should also prioritise direct activities in markets with:

- High plastic pollution leakage, including from food packaging, referring to data from Our World in Data, for example; and
- High average food waste per capita, consulting the UNEP Food Waste Index and country ranking database.

Figure 3: Common impact drivers for the food and agriculture sub-sectors

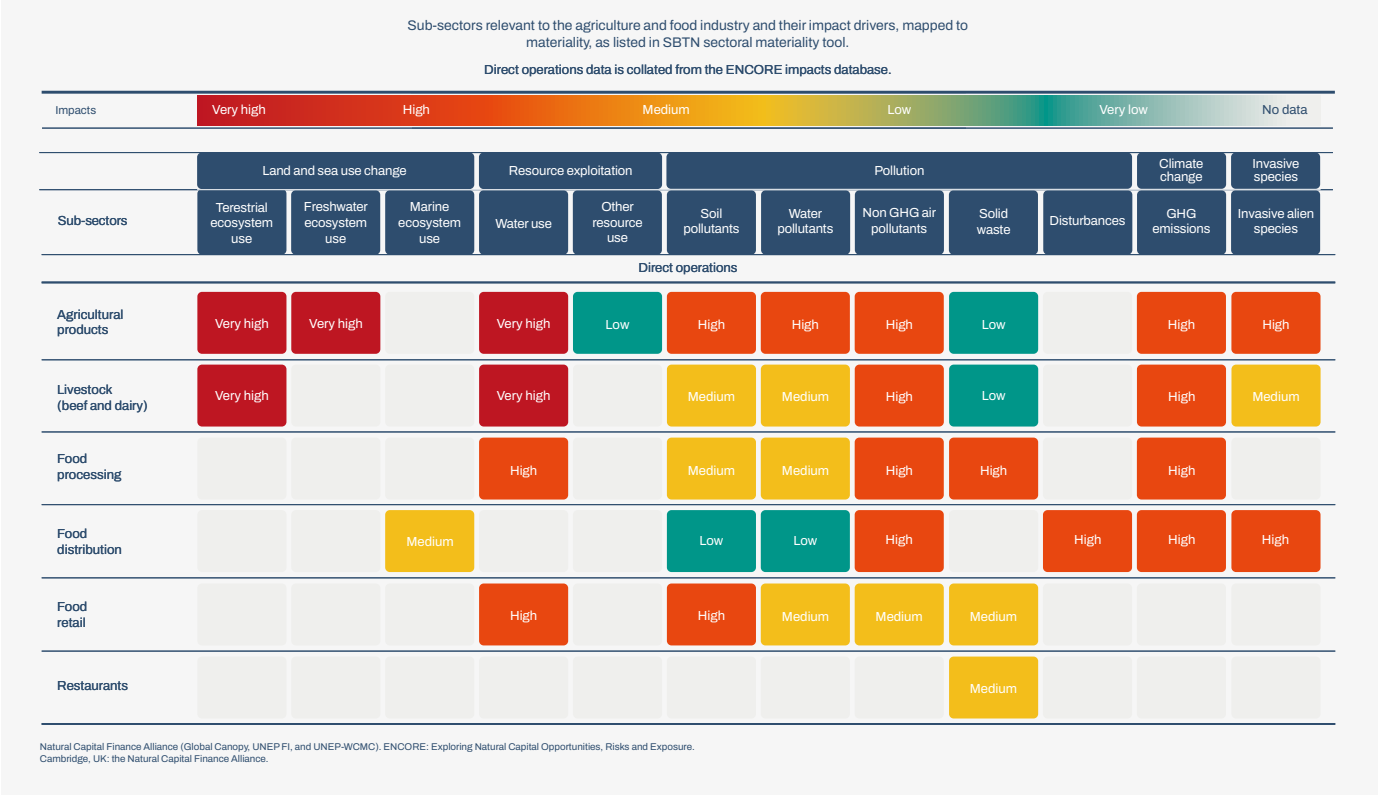
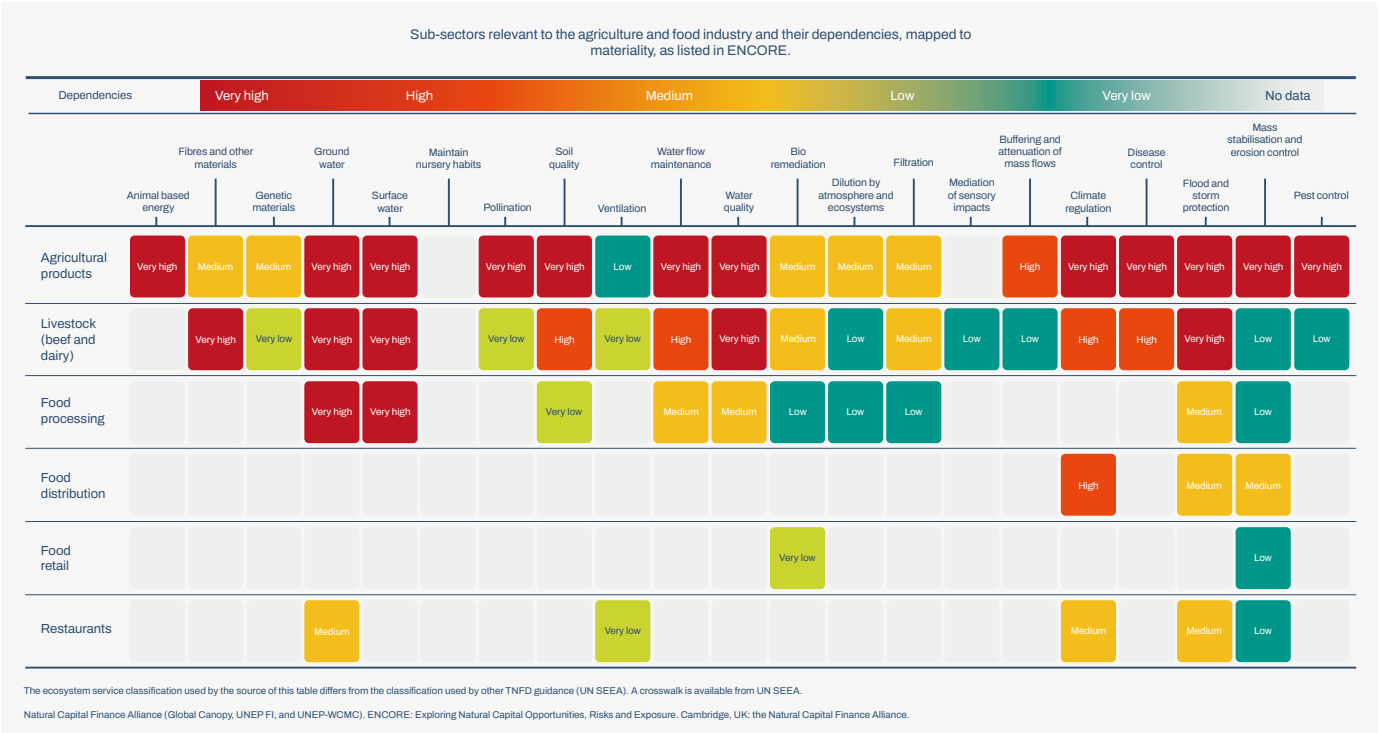


Figure 4: Common ecosystem services depended on by the food and agriculture sub-sectors



Note: The ecosystem service classification used by the source of this table differs from the classification used by other TNFD guidance (UN SEEA). A crosswalk is available from UN SEEA.

To screen the value chain industries of resource transformation and transport, an organisation should consult the associated TNFD guidance on the LEAP approach.

Useful additional tools and sources for the food and agriculture sector for the L2 component of the Locate phase include:

- Regulation (EU) 2023/1115 of the European Parliament and of the Council;
- UNEP's global air pollution data platform;
- Our World in Data database on plastic pollution; and
- UNEP's Food waste index and country ranking database.

L3: Interface with nature

Guiding question:

Where are the sectors, value chains and direct operations with potentially moderate and high dependencies and impacts located?

Which biomes and specific ecosystems do our direct operations, moderate and high dependency and impact value chains and sectors, interface with?

Organisations buying directly from farms (directly procured commodities) should be able to locate the GPS coordinates of supplier farms.

Organisations buying indirectly from cooperatives, traders and brokers (indirectly procured commodities) should map points of procurement and use the supply shed approach (Box 2) to geolocate the sourcing area and progressively increase granularity with the aim of reaching farm-level traceability in a set timeframe.

Box 2: The supply shed approach

When geolocation data is not available for upstream suppliers, organisations can use the supply shed approach to identify where an ingredient first entered the supply chain. This is usually:

- A mill for palm oil, fresh fruit or sugarcane; or
- A trader, cooperative or storage centre for soy and coffee.

The size of the supply shed is commodity specific. As a transition measure, organisations may also use certification standards until full transparency of the supply chain can be achieved.

As cattle move between locations, a company can use national physical asset registries, ESG data providers or existing databases to geolocate their entry to the supply chain. Once these points are identified, a company can use a supply shed approach to create a proxy geolocation of the sourcing area.

Organisations should also identify the biomes and ecosystems with which their identified direct, upstream and downstream locations interface. The food and agriculture sector typically interfaces with the following biomes:

Land:

- Tropical-subtropical Forest (T1);
- Savannahs and grasslands (T4);
- Intensive land use systems (T7); and
- Vegetated wetlands (TF1).

Freshwater:

- Rivers and streams (F1);
- Lakes (F2); and
- Artificial wetlands (F3).

Ocean:

- Shoreline systems (MT1);
- Coastal inlets and lagoons (FM1); and
- Brackish tidal systems (MFT1).

This list can be considered as a reference. However, organisations should review all applicable biomes connected to their specific interfaces across their value chains and associated activities where significant dependencies and impacts on those biomes exist.

Organisations may also refer to the TNFD biome guidance for further guidance when analysing their interfaces with these biomes.

L4: Interface with sensitive locations

Guiding questions:

For our organisation's activities in moderate and high dependency and impact value chains and sectors, which of these are in ecologically sensitive locations? Which of our direct operations are in sensitive locations?

No additional sector-specific guidance identified for L4.

List of datasets and tools

Table 3 provides a list of tools that food and agriculture sector organisations may find useful for the Locate phase of LEAP, in addition to those listed in the cross-sector LEAP guidance. Organisations should also reference tools in the TNFD Tools Catalogue.

Table 3: Additional tools for food and agriculture sector organisations for the Locate phase of LEAP

Tool name	Description
Our World in Data – Plastic emitted to the ocean	Measures total plastic waste generation prior to management and therefore does not represent the quantity of plastic at risk of polluting waterways, rivers and the ocean environment.
Food Waste Index	Presents the most comprehensive food waste data collection, analysis and modelling to date, generating a new estimate of global food waste and publishing a methodology for countries to measure food waste at a household, food service and retail level to track national progress towards 2030 and to report on SDG 12.3.
Global Lakes and Wetlands database	Includes the best available data sources and GIS functionality for global lakes and wetlands focused on three scales: (1) large lakes and reservoirs; (2) smaller water bodies; and (3) wetlands.

Evaluate dependencies and impacts on nature

This section provides additional guidance to help food and agriculture sector organisations with the Evaluate phase of the LEAP approach.

E1: Identification of environmental assets, ecosystem services and impact drivers

Guiding questions:

What are the sectors, business processes or activities to be analysed?

What environmental assets, ecosystem services and impact drivers are associated with these sectors, business process, activities and assessment locations?

Table 4 provides examples of business activities in the agricultural products and meat, poultry and dairy industries, the associated impact drivers, and the environmental assets and ecosystem services that the impact drivers affect. Annex 1 sets out proposed metrics for organisations to quantify these impact drivers.

Table 4: Primary impact drivers associated with common business activities in the agriculture and food sectors, and the ecosystem assets and services affected

Business activity	Impact drivers	Indicators	Environmental assets affected	Ecosystem services affected
Agricultural products, and meat, poultry and dairy				
Land clearance Including for cultivation and land clearance for livestock grazing/ potential overgrazing.	Land/freshwater/ ocean use change: Land ecosystem use. Climate change: Greenhouse gas emissions.	Agriculture-driven terrestrial natural ecosystem conversion (in km^2) before and after business activity.	Primary forests Secondary growth forests Wetlands/peatlands	• Water supply • Genetic material • Biomass provisioning • Pollination services • Biological control • Soil and sediment retention • Flood mitigation • Water flow regulation • Rainfall pattern regulation • Global climate regulation • Soil quality regulation • Water purification • Air filtration • Noise attenuation • Education, scientific and research services • Spiritual, artistic and symbolic services

Business activity	Impact drivers	Indicators	Environmental assets affected	Ecosystem services affected
Field expansion into buffer zones and zones of natural vegetation, land tillage, soil compaction, monoculture cultivation.	Land/freshwater/ ocean use change: Land ecosystem use. Climate change: Greenhouse gas emissions.	Total spatial footprint (km^2).	Primary forests Secondary growth forests Wetlands/peatlands	• Water supply • Genetic material • Biomass provisioning • Pollination services • Biological control • Soil and sediment retention • Flood mitigation • Water flow regulation • Rainfall pattern regulation • Local (micro and meso) climate regulation • Global climate regulation • Soil quality regulation • Water purification • Air filtration • Noise attenuation • Education, scientific and research services • Spiritual, artistic and symbolic services

Business activity	Impact drivers	Indicators	Environmental assets affected	Ecosystem services affected
Application of chemical and organic fertilisers, including livestock waste.	Pollution/pollution removal: Soil pollutants, non-GHG air pollutants. Climate change: Greenhouse gas emissions.	Pollutants released to soil, including nitrogen balance and phosphorus balance.	• Land • Freshwater ecosystems • Marine ecosystems • Atmospheric systems	• Genetic material • Biomass provisioning • Global climate regulation • Soil quality regulation • Water purification
Application of pesticides.	Pollution/pollution removal: Soil pollutants.	Pollutants released to soil including pesticides by toxicity level.	• Land • Freshwater ecosystems • Marine ecosystems • Atmospheric systems	• Genetic material • Biomass provisioning • Pollination • Biological control • Nursery population and habitat maintenance • Soil quality regulation
Wastewater discharge (e.g. from livestock watering and cleaning, discharge from food processing facilities, from restaurants).	Pollution/pollution removal: Water pollutants.	Volume of water discharged and concentration of pollutants.	• Land • Freshwater ecosystems • Marine ecosystems	• Genetic material • Biomass provisioning • Global climate regulation • Soil quality regulation • Water purification

Business activity	Impact drivers	Indicators	Environmental assets affected	Ecosystem services affected
Waste generation and disposal (including food spoilage during transportation and transport, food packaging processes, end of life food disposal).	Pollution/pollution removal: Solid waste. Indirectly, all other impact drivers associated with this sector.	Food lost and/or wasted by type of food along the relevant stages of the value chain.	• Land • Forests • Freshwater ecosystems	• Water supply • Genetic material • Biomass provisioning • Pollination • Biological control • Soil and sediment retention • Flood mitigation • Water flow regulation • Rainfall pattern regulation • Local (micro and meso) climate regulation • Global climate regulation • Nursery population and habitat maintenance • Water purification • Air filtration • Visual amenity services • Education, scientific and research services • Spiritual, artistic and symbolic services

Business activity	Impact drivers	Indicators	Environmental assets affected	Ecosystem services affected
Packaging of food, procurement of plastic packaging composed of different polymer types.	Pollution/pollution removal: Solid waste.	Plastic pollution: Plastic footprint measures by total weight (tonnes) of plastics polymers. Polyvinyl chloride (PVC), polypropylene (PP) and polystyrene (PS) have the highest risk of environmental harm and the greatest leakage at end-of-life stages, so should form part of the impact driver identification of the downstream industries.[17]	• Freshwater ecosystems • Marine ecosystems	• Genetic material • Biomass provisioning • Pollination • Nursery population and habitat maintenance • Water purification • Recreation-related services • Visual amenity services
Industrial emissions from food processing.	Pollution/pollution removal: Non-GHG air pollutants.	Non-GHG air pollutants (tonnes).	• Marine ecosystems • Atmospheric systems	• Global climate regulation
Water withdrawal for irrigation, livestock watering, for food processing, cleaning.	Resource use/ replenishment: Water use.	Water withdrawal and consumption (m^3).	• Freshwater ecosystems	• Water supply • Soil quality regulation • Local (micro and meso) climate regulation

Source: Adapted from ENCORE and TNFD draft sector metrics

17 Senathirajah, K. et al. (2023) Fate and transformation of microplastics due to electrocoagulation treatment: Impacts of polymer type and shape. Environmental Pollution 334.

Organisations in the downstream sub-industries can leverage tools such as the science-based polymer prioritisation framework to identify sourced plastic products such as packaging or plastic packaging LCA data to guide assessment.

E2: Identification of dependencies and impacts

Guiding question:

What are our dependencies and impacts on nature?

External factors with particular relevance to the sector include:

- **Eutrophication and water contamination:** Organisations need to identify which other watershed participants operate business models that result in excess organic and chemical fertilisers in freshwater ecosystems to assess potential changes in the availability of water-related ecosystem services.
- **Climate change:** Climate change leads to higher frequency of rapid weather events, such as drought, and slow onset weather events, such as the lowering of water tables. These influence provisioning and regulating ecosystem services, such as soil quality regulation and water supply. These external changes are likely to reduce the availability of ecosystem services, so organisations will need to apply climate models to assess the influence of climate change on the ecosystem services upon which its production depends.

Impacts on nature

Table 5 shows the impact pathways for the specific impact drivers identified in L2 and E1, linked to key agricultural commodities and agricultural production systems. It also offers guidance to help organisations identify the impacts associated with their particular business model. The table uses ratings of commodities and agricultural production systems most linked to each impact, based on scientific literature and/or expert reports. While the majority of impacts are listed under the agricultural products and meat, poultry and dairy industries, these industries' impacts should be included in the identification of impacts for all downstream industries.

Animal welfare is not covered in this guidance, but organisations should include this issue from the SASB meat, dairy and poultry standard if relevant to their business model. This is most relevant for the meat, poultry and dairy; processed foods; food retailers and distributors; and restaurants industries.

Table 5: Impact pathways

SASB sub-industry	Impact driver	Commodities or production processes linked to impact	Impacts on state of nature and ecosystem services	Guidance to identify impacts
Deforestation (Primary and secondary growth forests)				
Agricultural products Meat, poultry and dairy	Land ecosystem use (forest ecosystems)	Deforestation risk commodities: • Cattle; • Cocoa; • Palm oil; • Coffee; and • Soya beans.	Increased species extinction risk. Reduction in extent of primary and secondary growth forests. Habitat fragmentation. Disruption to the water cycle. Increased vulnerability to flooding. Reduced abundance of pollination services due to loss of wild pollinator forest habitats.	Identify the specific high deforestation-risk commodities in the supply chain to identify impacts. Annex 2 includes a list of derived products based on EU Commission (2023) that should also be considered. To identify changes in ecosystem services, organisations can use: • eDNA for pollinator abundance tracking; and • Methodological data on rainfall distribution to capture changes to the water cycle.

SASB sub-industry	Impact driver	Commodities or production processes linked to impact	Impacts on state of nature and ecosystem services	Guidance to identify impacts
Wetland conversion				
Agricultural products	Land ecosystem use (wetlands)	Wetland conversion risk production systems: • Rainfed intensive agriculture; • Irrigated intensive agriculture; and • Horticulture.	Reduction in extent of wetlands. Increased species extinction risk. Breakdown of ecosystem services e.g. flood protection and carbon sequestration.[18]	Identifying a list of commodities with high embodied wetland conversion risk is difficult as a wide variety of crops are grown in wetland areas. Organisations can apply a production systems lens to identify wetland impacts. To identify changes to ecosystem services, organisation can use: • Soil sampling to capture soil carbon organic matter content; and • Remote sensing data, such as satellite imagery, to model soil carbon storage, based on observed patterns that are known to affect soil carbon storage, such as wetland extent and condition.

18 Wetlands contain 20–25% of total organic carbon. Delle Grazie, F. M. and Gill, L. W. (2022) Review of the Ecosystem Services of Temperate Wetlands and Their Valuation Tools. Water 14(9), 1345.

SASB sub-industry	Impact driver	Commodities or production processes linked to impact	Impacts on state of nature and ecosystem services	Guidance to identify impacts
Soil degradation and eutrophication				
Agricultural products	Soil pollutants (pesticides)	Pesticide-intensive crops based on global sales numbers: • Fruit and vegetables; • Cereals; • Soya beans; • Maize; • Rice; and • Other.[19]	Soil contamination[20] and acidification. Decline in insect populations. Freshwater contamination.	Identify pesticide-intensive crops by, for example, using 2018 global sales values.[21] See Figure 5 for more crops, as well as sale percentages. Source data from suppliers to account for actual pesticide use per toxicity hazard level in the business model. To identify soil degradation and eutrophication impacts on ecosystem services an organisation can: • Identify changes to soil pH levels; • Identify development of soil crust; • Measure changes in freshwater provisioning available for irrigation; and • Measure changes to nutrient and pathogen regulation and sequestration services.[22] Measure changes to soil structure and soil organic carbon content.

19 UNEP (n.d.) Environmental and Health Impacts of Pesticides and Fertilizers and Ways of Minimizing Them Envisioning – A Chemical-Safe World.

20 EEA (2023) How Pesticides impact human health and ecosystems in Europe.

21 UNEP (n.d.) Environmental and Health Impacts of Pesticides and Fertilizers and Ways of Minimizing Them Envisioning – A Chemical-Safe World.

22 Kermagoret, C. et al. (2019) How does eutrophication impact bundles of ecosystem services in multiple coastal habitats using state-and-transition models, Ocean and Coastal Management, 174.

SASB sub-industry	Impact driver	Commodities or production processes linked to impact	Impacts on state of nature and ecosystem services	Guidance to identify impacts
Agricultural products	Soil pollutants (fertiliser)	Nitrogen and phosphorus-intensive crops: • Maize; • Wheat; and • Rice. Annex 3 provides further nitrogen and phosphorus-intensive crops.	Soil health degradation. Soil acidification. Eutrophication.	Identify nitrogen and phosphorus-intensive commodities, for example, by using IFA fertiliser-use data to identify the most nitrogen and phosphorus-intensive crops in its value chain. Use maps of excess nitrogen per hectare of cropland and overlay sourcing areas of nitrogen-emitting crops to identify areas of impact. Figure 5 includes more detail on nitrogen and phosphorus-intensive commodities.

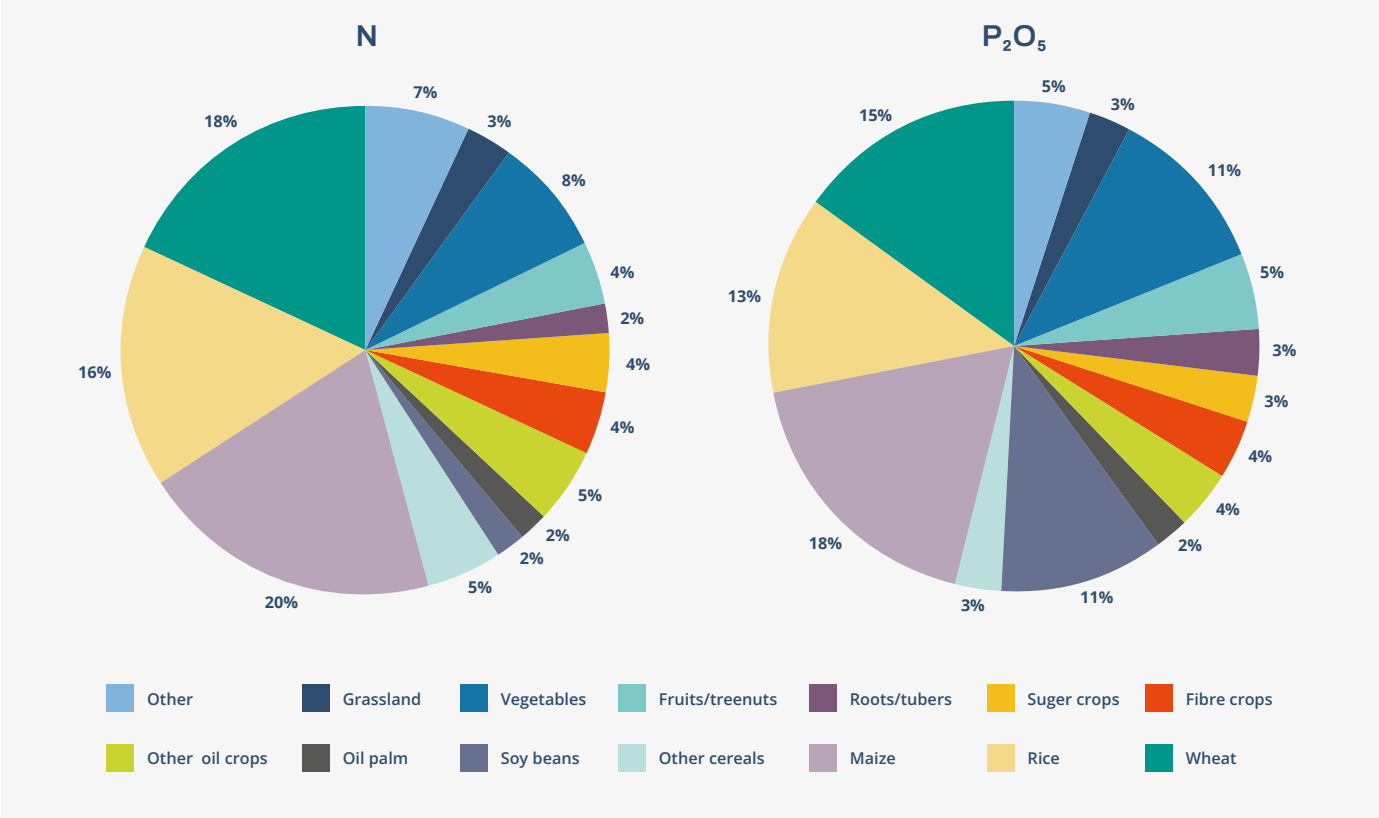
SASB sub-industry	Impact driver	Commodities or production processes linked to impact	Impacts on state of nature and ecosystem services	Guidance to identify impacts
Meat, poultry and dairy	Soil pollutants (animal waste)	Ranking of nitrogen-intensive livestock systems with decreasing nitrogen intensity: • Mixed dairy cattle; • Mixed beef cattle; • Mixed buffalo milk; • Backyard pigs; • Grazing dairy cattle; • Broiler chickens; • Industrial pigs; • Beef cattle feedlot; • Intermediate pigs; • Backyard chickens.[23]	Soil health degradation. Soil acidification. Eutrophication. Emissions to air of nitrous oxide (N_2O), ammonia (NH_3) and nitrogen oxides (NO_x).	Measure farm gate nutrient balances or acquire data on nutrient balances from suppliers. Use nitrogen-intensity ratings of different livestock commodities to identify the highest potential impact livestock commodities of business model. Use maps of eutrophication to identify impacts, either global jurisdictional level maps, maps from national environmental agencies or own measured sources.

23 Uwizeye, A. et al. (2020) Nitrogen emissions along global livestock supply chains. Nature Food 1, 437–446.

SASB sub-industry	Impact driver	Commodities or production processes linked to impact	Impacts on state of nature and ecosystem services	Guidance to identify impacts
Processed foods, food retailers and restaurants	Solid waste (plastic)	The three polymers with the highest risk of environmental harm and the greatest leakage at the end-of-life stage are: • Polyvinyl Chloride (PVC); • Polypropylene (PP); and • Polystyrene (PS).[24]	Plastic concentration in the water column. Increased marine species extinction risk.	Use plastic leakage numbers of sales jurisdictions and link to plastic packaging volumes of business model per high leakage jurisdictions. Use more granular data to identify specific landfills and leakage areas. First focus on most harmful polymers and thereafter include all types of polymers.
Climate change				
All	GHG emissions	Organisations should consult the TCFD agriculture guidance.		

24 Senathirajah K. et al. (2023) Fate and transformation of microplastics due to electrocoagulation treatment: Impacts of polymer type and shape, Environmental Pollution 334.

Figure 5: Global mineral fertiliser usage by crop, based on global sales numbers



Source: IFA (2022) Fertilizer Use By Crop.

Dependencies on nature

Table 6 sets out common dependencies for this sector, linked to key commodities or production systems.

Table 6: Dependencies

SASB sub-industry	Commodities or production processes linked to dependencies (not exhaustive)	Guidance to identify dependencies
Water supply		
Agricultural products	Water-intensive crops in order of decreasing intensity: Cotton, rice, sugar cane, soya bean, wheat, potatoes.[25] Table 6 includes data on water consumption per crop.	Agricultural production accounts for 70% of water withdrawals worldwide.[26] Organisations should identify water-intensive crops. Overlay location data on the catchment area of each crop category sourced with spatial maps of current levels of water stress, using, for example, the open-source Aqueduct Food Platform, to identify water stress value chain impacts.

25 WWF (2013) Living Waters – conserving the source of life.

26 FAO (2017) Water Pollution from Agriculture: A global review.

SASB sub-industry	Commodities or production processes linked to dependencies (not exhaustive)	Guidance to identify dependencies
Meat, dairy and poultry	Water use averages per kilogram of meat product: • Beef: 15,415 litres; • Sheep: 9,000 litres; • Goat: 9,000 litres; • Pork: 6,000 litres; and • Chicken: 4,300 litres.[27]	Livestock water requirements vary significantly depending on species, growth stage and especially feed use efficiency. If downstream organisations do not have access to water footprint data from meat suppliers, they can leverage scientific literature with rankings of average water intensity per livestock species to identify which livestock-based products to focus their water dependency evaluation on initially. Upstream farm businesses can use the FAO Water use in livestock production systems and supply chains – Guidelines for assessment to develop a water inventory and footprint of produced livestock species as part of their dependency evaluation. Thereafter, organisations can overlay location data on each catchment area of the most water-intensive livestock species produced or sourced with spatial maps of water stress hotpots. Different water sheds will need to be mapped depending on the scope of the dependency evaluation. Figure 6 provides an illustration of water sheds across a dairy value chain. To arrive at an accurate understanding of livestock water consumption, organisations will need to identify water used to produce animal feed, as this input into livestock production accounts for the highest water use, as well as water for cleaning, cooling and drinking.[28]

27 WWF (2013) Living Waters – conserving the source of life.

28 FAO (2021) Accounting for livestock water productivity: How and why?

SASB sub-industry	Commodities or production processes linked to dependencies (not exhaustive)	Guidance to identify dependencies
Pollination		
Agricultural products	Crops with high pollinator dependency: • Essential: Fruits, brazil nuts, cocoa beans; and • High dependency: Avocados, fruits, nuts.	The dependence of different crop varieties on pollinators differs significantly, but as a general trend, the world has shifted towards more pollination-dependent agricultural commodities. To identify their pollination dependencies, an organisation can: • Consult scientific literature and indices to identify crops most dependent on pollinators (Our World in Data, IPBES Pollinator and Food Production assessment); and • Use eDNA to assess pollinator abundance in different sourcing areas of the same crop to assess dependency on different types of wild insect pollinators. Organisations may define crops with different degrees of pollinator dependency: • **Essential:** Pollinators are essential for most varieties. These varieties would see a 90% yield reduction in case of pollination service breakdown. • **High:** These crops would see a yield reduction of 40% to 90% without pollinators. Annex 3 provides a science-based ranking of crop dependency on pollination.
Biological control		
Agricultural products	Crops with high pathogen and pest sensitivity (P&P): • Maize; • Rice; and • Soya beans.[29]	Organisations can identify the tropical staple crops their business model is dependent on, because these crops, with restricted latitude ranges, tend to be more saturated with pests and pathogens than temperate stable crops with broad latitudinal ranges.[30] Annex 3 provides a science-based ranking of crop dependency on pollination.[31]

29 He, S. et al. (2020) Pandemics of people and plants: Which is the greater threat to food security? Molecular Plant 13.

30 He, S. et al. (2020) Pandemics of People and Plants: Which Is the Greater Threat to Food Security? Molecular Plant 13.

31 IPBES (2016) The assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on Pollinators, pollination and food production.

SASB sub-industry	Commodities or production processes linked to dependencies (not exhaustive)	Guidance to identify dependencies
Global climate regulation and storm and flood mitigation		
Agricultural products Meat, poultry and dairy	Crop response to a weather-related stress varies according to growth stage. Science offers crop-specific vulnerability curves.[32] Refer to listing of water-intensive livestock species in Table 6.	Identify the most drought-sensitive, storm-sensitive and flood-sensitive crop varieties and livestock species by growth stage. Organisations can also use the FAO's Vegetation Condition Index (VCI).[33] Identify dependencies on climate and flood-regulating ecosystem services, such as forests acting as storm fences and wetlands regulating floods. Use tools such as LandMap App for this dependency identification.
Soil and sediment retention and soil quality regulation		
Agricultural products Meat, poultry and dairy	Practices that put soil health at risk include: • Tillage; • Monocropping/low crop genetic diversity; • Soil compaction; • Monocropping; and • Pesticide usage and residue. The key to soil health is organic matter as it increases nutrient retention, water holding and biological activity.[34]	Organisations can use lists of drought-sensitive crops, or crops high in mineral demand, to identify crops with a high dependency on soil quality. Soil databases can be used to identify different soil types and their ability to maintain a healthy nutrient circulation, moisture retention and soil structure.

32 Monteleone, B. et al. (2022) Quantifying crop vulnerability to weather-related extreme events and climate change through vulnerability curves. Natural Hazard 116, 2761–2796.

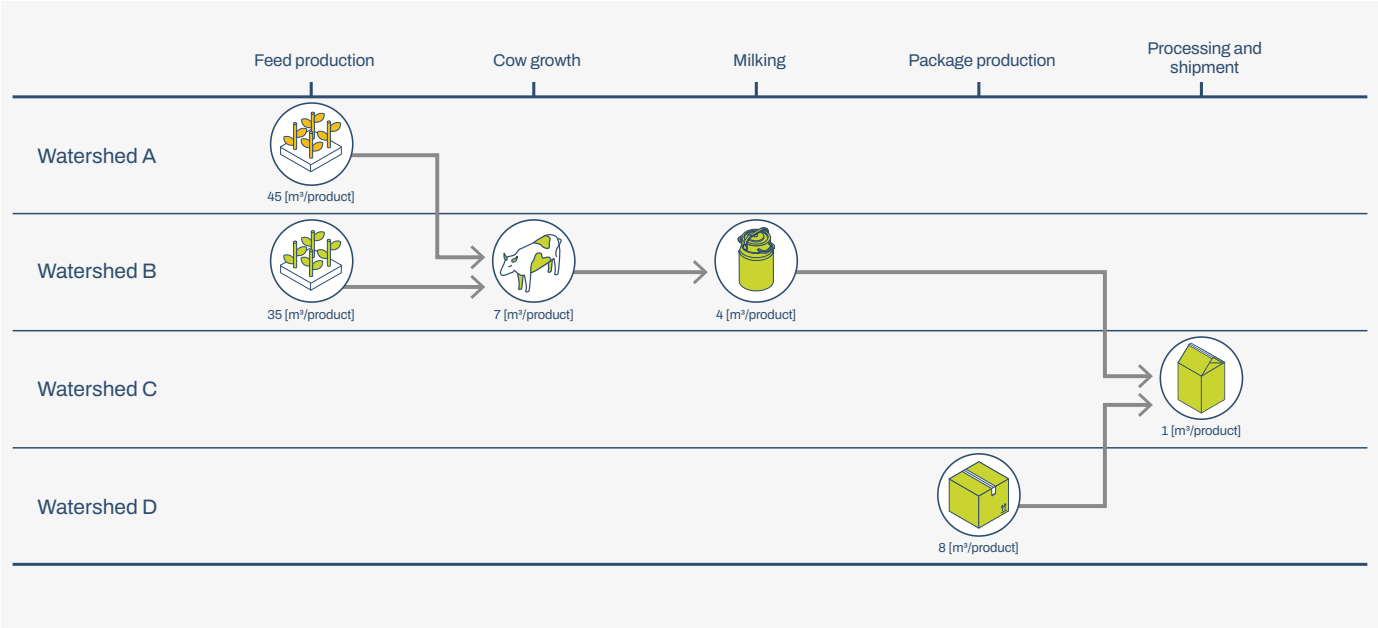
33 FAO Map Catalogue.

34 Overstret L. F. and DeJong-Hughes, J. (n.d.) The Importance of Soil Organic Matter in Cropping Systems of the Northers Great Plains.

Table 6: Water-intensive crops

Crop	Typical water requirement (litres/kilogram of crop)
Cotton	7,000–29,000
Rice	3,000–5,000
Sugar cane	1,500–3,000
Soya beans	2,000
Wheat	900
Potatoes	500
Source: WWF (2013) Thirsty Crops: Our food and clothes: eating up nature and wearing out the environment?	

Figure 6: Water use in livestock production and supply chains



Source: FAO (2019) Water use in livestock production systems and supply chains – Guidelines for assessment.

E3: Dependency and impact measurement

Guiding questions:

What is the scale and scope of our dependencies on nature?

What is the severity of our negative impacts on nature? What is the scale and scope of our positive impacts on nature?

For quantification of negative and positive impacts and dependencies, organisations in the sector should use the TNFD's draft core food and agriculture disclosure metrics in Annex 1.

Suggested data sources and approaches to estimate key impacts include:

- **Deforestation:** If organisations have supplier geolocation data, they can use Copernicus open source satellite data, Global Forest Watch or another earth observation data platform to quantify the square kilometres deforested before and after business activity. If organisations do not have full supply chain traceability, they can use the supply shed approach described in L2 and assess deforestation in the specific supply sheds using satellite data, before ascribing a percentage of the deforestation to the organisation.
- **Soil degradation and eutrophication:**
  - **Nitrogen and phosphorus surpluses:** If farmgate nitrogen and phosphorus balance data are not available, organisations can use global fertiliser sales numbers per crop to estimate nitrogen and phosphorus usage. Our World in Data and FAOSTAT offer access to data on jurisdictional quantities of nitrogen and phosphorus inputs per crop or per quantities of meat produced. These data sets can be used to create an initial estimate. Alternatively, organisations can use LCA methodologies, as nitrogen emissions are usually considered in life cycle assessments.
  - **Pesticides:** Organisations can use pesticide sales numbers per crop type to create an initial estimate until location-specific data are available.
- **Plastic leakage:** Organisations can start by identifying their interface with the top ten rivers that account for plastic in the ocean. Seven of these ten rivers are in the Philippines, two are in India and one is in Malaysia.[35] Organisations can use sales numbers from these high leakage jurisdictions to estimate an impact. If the main landfills where packaging ends up are known, an organisation can use earth observation data such as the Plastic Watch database on landfills to estimate impacts.

Suggested data sources and approaches to estimate key dependencies include:

- **Freshwater:** Organisations can use the list of crops with a high freshwater dependency identified in E2 and overlay detailed location data on the catchment area of each crop category, using spatial maps of current levels of water stress to estimate the size of the dependency. Organisations can use data sources such as the open source Aqueduct Food Platform to access water stress spatial maps and water risk scores per crop per catchment area.
- **Pollination services:** Organisations can use pollination dependency ratings for crop categories to classify procured or produced crops into groups of those with a moderate, high or essential dependence on pollinators (see Annex 3). Thereafter, organisations can estimate the size of the dependency by the quantity of the crops procured.

35 Ritchie, H. (2021) Where does the plastic in our oceans come from?

- **Global and local climate regulation and flood and storm mitigation:** Organisations can use the lists of drought, storm and flood-sensitive crop varieties identified in E2 to develop an initial estimate of the size of their dependency on key regulating ecosystem services. For many organisations, this information is already part of the physical climate-related risk data disclosed as part of the IFRS's ISSB S2 standard on climate-related financial disclosures.

E4: Impact materiality assessment

Guiding question:

Which of the identified impacts are material?

No additional sector-specific guidance identified for E4.

List of datasets and tools

Table 7 provides a list of tools that food and agriculture sector organisations may find useful for the Evaluate phase of LEAP, in addition to those listed in the cross-sector LEAP guidance. Organisations should also reference tools in the and TNFD Tools Catalogue.

Table 7: Additional tools for food and agriculture sector organisations in the Evaluate phase of LEAP

Tool name
• Our World in Data – Total nitrogen used per crop • FAO guidelines to quantitative assess biodiversity impacts of livestock • Polymer prioritisation framework • Chemicals associated with plastic packaging: Inventory and hazards • Guidance on deforestation-free sourcing

Assess risks and opportunities

This section provides additional considerations to help food and agriculture sector organisations with the Assess phase of the LEAP approach.

A1: Risk and opportunity identification

Guiding question:

What are the corresponding risks and opportunities for our organisation?

Table 8 provides a list of illustrative physical and transition risks and opportunities for the sector.

Table 8: Illustrative risks and opportunities in the food and agriculture sector

Risk and opportunity type		Examples of risks and opportunities	Source
Physical risk	Acute	Revenue reduction due to increase in crop and livestock pests and disease.	TNFD
		Increase in production and sourcing costs due to high or extremely high baseline water stress.	TNFD
		Increase in capital expenditure on infrastructure repair due to damage by flooding, landslide or other natural disaster in the area of food company operations.	TNFD

Risk and opportunity type		Examples of risks and opportunities	Source
Physical risk	Chronic	Decreasing land productivity and climate hazard regulation services as a result of soil health degradation leads to profit loss for farmers due to yield losses and to downstream corporations due to supply chain disruption.	TNFD
		Increase in production and sourcing costs due to dependency on agricultural products (including meat, dairy and poultry) from areas with concentration of water pollutants.	TNFD
		Increase in capital expenditure for mechanical and/or hand pollination due to decline in natural pollinators.	TNFD
		Asset devaluation due to proportion of land with soil degradation.	TNFD
		Costs associated with the relocation of agricultural operations and agricultural product suppliers due to lost productivity of agricultural land.	TNFD
		Increase in capital expenditure on water purification and desalination technologies and soil cleaning technologies due to pollution concentration and water stress.	TNFD
		Land asset depreciation due to pesticide land concentration/soil health condition and water chemical and nutrient concentration.	TNFD
		Increased climate hazard insurance costs due to decreased climate regulating ecosystem services (storm regulation, local (micro and meso) climate regulation, flood mitigation, soil and sediment retention etc).	TNFD
		Reduction in yield in areas with low to no natural pest control and declining pollinator abundance.	Adapted Han-mind, H. E. et al. (2019)

Risk and opportunity type		Examples of risks and opportunities	Source
Transition risk	Policy and legal	Increased costs due to food sector GHG gas emission reduction targets (e.g. change in fodder costs to lower methane emissions).	National NDCs
		Increase in compliance costs due to dependency on forest risk commodities exposed to jurisdictions with regulatory restrictions.	Related to GBF Target
		Increase in fines due to failure to meet regulatory limits on pesticide/ antibiotics/fertiliser use and/or nitrogen efficiency requirements.	Related to GBF Target 7 and Target 10
		Increased transition risk rating leading to higher costs of capital.	Related to GBF Target 16
		Increased costs due to extended product responsibility regulation to pay for plastic pollution clean-up from food waste packaging leakage.	Related to GBF Target 7 and 16
		Permit denials as a result of failure to meet legally binding targets to reduce food waste.	Related to GBF Target 16
		Early retirement of food processing machinery based on banned types of plastic packaging.	Related to GBF Target 7 and 16
		Loss of licence to operate in markets with regulatory requirements on deforestation-free food sector commodities.	GBF Target
		Costs of substituting from virgin to recycled food packaging/costs of changing to regenerative farming practices due to regulation.	GBF Target 7 and 16
		Costs of relocating production and/or sourcing areas due to expansion of protected area (GBF 30/30 target).	TNFD
		Loss of operating area due to collective land rights claims by Indigenous Peoples and Local Communities.	TNFD
Transition risk	Technology	Expenditure on precision farming technologies/regenerative farming practices/crop varieties with lower water needs/alternative fodder options with low emissions to air etc.	TNFD
		Increased operational costs to transition to systems that enable reduced food loss and waste.	TNFD

Risk and opportunity type		Examples of risks and opportunities	Source
Transition risk	Market	Market share loss due to slow adoption of environmentally friendly plastic packaging.	TNFD
		Market share loss due to increasing consumer preferences for food produced via regenerative practices and/or for plant based, sustainably produced protein.	TNFD
Transition risk	Reputation	Loss in revenue due to reputational damage caused by business contamination of ground water, eutrophication, plastic pollution, deforestation and/or emissions.	TNFD
Opportunity	Resource efficiency	Full traceability of ingredients with high-risk exposure to embodied nature-related risks reduce certification and compliance costs.	TNFD
		Reduction in input costs as a result of investment into precision farming technologies.	TNFD
		Increase in market valuation due to regenerative farming practices and increase in percentage of natural vegetations enhancing ecosystem services and environmental assets (e.g. soil structure increases resilience to weather-related shocks).	TNFD
		Percentage reduction in input costs due to increased rate of recycling (plastics, nutrients, water etc.).	TNFD
Opportunity	Products and services	Increase in revenue from reuse and repurposing of food waste and loss into alternative products (e.g. upcycling of food or reuse of non-edible food waste into non-food products).	TNFD
		Increase in revenue due to increase in sustainably certified food and agricultural product offerings.	TNFD
		Increase in revenue from participation in biodiversity-relevant tradable permit schemes.	TNFD
Opportunity	Markets	Improved ESG rating, lower transition risk rating and improved asset valuation due to alignment of food company business strategy with GBF 2030 and 2050 goals.	TNFD
		Increase in food company green debt based on below market interest rates.	TNFD
Opportunity	Reputation	Increase in consumer brand loyalty due to brand positioning as low to no negative nature footprint food company.	TNFD

A2: Adjustment of existing risk mitigation and risk and opportunity management

Guiding questions:

What existing risk mitigation and opportunity management processes and elements are we already applying?

How can risk and opportunity management processes and associated elements (risk taxonomy, risk inventory and risk tolerance criteria) be adapted?

No additional sector-specific guidance identified for A2.

A3: Risk and opportunity measurement and prioritisation

Guiding question:

Which risks and opportunities should be prioritised?

No additional sector-specific guidance identified for A3.

A4: Risk and opportunity materiality assessment

Guiding question:

Which risks and opportunities are material and therefore should be disclosed in line with the TNFD recommended disclosures?

No additional sector-specific guidance identified for A4.

Prepare to respond and report

P1: Strategy and resource allocation plans

Guiding question:

What risk management, strategy and resource allocation decisions should be made as a result of this analysis?

Table 9 provides a set of illustrative responses that organisations in this sector might want to consider in light of the analysis undertaken in the other phases of LEAP.

Table 9: Example response actions for the food and agriculture sector

Response category	Response option	Source
Governance	Undertake an annual strategic review for nature-related issues at the board level.	Adapted from CDP; TNFD
Sourcing		
DIRO management	Develop a strategy to manage environmental and social risks arising from contract growing and commodity sourcing.	SASB Agricultural products, FB-AG-430a.3
	Establish a strategy to ensure that suppliers conform to social and environmental responsibility audits and correct major and minor non-conformances.	SASB Agricultural products, FB-AG-430a.2
	Track the percentage of agricultural products/revenue from products that are certified to third-party environmental and/or social standards and develop a strategy to increase certification.	TNFD
	Create a plan with targets for the percentage of food ingredients sourced that are certified to third-party environmental and social standards with a focus on nature-positive outcomes.	Adapted from SASB processed foods (2018)
	Develop a strategy to discuss sourcing risks due to environmental and social considerations from a list of priority food ingredients.	SASB processed foods FB-PF-440a.2
Land-use change		
Strategy	Implement policies and commitments to reduce or eliminate agricultural-driven natural ecosystem conversion with specified targets and cut-off dates for the organisation's own production, sourcing of animal feed, and products sourced for aggregation, processing or trade.	GRI 13, 2021; draft SBTN targets for land (2023)

Response category	Response option	Source
Soil and fertiliser management		
Strategy	Create a soil management plan that identifies main threats to soil health, describes soil management practices used and outlines an approach to input optimisation, including the use of fertilisers.	GRI 13 (2022)
	Establish a plan with time-bound targets to reduce excess fertiliser use intensity per fertiliser nutrient type (N, P_2O_5, K_2O) with an open methodology for the specific production system.	FAO (2021); related to GBF target 7
	Invest in precision technologies to increase nutrient use efficiency and decrease runoff and eutrophication, as well as technologies for nutrient recycling and organic fertilisers.	TNFD
GHG emissions		
Strategy	Create a plan with time-bound targets to reduce GHG emissions, including emissions from land-use change and identify principal ingredients to address GHG emissions.	FAO (2021): GRI 13; SASB Agricultural products, FB-AG-440a.1
Pesticides		
Strategy	Invest in pesticide efficiency technologies and environmentally friendly pest control.	FAO (2021)
	Develop and adhere to an Integrated Pest Management Plan, in line with best practices from the International Code of Conduct on Pesticide Management, to prevent, mitigate and remediate negative impacts associated with the use of hazardous pesticides and excess pesticide use.	FAO (2021)
Air pollution		
Strategy	Create a plan with time-bound targets to reduce non-GHG emissions to air, including NO_x, SO_x, NH_3 and NMVOCs.	GRI 13 (2021)
On-farm nature management		
Strategy	Develop a strategy with clear targets for the proportion of agricultural area under regenerative agriculture and the proportion of commodities sourced from regenerative agriculture production sites.	Adapted from GBF target 10 headline indicator 10.1 (2022)
	Invest in rewilding initiatives, such as natural vegetation in cropped landscapes, rewilding, flower strips and tree cover on crop land.	TNFD
	Make investments in breed and crops at risk of extinction, indigenous crops and in an increased number of crop varieties (genetic varieties).	Related to GBF Goal A
	Implement strategies to manage the use of genetically modified organisms (GMOs).	SASB: Agricultural Products Standard (2018)

Response category	Response option	Source
Human rights and engagement with Indigenous Peoples, Local Communities and affected stakeholders		
Strategy	Commit to providing support to smallholder producers to help them enter responsible supply chains and improve their yields and production practices.	AfI Guidance, Smallholders in Sustainable Supply Chains, Principle 3.1
	Commit to testing for Free, Prior, and Informed Consent (FPIC) of potentially affected Indigenous Peoples and Local Communities before acquiring new interests in land or resources and before new developments or expansions.	Accountability Framework Initiative, Core Principles, Core Principle 2.2.3., p 7
	Commit to respecting and refraining from land acquisition or development until existing conflicts linked to customary rights to land, resources and territory have been resolved.	Accountability Framework Initiative, Core Principles, Core Principle 7.1, p 18
	Commit to a zero-tolerance approach to violence and threats against forest, land and human rights defenders.	Accountability Framework Initiative, Core Principles, Core Principle 2.1.7, p 7
Water		
Strategy	Establish a water efficiency strategy, including company-specific freshwater quantity targets for freshwater quality and nutrient loading.	SBTN (2022)
	Establish a water management plan with clear targets for reducing emissions to water of key pollutants, including NO_x, SO_x, pesticides and antibiotics.	TNFD
	Invest in water-efficient farming technologies and water recycling technologies.	FAO (2021)
Waste		
Strategy	Adopt policies and commitments to address food loss and waste in direct operations and the supply chain, with a target to reduce food waste by 50% and food losses by at least 25% by 2030, in alignment with the GBF.	Adapted GRI 13 (2022); GBF target 16; SDG 13.1; Champions 12.3
	Develop strategies to reduce the environmental impact of packaging throughout its life cycle, including commitments to eliminate unnecessary plastic packaging, transition from single use to reuse models, reduce virgin plastic usage, increase post-consumer recycled content, and ensure plastic packaging is reusable, recyclable or compostable.	Adapted from SASB: Processed Foods (2018); UNEP & Ellen MacArthur Foundation (2018); related to GBF target 16
	Invest in plastic recycling technologies and infrastructure and plastic reuse solutions.	TNFD

P2: Target setting and performance management

Guiding question:

How will we set targets and define and measure progress?

Organisations wishing to set targets may find it useful to consider:

- **Targets on natural vegetation/natural habitat in food production:** For example, placing 10%/20%/25% (per square kilometre) of agricultural land under natural and diverse vegetation by 2030, following the GBF's complementary indicator under target 2.2, the GBF's agro-biodiversity index complementary indicator under target 10, and the EU taxonomy draft Regulatory Technical Standards (RTS) for agriculture's 10% high biodiversity landscape features;
- **Deforestation-free target:** No deforestation for primary deforestation-linked commodities, with a target date of no later than December 31, 2025 (2020 cut-off date);[36] and
- **Food waste and food loss target:** Reduce food waste by 50% and reduce food losses by at least 25% by 2030, in line with GBF target 16, SDG 12.3.1A, Champions 12.3.

P3: Reporting

Guiding question:

What will we disclose in line with the TNFD recommended disclosures?

No additional sector-specific guidance identified for P3.

P4: Presentation

Guiding question:

Where and how do we present our nature-related disclosures?

No additional sector-specific guidance identified for P4.

36 SBTi (2022) Forest, Land and Agriculture Science Based Target-Setting Guidance.

Glossary

In addition to the concepts and definitions provided in the TNFD glossary, the table below outlines concepts detailed in this guidance. The TNFD glossary will be updated with these definitions once the food and agriculture sector guidance is finalised, based on market consultation and feedback.

Concept	Definitions
Crop genetic diversity	Any variation within and between crop cultivars, including their genotypic and phenotypic characters. Bal, K. J. et al. (2023) Approaches and Advantages of Increased Crop Genetic Diversity in the Fields.
Managed bees	A kind of pollinator that is maintained by human beings through husbandry (e.g. some honeybees, some leaf cutting and orchard bees, some bumble bees). The terms can be broadened to include wild pollinators (q.v.) that flourish by human encouragement. IPBES (2016) The assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production.
Natural habitat	Areas composed of viable assemblages of plants and/or animal species of largely native origin, and/or where human activity has not essentially modified the area's primary ecological function and species composition. IFC (2016) Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Annex 1: Sector-specific disclosure metrics – Food and agriculture

Proposed guidance on the application of the core global disclosure metrics

Organisations should refer to Annex 1 of the TNFD Recommendations for further information on the core global disclosure metrics.

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**
Driver of nature change: Climate change				
	GHG emissions	Refer to IFRS S2 Climate-related Disclosure Standard.	No further guidance.	
Driver of nature change: Land/freshwater/ocean-use change				
C1.0	Total spatial footprint	Total spatial footprint (km^2) (sum of): • Total surface area controlled/managed by the organisation, where the organisation has control (km^2); • Total distributed area (km^2); and • Total rehabilitated/restored area (km^2).	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** No further guidance.	

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**
C1.1	Extent of land/ freshwater/ocean-use change	Extent of land/freshwater/ocean-use change (km^2) by: • Type of ecosystem[37], and • Type of business activity.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** Land-use change to report under the core global disclosure metric includes: • Agriculture-driven terrestrial natural ecosystem conversion since 2020, including, at least, conversion of primary forests, other naturally regenerating (second growth) forests and freshwater natural ecosystems, linked to land owned, leased, operated, financed or sourced from.	GBF Target 1 and Target 2 (2022); GBF Target 10 (2022); SBTN (2023); Adapted from CDP (2022) F15a; AFi (2022)
		Extent of land/freshwater/ocean ecosystem conserved or restored (km^2), split into: • Voluntary; and • Required by status or regulators.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** The extent conserved or restored under the core global disclosure metric should include: • Area reforested in direct operations or in the supply chain of the organisation; and • Area of wetlands rewetted in direct operations or supply chain of the organisation.	TNFD
C1.1	Extent of land/ freshwater/ocean-use change	Extent of land/freshwater/ocean ecosystem that is sustainably managed (km^2) by: • Type of ecosystem[38], and • Type of business activity.	No further guidance.	

37 When disclosing on ecosystem types, refer to the International Union for Conservation of Nature Global Ecosystem Typology.

38 When disclosing on ecosystem types, refer to the International Union for Conservation of Nature Global Ecosystem Typology.

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**

C2.0	Pollutants released to soil split by type	Pollutants released to soil (tonnes) by type, referring to sector-specific guidance on types of pollutants.	**Agricultural products; Meat, poultry and dairy**
			
			Pollutants to report under the core global disclosure metric include:
			
			• Pesticides used by toxicity hazard level (either extremely hazardous, highly hazardous, moderately hazardous, slightly hazardous, or unlikely to present an acute hazard) against baseline.
			• Nitrogen balance:
			  • Nitrogen input from livestock manure and fertilisers; and
			  • Nitrogen output.
			• Phosphorus balance:
			  • Phosphorus input; and
			  • Phosphorus output.
			• If relevant, balances for potassium and other nutrients (e.g. micronutrients).
			
			Processed foods; Food retailers and distributors; Restaurants
			
			No further guidance.
				GBF Target 7 (2022); GRI 13 (2022); WHO (2017); OECD (2023)

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**
C2.1	Wastewater discharged	Volume of water discharged (m_3), split into: • Total • Freshwater; and • Other.[39] Including: • Concentrations of key pollutants in the wastewater discharged, by type of pollutant, referring to sector-specific guidance for types of pollutants; and • Temperature of water discharged, where relevant.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** Pollutants to report under the core global disclosure metric include: • Nutrients (nitrogen and phosphorus); • Pesticides; • Organic loading (including crop and livestock excreta); • Pathogens; • Metals; and • Other and emerging pollutants (including antimicrobials and other veterinary medicines).	Adapted from GBF Target 7 (2022); FAIRR Index; FAO (2017); WHO (2017)

39 Freshwater: (≤1,000 mg/L Total Dissolved Solids). Other: (>1,000 mg/L Total Dissolved Solids). Reference: GRI (2018) GRI 303-4 Water discharge.

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**
C2.2	Waste generation and disposal	Weight of hazardous and non-hazardous waste generated by type (tonnes), referring to sector-specific guidance for types of waste. Weight of hazardous and non-hazardous waste (tonnes) disposed of, split into: • Waste incinerated (with and without energy recovery); • Waste sent to landfill; and • Other disposal methods. Eight of hazardous and non-hazardous waste (tonnes) diverted from landfill, split into waste: • Reused; • Recycled; and • Other recovery operations.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** Types of non-hazardous waste to report under the core global disclosure metric include: • Food lost and/or wasted by type of food along the relevant stages of the value chain in which the organisation is involved. Total food waste should be disaggregated by destination (e.g. landfill, composting, controlled, combustion, refuse, land application, co-digestion).	Adapted from SASB FB-FR-150a.1 (2018); FAO (2021); GBF Target 16 (2022); UNEP (2021)

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**
C2.3	Plastic pollution	Plastic footprint as measured by total weight (tonnes) of plastics (polymers, durable goods and packaging) used or sold broken down into raw material content.[40] For plastic packaging, percentage of plastics that is: • Reusable; • Compostable; • Technically recyclable; and • Recyclable in practice and at scale.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** No further guidance.	
C2.4	Non-GHG air pollutants	Non-GHG air pollutants (tonnes) by type: • Particulate matter $PM_{2.5}$ and/or PM_{10}); • Nitrogen oxides (NO_2, NO and NO_3); • Volatile organic compounds (VOC or NMVOC); • Sulphur oxides (SO_2, SO, SO_3, SO_x); and • Ammonia (NH_3).	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** No further guidance.	

40 Raw material content: % of virgin fossil-fuel feedstock; % of post-consumer recycled feedstock; % of post-industrial recycled feedstock; % of virgin renewable feedstock.

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**
C3.0	Water withdrawal and consumption from areas of water scarcity	Water withdrawal and consumption[41] (m^3) from areas of water scarcity, including identification of water source.[42]	**Agricultural products; Meat, poultry and dairy; Processed foods** An organisation should also report: • Water withdrawal from areas of high-water scarcity to produce a tonne of crop and/or product dry matter and/or animal protein.	TNFD
C3.1	Quantity of high-risk natural commodities sourced from land/ ocean/freshwater	Quantity of high-risk natural commodities[43] (tonnes) sourced from land/ocean/ freshwater, split into types, including proportion of total natural commodities.	No further guidance.	GBF Target 11 (2022); SASB FB-AG-250a.2 FB-MP-440a1, FB-PF-440a.1 (2018)
		Quantity of high-risk natural commodities[44] (tonnes) sourced under a sustainable management plan or certification programme, including proportion of total high-risk natural commodities.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** This metric should also be expressed as a percentage of all agricultural products, by certification programme.	GBF Target 11 (2022); SASB FB-AG-250a.2 (2018)

41 Water consumption is equal to water withdrawal less water discharge. Reference: GRI (2018) GRI 303-5.

42 Surface water; groundwater; seawater; produced water; third-party water. Reference: GRI (2018) GRI 303-3.

43 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL) and indicate what proportion of these commodities represent threatened and CITES listed species.

44 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL) and indicate what proportion of these commodities represent threatened and CITES listed species.

Agricultural products; Meat, poultry and dairy (exc. aquaculture); Processed foods; Food retailers and distributors; Restaurants				
Metric no.	**Core global indicator**	**Core global metric**	**Proposed guidance for the sector**	**Source**
C4.0	Placeholder indicator: Measures against unintentional introduction of invasive alien species (IAS)[45]	Proportion of high-risk activities operated under appropriate measures to prevent unintentional introduction of IAS, or low risk designed activities.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** No further guidance.	TNFD

45 Due to the measurement of levels of invasive species for organisations being a developing area, the chosen indicator focuses on whether an appropriate management response is in place for the organisation. The additional sets of metrics contain measurement of the level of invasive species within an area. The TNFD intends to do further work with experts to define 'high-risk activities' and 'low-risk designed activities'.

Proposed core sector disclosure indicators and metrics

Metric category	Metric subcategory	Indicator	Proposed core sector disclosure indicator or metric	Source
Impact driver	Land/freshwater/ocean-use change	Deforestation-free products	Percentage of production volume from land owned, leased, managed or sourced from that is determined to be deforestation-free, by product.	
		Regenerative or sustainable land management	Percentage of land managed or sourced from that deploys practices with measurable regenerative or sustainable outcomes. An organisation should describe and disclose the definition of regenerative or sustainable agriculture used for disclosure.[46]	
	Pollution/pollution removal	Waste management	Percentage of food waste repurposed into by-products and/or co-products.	Adapted from SASB FB-FR-150a.1 (2018); FAO (2021); GBF Target 16 (2022); UNEP (2021)
	Resource use/ replenishment	Products from areas of water scarcity	Percentage of agricultural products or animal feed produced or sourced from regions with high or extremely high baseline water scarcity.	GBF Target 11 (2022); SASB FB-AG-250a.2 FB-MP-440a.1, FB-PF-440a.1 (2018)

46 The measures start when a baseline has been undertaken for the corporation to track regeneration of environmental assets against, as disclosure data for the metric.

Proposed additional sector disclosure indicators and metrics

Metric category	Metric subcategory	Cross-sector indicator	Proposed additional sector disclosure indicator or metric	Source
Impact driver	Land/freshwater/ocean-use change	Land-use change	Percentage of cropland owned, leased, operated and/or sourced from with at least 10% natural vegetation per 1 km^2 cultivated area. Percentage of such land with more than 20% natural vegetation per 1 km^2 cultivated area.	GBF Target 10 (2022); Jones et al. (2021)
			Actual and potential yield, and yield gap, by type of crop.	GYGA (2022)
			Crop breed diversity in production area that is owned, leased, operated or sourced from.	GBF Target 4 (2022); Jones et al. (2021)
	Climate change	Greenhouse gas emissions	Gross global scope 1 emissions from refrigerants.	SASB Food retailers, FBFR-110b.1 (2008)
	Pollution/pollution removal	Water pollution	Volume of water discharged (total, freshwater, other) per tonne of crop and/or product dry matter and/or animal protein.	TNFD
			Volume of wastewater discharged to the environment from 1) crop product processing facilities and/or 2) animal processing facilities and volume of wastewater reused.	Adapted from SASB Agricultural Products (2018)
			Water pollutant loading rate (kg pollutant per month), including locally developed model results for pollutants from non-point source, based on average nitrogen and phosphorus nutrient loads over past 5 years of operations.	SBTN Freshwater (2023)

Metric category	Metric subcategory	Cross-sector indicator	Proposed additional sector disclosure indicator or metric	Source
Impact driver	Pollution/pollution removal	Waste	Percentage of food loss and/or waste (%) as total food produced/handled and percentage diverted (%).	Adapted from SASB Restaurants (2018)
			Total nutritional density of food waste and/or food loss (calories).	Hatten J. et al. (2019)
			Total weight (tonnes) of non-plastic packaging (primary, secondary and tertiary packaging) for food products by entity by packaging type.	Adapted from SASB Processed Foods (2018)
			Percentage total of sourced and purchased non-plastic packaging made from recycled materials. Percentage total of sourced and purchased non-plastic packaging made from renewable materials. Percentage total of sourced and purchased non-plastic packaging made from compostable materials. For each material used, percentage that is recycled, reused and composted, according to local laws and regulations.	Adapted from SASB Processed Foods (2018)
		Soil pollution	Avoided pesticide use per hectare (as proportion of the total cropland area owned, leased managed or sourced from by the entity) by pesticide toxicity level (either extremely hazardous, highly hazardous, moderately hazardous, slightly hazardous, or unlikely to present an acute hazard).	Adapted from GRI 13 (2022); WHO (2017)
			Nitrogen use efficiency (NUE), ratio of total N inputs and total N outputs) to produce a crop, animal product or agrifood product and disclose the calculation methodology.	
	Invasive species and other	Biological alterations	Percentage of animal production or animal protein sourced that receives (1) medically important antimicrobials and (2) not medically important antimicrobials, by animal type.	SASB Meat, Dairy and Poultry (2018)

Metric category	Metric subcategory	Cross-sector indicator	Proposed additional sector disclosure indicator or metric	Source
State of nature	Ecosystem extent and condition	Ecosystem condition	Proportion of land with soil degradation in the total area of agricultural production, including soil erosion, reduction in soil fertility, salinisation of irrigated lands and waterlogging.	FAO (2021)
			Trends in the amount of litter in the water column including microplastics and on the seafloor.	TNFD
			Coastal and freshwater eutrophication; plastic debris density: 1) Chlorophyll-A concentration 2) In-situ concentration of nitrogen, phosphate and silica.	GBF draft monitoring Framework (2022)
			Name, amount, volume and concentration of pesticides by location (per land/marine area sensitivity), weighted by toxicity levels (1, 8, 16 and 64 for low risk, normal, more hazardous and non-approved substances).	UNEP WCMC (2021); GBF draft monitoring Framework (2022)
			Volume per month (Ml/month) of discharge flow and mass of nutrients per volume (mg P/l).	SBTN (2022)
			Changes in soil organic carbon stocks (over 5+ years relative to a baseline).	GBF draft monitoring Framework (2022)
	Species	Extinction risk	Species threat, abatement and restoration (STAR).	IUCN, Mair et al. (2021)
			Red List Index.	GBF draft monitoring Framework (2022)
		Population size	Local species population indexes (e.g. farmland bird index).	OP2B
			Diversity of pollinators and natural predators of livestock and cropland pests.	ADBI (2022)

Annex 2: High deforestation risk derived products

Commodity	Derived products
Cattle	Relevant ingredients: live cattle; meat of cattle fresh, chilled or frozen; edible offal of cattle, fresh or chilled; edible cattle livers, frozen; edible cattle offal (excluding tongue and livers) frozen; other prepared or preserved meat, meat offal, blood, of cattle; raw hides and skins of cattle, fresh, or salted, dried, limed, pickled or otherwise preserved, but not tanned, parchment-dressed or further prepared, whether or not dehaired or split.
Cocoa	Relevant ingredients: cocoa beans, whole or broken, raw or roasted; cocoa shells, husks, skins and other cocoa waste; cocoa paste, whether or not defatted; cocoa butter, fat and oil; cocoa powder, not containing added sugar or other sweetening matter; chocolate and other food preparations containing cocoa.
Coffee	Whether or not roasted or decaffeinated (relevant ingredients: coffee husks and skins, coffee substitutes containing coffee in any proportion).
Oil palm	Relevant ingredients: palm nuts and kernels; palm oil and its fractions, whether or not refined, but not chemically modified; crude palm kernel and babassu oil and fractions thereof, whether or not refined, but not chemically modified; oilcake and other solid residues of palm nuts or kernels, whether or not ground or in the form of pellets, resulting from the extraction of palm nut or kernel fats or oils; glycerol, palmitic acid, stearic acid, their salts and esters; saturated acyclic, monocarboxylic acids; steric acid; oleic acid; industrial monocarboxylic fatty acids, acid oils from refining; industrial fatty alcohols.
Soya bean	Relevant ingredients: soya beans, whether or not broken; soya bean flour and meal; soya bean oil and its fractions whether or not refined, but not chemically modified; oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soy-bean oil.

Source: Commodities listed based on EU Commission (2023) Regulation (EU) 2023/1115.

Annex 3: Pollinator dependency ranking

Food crop dependency on pollinators	
Essential: Yield reduction greater than 90% without pollinators	Fruits including kiwi, melons, pumpkins, watermelons.
	Cocoa beans
	Brazil nuts
High dependency: Yield reduction of 40%–90% without pollinators	Fruits including apples, apricots, blueberries, cherries, mangoes, peaches, plums, pears, raspberries
	Nuts including almonds, cashew nuts, kola nuts
	Avocados
Modest dependency: Yield reduction of 10%–40% without pollinators	Oil crops including sunflower seed, rapeseed, sesame, mustard seed
	Soya beans
	Fruits including strawberries, currants, figs, gooseberries, eggplant
	Coconuts and okra
	Coffee beans
Little dependency: Yield reduction of 0–10% without pollinators	Fruit and veg including oranges, tomatoes, lemons, limes, papayas
	Oil crops including palm, poppy seed, linseed, safflower seed
	Legumes including beans, cow beans, pigeon peas
	Groundnuts

Source: Aizen, M. A. et al. (2009) How much does agriculture depend on pollinators? Lessons from long-term trends in crop production. Annals of Botany 103, 1579–1588.

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