Additional sector guidance
Food and agriculture

June 2024
Version 1.0

SICS® industries:
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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Taskforce on Nature-related Financial Disclosures

Contents

1. Introduction

1.1. The purpose of this guidance

In September 2023, the TNFD published its recommendations for disclosure of nature-related issues and supporting implementation guidance. This document provides sector-specific additional guidance for the food and agriculture sector, covering:

- The assessment of nature-related issues using the TNFD's LEAP approach (Section 2); and
- The disclosure of sector-specific metrics in line with the TNFD's recommended approach to metrics (Section 3).

The TNFD's Guidance on the identification and assessment of nature-related issues: The LEAP approach is designed as an iterative process – across business locations and business lines – in line with established risk management processes and corporate reporting cycles. Organisations may choose to start with a narrow scope for a LEAP assessment, and gradually expand the scope of the assessment as they gain experience and insight.

The TNFD recognises that there can be significant differences across sectors for corporates applying the LEAP approach. It has published this additional guidance with significant input from a range of knowledge partners and market participants, to help food and agriculture 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 and nature-related issues within sectors. To facilitate that sector-level analysis, this guidance also includes:

- Guidance on the application of the core global disclosure indicators and metrics to food and agriculture sector (Section 3.1); and
- Core and additional sector disclosure indicators and metrics (Sections 3.2 and 3.3).

Figure 2 provides an overview of the TNFD disclosure measurement architecture and where indicators and metrics are listed in the TNFD recommendations and relevant sector guidance.

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

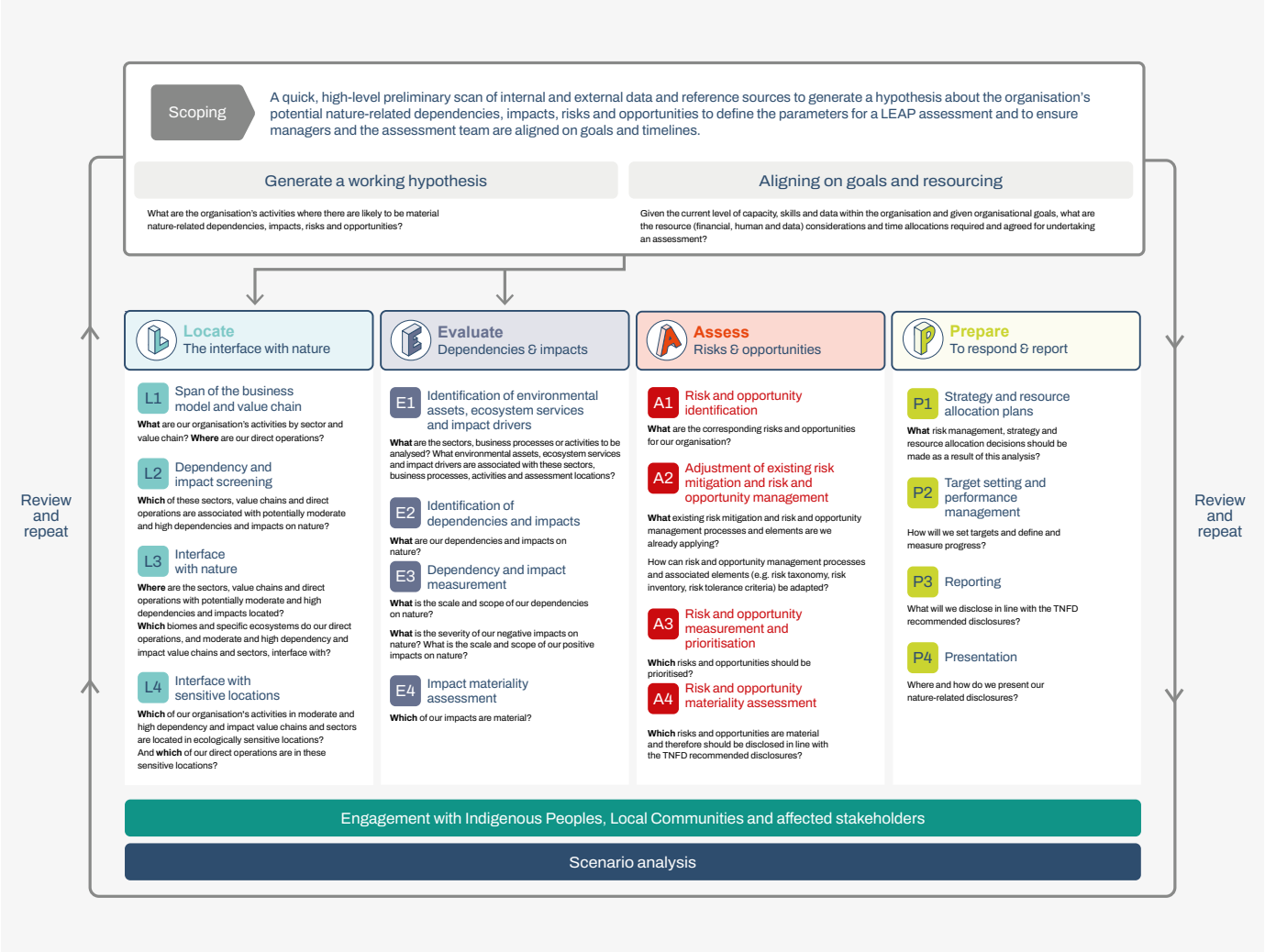
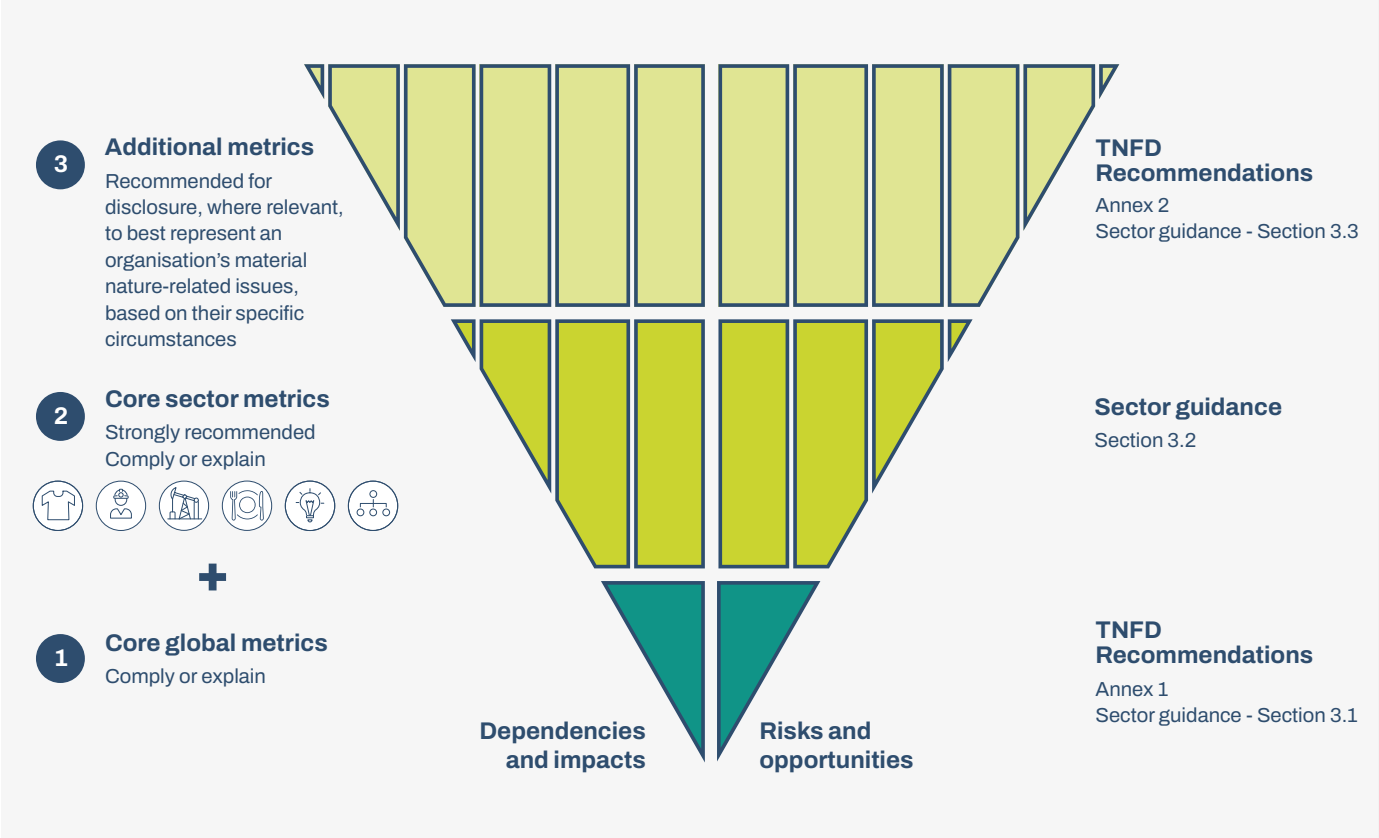


Figure 2: TNFD disclosure metrics architecture signposted to metrics lists



The guidance in Section 3 on the application of the TNFD core global metrics for this sector, as well as the core and additional sector metrics outlined, expand on the disclosure indicators and metrics outlined in Annexes 1 and 2 of the TNFD recommendations. The TNFD has incorporated and sought to build on existing industry standards and disclosure metrics wherever possible to build on current data collection and reporting practices and minimise additional assessment and reporting costs.

1.2. Audience for this guidance

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

Box 1: SICS® industries in the scope of this guidance document

Agricultural Products (FB-AG)

Meat, Poultry & Dairy (FB-MP)

Processed Foods (FB-PF)

Food Retailers & Distributors (FB-FR)

Restaurants (FB-RN)

Under the Sustainable Industry Classification System® (SICS®) developed by the Sustainability Accounting Standards Board (SASB), food and agribusiness fall under the Food and Beverage thematic sector. This sector guidance covers:

- Agricultural Products industry: 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 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 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 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 industry: 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.

1 SASB Standards (2023) Agricultural Products.

2 SASB Standards (2023) Meat, Poultry & Dairy. Aquaculture is covered in separate TNFD sector guidance.

3 SASB Standards (2023) Processed Foods.

4 SASB Standards (2023) Food Retailers & Distributors.

5 SASB Standards (2023) Restaurants.

The examples provided in this guidance for the food and agriculture sector are intended to be illustrative. They are not exhaustive, universally applicable or recommended by the TNFD as examples of measures for all entities within the industry. Each company's context, location and nature-related interactions are unique. The TNFD encourages all companies to consult additional relevant sources, including scientific references and relevant industry standards or best practice guides, and conduct thorough assessments to identify and assess nature-related dependencies, impacts, risks and opportunities specific to their operations and value chains. This guidance aims to support, not replace, a tailored assessment, which will be necessary for each entity.

Table 1: Areas of LEAP with additional guidance for the food and agriculture sector in this guidance document

Scoping	✓

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

1.3. Sector background

The global food system is critical for the health and 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] 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.[7] 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.

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

7 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.

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.[8] 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,[9] and diverse wild pollinator species are necessary for crop growth even when managed bees are present in high numbers.
- Soils are the basis for producing 95 percent of our food. However, one-third of the world's soils are degraded to some extent due to erosion, loss of organic carbon, salinisation, acidification, compaction and nutrient imbalance. 33% of global soils are already degraded.[10]
- 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.[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.

The transformation of habitats for agriculture reduces the abundance and changes the composition of wildlife communities and impacts native biodiversity, including migratory wildlife such as songbirds and waterbirds, non-pollinating insects, plants and resident birds.

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

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

10 FAO (2023) Soils where food begins.

11 World Bank (2022) Water in agriculture.

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.

2. Sector-specific LEAP assessment guidance

2.1. 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 the Taskforce recommends that organisations make this 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.[14]

The assessment of upstream nature-related issues is also affected by the ever-changing supplier base. The variety of business models and supply chain relationships means that supply chains can be relatively opaque. 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 nature on 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

14 SASB Standard (2023) Meat, Poultry & Dairy.

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. The Taskforce recommends that organisations 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 include:

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

2.2. 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

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?

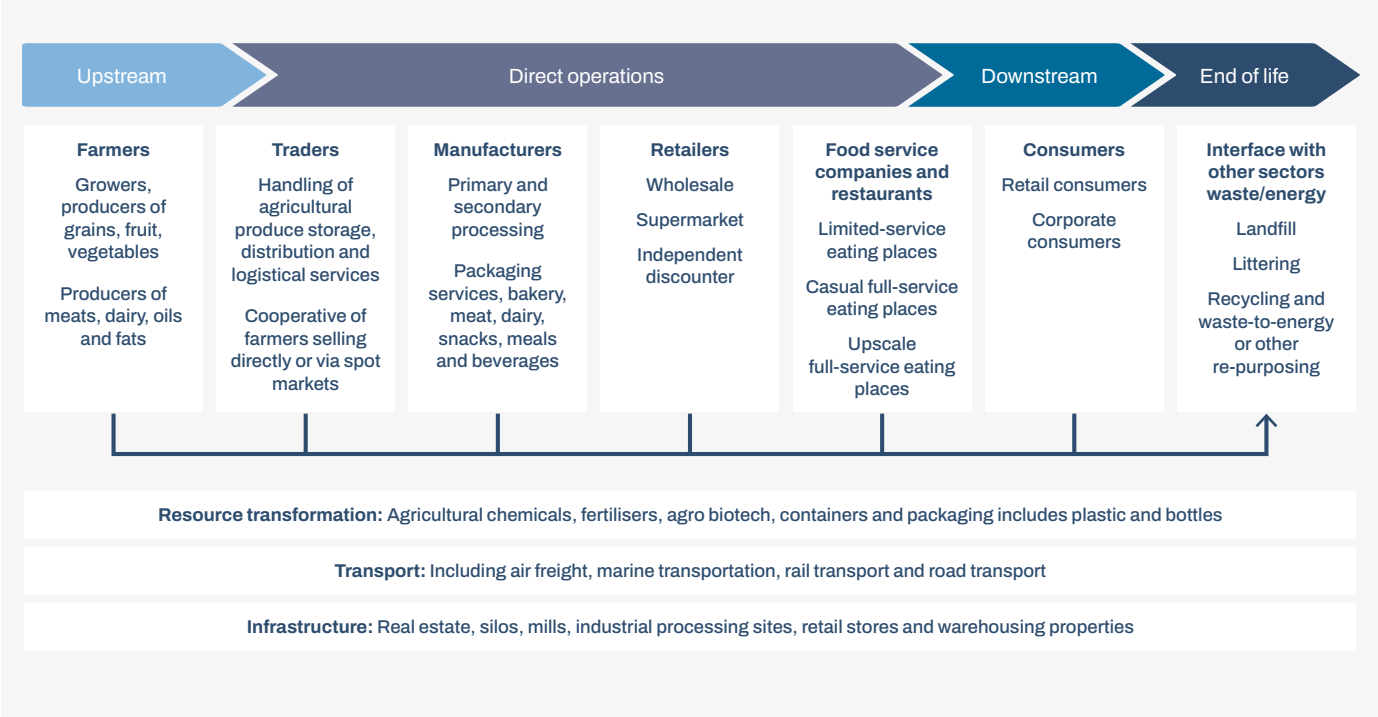
The agricultural products and meat, poultry and dairy value chains are highly complex, with a large number of actors involved. Primary producers will often sell to a trading company or farmer cooperative, which aggregates the products for customers, such as distributors, wholesalers, packed and processed 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 3 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.[15]

15 SASB (2023) Meat, Poultry & Dairy.

Figure 3: 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 can list their agricultural products 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.

The Taskforce recommends that organisations also include the three SICS sectors of Resource Transformation; Transportation; and Infrastructure (illustrated in Figure 3) on their value chain map. Organisations should refer to the TNFD guidance for these sectors where available. In addition, organisations can consult the TNFD value chain guidance for more information on traceability.

L2 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?

Figures 4a, 4b, 5a and 5b 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.

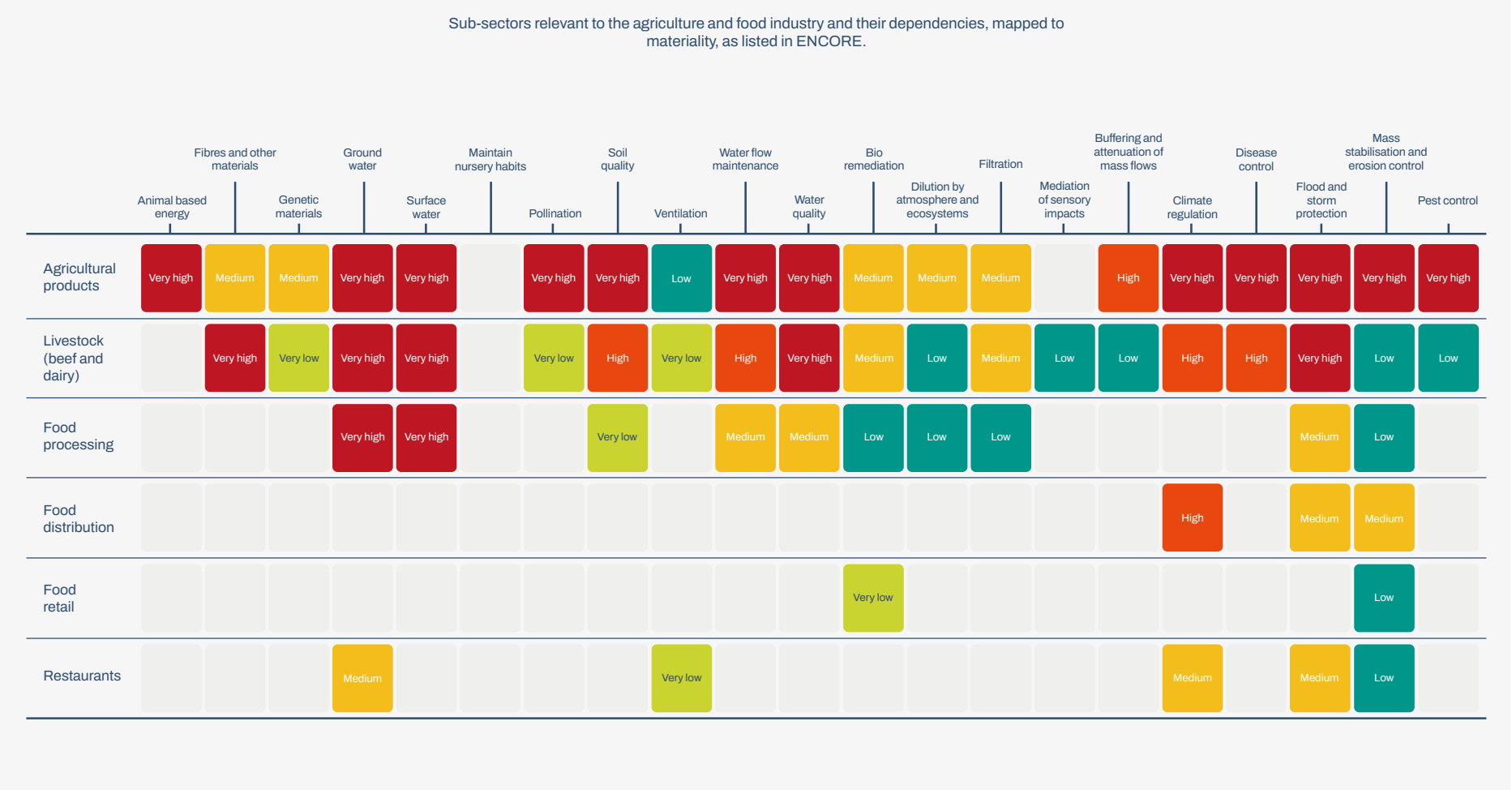
In addition, the Taskforce recommends that organisations in all food and agriculture industries prioritise:

- Developing lists of key agricultural products produced or procured;
- Identifying value chains of any deforestation risk sourcing, 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.

The Taskforce recommends that organisations in the processed foods, retailers and restaurants industries 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 4a: Materiality ratings of ecosystem services the food and agriculture sector typically depends on (based on ENCORE 2018-2023 data)



Source: 2018-2023 version of the ENCORE knowledge base.

Figure 4b: Materiality ratings of ecosystem services the food and agriculture sector typically depends on (based on ENCORE 2024 data)

	ENCORE 2024	Growing of cereals (except rice), leguminous crops and oil seeds	Raising of cattle and buffaloes	Manufacture of other food products	Other land transport	Retail sale of food, beverages and tobacco in specialized stores	Restaurants and mobile food service activities
Provisioning services	Other provisioning services	Medium	N/A	N/A	Medium	N/A	N/A
	Biomass provisioning	Very high	Very high	N/A	N/A	N/A	N/A
	Genetic material	Very high	Medium	N/A	N/A	N/A	ND
	Water supply	High	High	High	Very low	Medium	Medium
Regulating & maintenance services	Solid waste remediation	Medium	Medium	Medium	ND	ND	ND
	Soil and sediment retention	Very high	Very high	Low	Low	Medium	Low
	Water purification	Very high	High	Very high	ND	ND	Very high
	Soil quality regulation	Very high	High	N/A	N/A	N/A	N/A
	Other regulating and maintenance service	Medium	Low	Low	Very low	N/A	ND
	Biological control	High	Medium	Very low	ND	Very low	Very low
	Air Filtration	Medium	Medium	Very low	Very low	Very low	Very low
	Flood mitigation	High	Medium	Medium	Medium	Medium	Very low
	Global climate regulation	Very high	Medium	Very low	Medium	Very low	Medium

	ENCORE 2024	Growing of cereals (except rice), leguminous crops and oil seeds	Raising of cattle and buffaloes	Manufacture of other food products	Other land transport	Retail sale of food, beverages and tobacco in specialized stores	Restaurants and mobile food service activities
Regulating & maintenance services continued	Nursery population and habitat maintenance	Very low	Very low	N/A	N/A	N/A	N/A
	Noise attenuation	N/A	Very low	N/A	Very low	N/A	ND
	Other regulating and maintenance service	N/A	Very low	N/A	N/A	N/A	ND
	Local (micro and meso) climate regulation	Very high	Medium	Low	Low	Low	Low
	Pollination	High	N/A	N/A	N/A	N/A	N/A
	Storm mitigation	High	High	Medium	Medium	Medium	Low
	Water flow regulation	High	High	High	Low	Medium	Low
	Rainfall pattern regulation	Very high	Very high	N/A	Medium	Very low	Medium
Cultural services	Recreation related services	N/A	ND	N/A	N/A	N/A	Very high
	Visual amenity services	N/A	ND	N/A	Very high	N/A	Very high
	Education, scientific and research services	N/A	Very high	N/A	N/A	N/A	ND
	Spiritual, artistic and symbolic services	N/A	Very high	N/A	N/A	N/A	Very high

N/A = Non-applicable

ND = No data

Source: ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (Unpublished, Expected 2024). ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. Cambridge, UK: the ENCORE Partners. Available at: https://encorenature.org. *DOI:* https://doi.org/10.34892/dz3x-y059.

Figure 5a: Materiality ratings for impact drivers typically relevant for the food and agriculture sector (based on 2018-2023 version of ENCORE)

Sub-sectors relevant to the agriculture and food industry and their impact drivers, mapped to materiality, as listed in SBTN sectoral materiality tool.

Direct operations data is collated from the ENCORE impacts database.

	Land and sea use change			Resource exploitation		Pollution					Climate change	Invasive species
Sub-sectors	Terrestrial ecosystem use	Freshwater ecosystem use	Marine ecosystem use	Water use	Other resource use	Soil pollutants	Water pollutants	Non GHG air pollutants	Solid waste	Disturbances	GHG emissions	Invasive alien species
	Direct operations											
Agricultural products	Very high	Very high		Very high	Low	High	High	High	Low		High	High
Livestock (beef and dairy)	Very high			Very high		Medium	Medium	High	Low		High	Medium
Food processing				High		Medium	Medium	High	High		High	
Food distribution			Medium			Low	Low	High		High	High	High
Food retail				High		High	Medium	Medium	Medium			
Restaurants									Medium			

Figure 5b: Materiality ratings for impact drivers typically relevant for the food and agriculture sector (based on 2024 version of ENCORE)

	ENCORE 2024	Growing of cereals (except rice), leguminous crops and oil seeds	Raising of cattle and buffaloes	Manufacture of other food products	Other land transport	Retail sale of food, beverages and tobacco in specialized stores	Restaurants and mobile food service activities
Land, freshwater and ocean use change	Land ecosystem use	High	Very high	Low	Medium	Low	Low
	Freshwater ecosystem use	Medium	High	N/A	N/A	N/A	Low
	Ocean ecosystem use	N/A	N/A	N/A	N/A	N/A	N/A
Climate change	Greenhouse gas (GHG) emissions	Medium	High	Low	Medium	Medium	Low
Pollution/pollution removal	Non-GHG air pollutants	High	High	Low	Low	Medium	Low
	Emissions of toxic soil and water pollutants	High	High	Medium	Low	Very low	Low
	Emissions of nutrient soil and water pollutants	Very high	High	ND	Medium	N/A	Low
	Solid waste	High	Very high	Medium	Very low	Very low	Medium
	Disturbances	Medium	Medium	Medium	Medium	Very low	Low
Resource use/ replenishment	Water use	Very high	High	Medium	Low	Medium	Low
	Other biotic resource use	ND	ND	N/A	N/A	N/A	N/A
	Other abiotic resource use	N/A	N/A	N/A	N/A	N/A	N/A
Invasive alien species introduction/removal	Introduction of invasive species	Very high	High	ND	Low	ND	N/A

N/A = Non-applicable. ND = No data

Source: ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (Unpublished, Expected 2024). ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. Cambridge, UK: the ENCORE Partners. Available at: https://encorenature.org. *DOI:* https://doi.org/10.34892/dz3x-y059.

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

Tools that are likely to be helpful for food and agriculture sector organisations in component L2 of the Locate phase include:

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

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

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) can 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

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?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

List of datasets and tools

Table 2 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 2: 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.
Global Forest Watch	Earth observation data platform quantifying the square kilometres deforested before and after business activity.

2.3. 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

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 3 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, with examples of relevant indicators. Section 3 sets out TNFD's recommended indicators and metrics for organisations to quantify these impact drivers.

Table 3: Typical impact drivers associated with common business activities in the food and agriculture sector, and the ecosystem assets and services affected

Business activity	Impact drivers	Examples of environmental assets affected	Examples of 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.	• Primary forests; • Secondary growth forests; • Wetlands/peatlands; • Native grasslands and rangelands; • Savannahs.	• 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	Examples of environmental assets affected	Examples of ecosystem services affected
Agricultural products, and meat, poultry and dairy			
Land management into buffer zones and zones of natural vegetation	Land/freshwater/ocean-use change: Land ecosystem use. Climate change: Greenhouse gas emissions.	• Primary forests; • Secondary growth forests; • Wetlands/peatlands; • Native grasslands and rangelands; • Savannahs.	• 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; • Education, scientific and research services; • Spiritual, artistic and symbolic services.

Business activity	Impact drivers	Examples of environmental assets affected	Examples of ecosystem services affected
Agricultural products, and meat, poultry and dairy			
Land management responsible practices: no-tillage, set aside preservation areas, crop rotation/ integrated farming/others	Land/freshwater/ocean-use change: Land ecosystem use/ regeneration.	• Land; • Freshwater ecosystems; • Cultivated biological resources; • Marine ecosystems.	• Water supply; • Water quality regulation; • Soil quality regulation; • Flood mitigation; • Water purification; • Air filtration.
Application of mineral/ chemical fertiliser	Pollution/pollution removal: Soil pollutants, non-GHG air pollutants. Climate change: Greenhouse gas emissions.	• Land; • Freshwater ecosystem; • Marine ecosystems; • Atmospheric systems.	• Biomass provisioning; • Global climate regulation; • Soil quality regulation; • Water purification.
Use of antibiotics in livestock production	Pollution/pollution removal.	• Land; • Freshwater ecosystems.	• Water provisioning; • Soil health.
Application of organic fertiliser including livestock waste	Pollution/pollution removal: Soil pollutants, non-GHG air pollutants.	• Land; • Freshwater ecosystems; • Marine ecosystems; • Atmospheric systems.	• Water supply; • Water purification; • Soil quality regulation; • Global climate regulation.

Business activity	Impact drivers	Examples of environmental assets affected	Examples of ecosystem services affected
Agricultural products, and meat, poultry and dairy			
Application of pesticides	Pollution/pollution removal: Soil pollutants.	• 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.	• Land; • Freshwater ecosystems; • Marine ecosystems.	• Genetic material; • Biomass provisioning; • Global climate regulation; • Soil quality regulation; • Water purification.

Business activity	Impact drivers	Examples of environmental assets affected	Examples of ecosystem services affected
Agricultural products, and meat, poultry and dairy			
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.	• Land; • Forests; • Freshwater ecosystems.	• Water supply; • Biomass provisioning; • Biological control; • Soil and sediment retention; • Water flow regulation; • Local (micro and meso) climate regulation; • Global climate regulation; • Water purification; • Air filtration; • Visual amenity services; • Education, scientific and research services; • Spiritual, artistic and symbolic services.
Packaging of food, procurement of plastic packaging composed of different polymer types	Pollution/pollution removal: Solid waste.	• Freshwater ecosystems; • Marine ecosystems.	• Genetic material; • Biomass provisioning; • Pollination; • Nursery population and habitat maintenance; • Water purification; • Recreation-related services; • Visual amenity services.

Business activity	Impact drivers	Examples of environmental assets affected	Examples of ecosystem services affected
Agricultural products, and meat, poultry and dairy			
Food processing	Pollution/pollution removal: Non-GHG air pollutants.	• Marine ecosystems; • Atmospheric systems.	• Global climate regulation.
Water withdrawal for irrigation, livestock watering, for food processing and cleaning	Resource use/replenishment: Water use.	• Freshwater ecosystems.	• Water supply; • Soil quality regulation; • Loal (micro and meso) climate regulation.

Source: Adapted from ENCORE.

E2

E2: Identification of dependencies and impacts

Guiding question:

What are our dependencies and impacts on nature?

Impacts on nature

Table 4 shows illustrative 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 extensively in this guidance, but the Taskforce recommends that organisations include this issue from the SASB Meat, Poultry and Dairy Standard if relevant to their business model and pay particular attention to animal welfare related issues of Concentrated Animal Feeding Operations (CAFOs). This is most relevant for the meat, poultry and dairy; processed foods; food retailers and distributors; and restaurants industries.

Table 4: Examples of impact pathways for the food and agriculture sector

SASB 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. Including commodities with high risk of conversion of grasslands and savannahs.	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. Increase in prevalence of zoonotic diseases.	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; • Meteorological data on rainfall distribution to capture changes to the water cycle; and • Acoustics monitoring to yield insights on changes in species abundance.
		Deforestation risk commodities.	% of natural vegetation preserved over sourcing area in endangered biome/ ecosystem.	Classify land cover types in sourcing area using Earth Observation or other types of available data.

SASB 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.[16]	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; • 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; and • Measurements of extent of wetted area and duration/seasonality of saturation.

16 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 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.[17]	Soil contamination.[18] Decline in insect populations incl. pollinators. Freshwater contamination. Drift of pesticides to surrounding water bodies and odour impairment.	Identify pesticide-intensive crops by, for example, using 2018 global sales values.[19] This information is mainly available furthest upstream. Source data from suppliers to account for toxicity hazard level of pesticides in the business model. To identify soil pesticide impacts on ecosystem services an organisation can: • Measure changes in freshwater provisioning available for irrigation; • Measure changes to nutrient and pathogen regulation and sequestration services;[20] and • Measure changes to soil structure and soil organic carbon content.

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

18 EEA (2023) How pesticides impact human health and ecosystems in Europe.

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

20 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 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 (surplus of N and P fertiliser)	Nitrogen and phosphorus intensive crops: • Maize; • Wheat; and • Rice.	Soil health degradation. Soil acidification. Eutrophication. Emissions to air including NH3 and odour impairment from organic fertiliser.	Identify nitrogen and phosphorus intensive commodities, for example, by using IFA fertiliser-use data to identify the most nitrogen and phosphorus-intensive crops and regions 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 6 includes more detail on nitrogen and phosphorus-intensive commodities.

SASB 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.[21]	Soil health degradation. Soil acidification. Eutrophication. Emissions to air of ammonia (NH_3) and nitrogen oxides (NO_x). Odour impairment.	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.

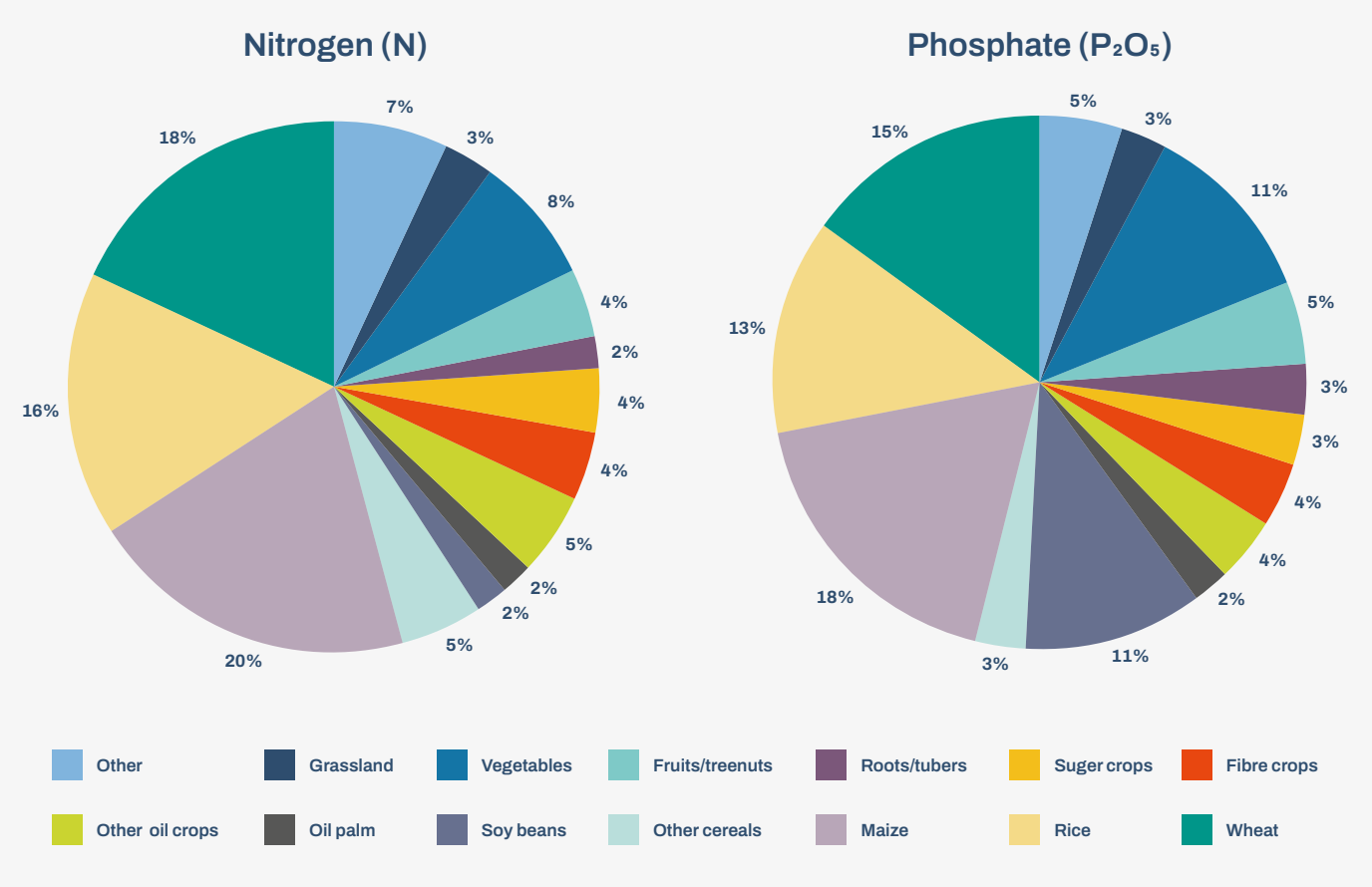
21 Uwizeye, A. et al. (2020) Nitrogen emissions along global livestock supply chains. Nature Food 1, 437–446.

SASB 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 and water pollutants	Distinguish whether the use of antibiotics is for therapeutic or non-therapeutic use. Key driver is when animals are routinely given antibiotics.	Soil health degradation. Water pollution.	Primary producers can measure antibiotics leakages to nature via testing of livestock urine and faeces. Food retailers and restaurants can test meat product for antibiotics residue. Use the degree of intensity of the livestock farming system in the supply chain to group suppliers according to those most at risk of overuse of antibiotics. Companies can use resources such as the Coller FAIRR Protein Producer Index Report.

SASB 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).[22]	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 jurisdiction. 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	Refer to IFRS S2 *Climate-related Disclosures*.		

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

Figure 6: Global nitrogen and phosphorous fertiliser usage by crop, based on global sales numbers



Source: IFA (2022) Fertilizer Use By Crop.

Dependencies on nature

Table 5 sets out common dependencies for this sector, linked to key commodities or production processes.

Table 5: Examples of dependency pathways for food and agriculture sector

SASB industry	Commodities or production processes linked to dependencies (not exhaustive)	Guidance to identify dependencies
Land		
Agricultural Products; Meat, Poultry & Dairy	Percentage of high-risk commodities sourced from newly deforested area over total sourcing of endangered biome/ecosystem.	Identify the specific high deforestation-risk commodities in the supply chain to identify impacts.
Water supply		
Agricultural Products	Water-intensive crops in order of decreasing intensity: Cotton, rice, sugar cane, soya bean, wheat, potatoes.[23]	Agricultural production accounts for 70% of water withdrawals worldwide.[24] 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.

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

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

SASB industry	Commodities or production processes linked to dependencies (not exhaustive)	Guidance to identify dependencies
Meat, Poultry & Dairy	Water use averages per kilogram of meat product (see Table 6 for comparison with water-intensive crops): • Beef: 15,415 litres; • Sheep: 9,000 litres; • Goat: 9,000 litres; • Pork: 6,000 litres; and • Chicken: 4,300 litres.[25]	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 7 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.[26]

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

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

SASB 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 2 provides a science-based ranking of crop dependency on pollination.[27]
Biological control		
Agricultural Products	Crops with high pathogen and pest sensitivity (P&P): • Maize; • Rice; and • Soya beans.[28]	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.[29]

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

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

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

SASB 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 & Dairy	Crop response to a weather-related stress varies according to growth stage. It may be useful to reference science-based crop-specific vulnerability curves.[30]	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).[31] 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 & 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.[32]	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.

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

31 FAO Map Catalogue.

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

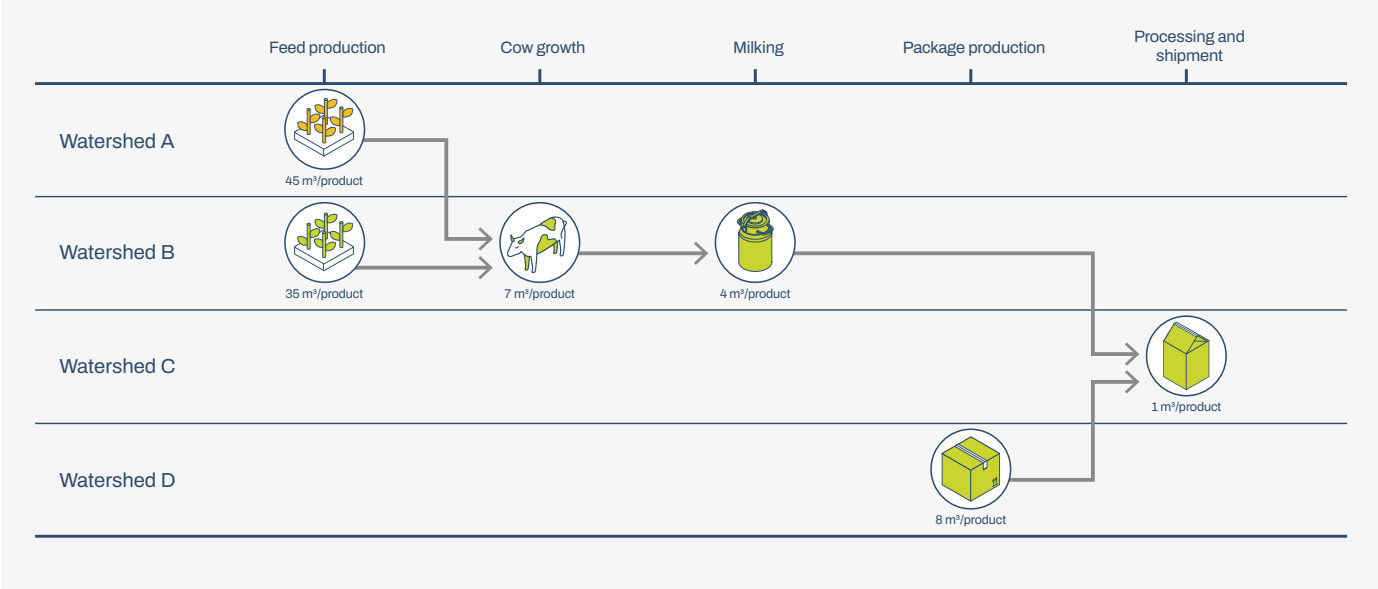
SASB industry	Commodities or production processes linked to dependencies (not exhaustive)	Guidance to identify dependencies
Fertile agricultural land		
Agricultural Products	Dependency arises from the need for nutrient-rich soils to ensure high quality and quantity of crop yield. Essential for cultivation of key agricultural commodities such as grains, vegetables and fruits.	Regular soil testing to assess nutrient levels, PH balance and organic matter content. This helps to determine the soil health and fertility status, guiding nutrient management plans. Review historical land use insights on past impacts on soil health. Engage with local farmers and agricultural experts to gather insights on soil health ad fertility management practices specific to the region.

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 7: Water use in livestock production and supply chains



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

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 and maintenance ecosystem services, such as soil quality regulation and water supply. Organisations will need to apply climate models to assess the influence of climate change on the ecosystem services upon which its production depends.

E3

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 refer to the TNFD's recommended food and agriculture disclosure indicators and metrics in Section 3.

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.
- 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.[33] 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 2). Thereafter, organisations can estimate the size of the dependency by the quantity of the crops procured.
- 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 S2 *Climate-related Disclosures*.

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

E4

E4: Impact materiality assessment

Guiding question:

Which of the identified impacts are material?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

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

2.4. 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

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 nature-related risks and opportunities in the food and agriculture sector

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

Risk and opportunity type		Examples of risks and opportunities
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.
		Increase in production and sourcing costs due to dependency on agricultural products (including meat, dairy and poultry) from areas with concentration of water pollutants.
		Increase in capital expenditure for mechanical and/or hand pollination due to decline in natural pollinators.
		Asset devaluation due to proportion of land with soil degradation.
		Costs associated with the relocation of agricultural operations and agricultural product suppliers due to lost productivity of agricultural land.
		Increase in capital expenditure on water purification and desalination technologies and soil cleaning technologies due to pollution concentration and water stress.
		Land asset depreciation due to pesticide land concentration/soil health condition and water chemical and nutrient concentration.
		Increased climate hazard insurance costs due to decreased climate and hazard regulating ecosystem services (storm regulation, local (micro and meso) climate regulation, flood mitigation, soil and sediment retention etc).
		Reduction in yield in areas with low to no natural pest control and declining pollinator abundance.

Risk and opportunity type		Examples of risks and opportunities
Transition risk	Policy and legal	Increased costs due to food sector GHG emission reduction targets (e.g. change in fodder costs to lower methane emissions).
		Increase in compliance costs due to dependency on forest risk commodities exposed to jurisdictions with regulatory restrictions.
		Increase in fines due to failure to meet regulatory limits on pesticide/ antibiotics/ fertiliser use and/or nitrogen efficiency requirements.
		Increased transition risk rating leading to higher costs of capital.
		Risk of inability to transition to regenerative agriculture if all costs are carried by the primary producer with no broader value chain participation.
		Increased costs due to extended product responsibility regulation to pay for plastic pollution clean-up from food waste packaging leakage.
		Permit denials as a result of failure to meet legally binding targets to reduce food waste.
		Early retirement of food processing machinery based on banned types of plastic packaging.
		Loss of licence to operate in markets with regulatory requirements on deforestation-free food sector commodities.
		Costs of substituting from virgin to recycled food packaging/costs of changing to regenerative farming practices due to regulation.
		Costs of relocating production and/or sourcing areas due to expansion of protected area.
		Loss of operating area due to collective land rights claims by Indigenous Peoples and Local Communities.
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.
		Increased operational costs to transition to systems that enable reduced food loss and waste.

Risk and opportunity type		Examples of risks and opportunities
Transition risk	Market	Market share loss due to slow adoption of environmentally friendly plastic packaging.
		Adoption of biodiversity net gain requirements.
		Market share loss due to increasing consumer preferences for food produced via regenerative practices and/or for plant based, sustainably produced protein.
Transition risk	Reputation	Loss in revenue due to reputational damage caused by business contamination of ground water, eutrophication, plastic pollution, deforestation and/or emissions.
Opportunity	Resource efficiency	Full traceability of ingredients with high-risk exposure to embodied nature related risks reduce certification and compliance costs.
		Reduction in input costs as a result of investment into precision farming technologies.
		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).
		Percentage reduction in input costs due to increased rate of recycling (plastics, nutrients, water etc.).
		Increasing market demand for sustainable protein leads to increased profit and business growth.
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).
		Increase in revenue due to increase in sustainably certified food and agricultural product offerings.
		Increase in revenue from participation in biodiversity-relevant tradable permit schemes.
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.
		Increase in food company green debt based on below market interest rates.
Opportunity	Reputation	Increase in consumer brand loyalty due to brand positioning as low to no negative nature footprint food company e.g. leader in rainforest conservation/fighting deforestation.

A2

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?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

A3

A3: Risk and opportunity measurement and prioritisation

Guiding question:

Which risks and opportunities should be prioritised?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

A4

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?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

2.5. Prepare to respond and report

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

P1

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.

Food and agriculture sector organisations can also reference the Nature Action developed collaboratively by Business for Nature, WEF and WBCSD. It contains relevant information for companies to prioritise key actions, including a Roadmap to Nature Positive: Foundations for the agri-food system, which is particularly relevant for the row crop commodities sub-sector.

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

Response category	Response option	Source
Governance	Undertake an annual strategic review of 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.	*Agricultural Products* SASB Standard (2023), FB-AG430a.3
	Establish a strategy to ensure that suppliers conform to social and environmental responsibility audits and correct major and minor non-conformances.	*Agricultural Products* SASB Standard (2023), FB-AG430a.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.	*Processed Foods* SASB Standard (2023)
	Ensure procurement departments are aware of traceability needs (can potentially use negotiation clauses) and value suppliers that have systems in place to manage the traceability of their supply chain.	TNFD
	Develop a strategy to discuss sourcing risks, due to environmental and social considerations, from a list of priority food ingredients.	*Processed Foods* SASB Standard FB-PF-440a.2
	Adopt sourcing practices that require that ingredient value chain suppliers engage in mitigation measures to manage water risks.	TNFD
	Use supplier contracts that stipulate that ingredient suppliers need to have a company policy that states it will prohibit the use of pesticides banned by the World Health Organization or the Food & Drug Administration.	TNFD

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 (2022); SBTN targets for land (2024)
	Create a plan with time-bound targets for the reduction of land footprint and increase land use efficiency from own production and sourcing of agricultural produce. (See Science Based Targets Network for more on land-based target setting).	SBTN Land footprint reduction (2024)
	Set landscape-level targets for key supply sheds and sourcing regions to enable regenerative, restorative and transformative actions in collaboration with primary producers and key supply chain participants.	Adapted from SBTN Landscape engagement (2024)
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 (2022); Agricultural Products SASB Standard, FB-AG440a.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 (2022)
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 breeds 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).	*Agricultural Products* SASB Standard (2023)
	Implement strategy and practices to manage risk of invasive species already introduced into the region of the company area of operation.	TNFD

Human rights and engagement with Indigenous Peoples, Local Communities and affected stakeholders for all value chain participants		
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 customary rights 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
	Develop an approach to verifying impacts on Indigenous Peoples on the ground, including through consultation with impacted communities.	TNFD
DIRO management	Establish an operational-level grievance mechanism in consultation and collaboration with relevant stakeholders.	FAO-OECD (2016)
DIRO management	Track share of suppliers screened for compliance and respect for the right to Free, Prior and Informed Consent and share of suppliers not able to verify that IPLCs were not negatively impacted.	TNFD

Water		
Strategy	Establish (science-based) targets to reduce your pressures on freshwater, including water quantity targets on a reduction of your water withdrawals from surface and groundwater sources, and water quality targets on reductions of nutrient loading (nitrogen and phosphorus) to freshwater systems.	SBTN freshwater quantity and quality targets (2024)
	Establish a water management plan with clear targets for reducing emissions to water of key pollutants, including NOx, SOx, 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.	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 postconsumer recycled content, and ensure plastic packaging is reusable, recyclable or compostable.	Adapted from *Processed Foods* SASB Standards (2023); UNEP & Ellen MacArthur Foundation (2018); related to GBF target 16
	Invest in plastic recycling technologies and infrastructure and plastic reuse solutions.	TNFD

P2 P2: Target setting and performance management

Guiding question:

How will we set targets and define and measure progress?

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach, which includes additional guidance on target setting in this component P2.

Organisations may wish to refer to the target-setting methods developed by the Science Based Targets Network and the summary guidance on SBTN's methods for setting science-based targets for nature, which the TNFD has co-developed with the Science Based Targets Network (SBTN).

Food and agriculture sector organisations wishing to set targets may find it useful to consider:

- Leveraging SBTN methods for setting science-based targets for nature related to water quality, water quantity, zero conversion, land footprint and landscape engagement.
- The WWF water risk filter to identify priority regions for target setting for water related targets.
- 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;
- Deforestation-free target: No deforestation for primary deforestation-linked commodities (see glossary for definition of deforestation and more specifications);[34] 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 P3: Reporting

Guiding question:

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

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

P4 P4: Presentation

Guiding question:

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

As for all components, refer to the Guidance on the identification and assessment of nature-related issues: The LEAP approach.

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

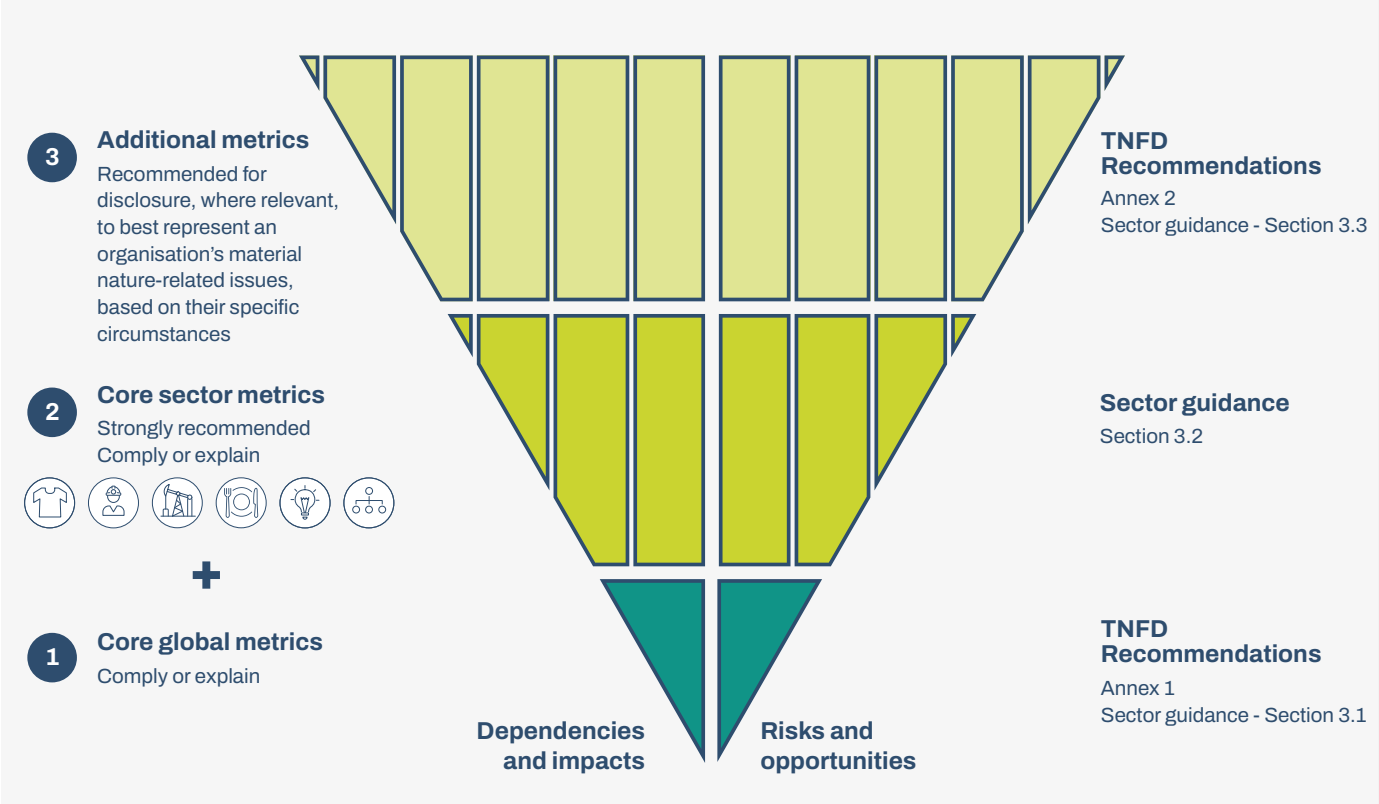
3. Sector-specific disclosure metrics and related guidance – food and agriculture

Sector-specific metrics form an important part of the TNFD's measurement architecture (see Figure 9). This reflects the diversity of business models across value chains and their interface with nature across and within sectors. Sector-specific metrics help financial institutions to compare organisations within the same sector, which often face similar nature-related issues.

This section provides the TNFD sector-specific metrics for the food and agriculture sector. It includes:

- Guidance on the application of the core global disclosure indicators and metrics to the food and agriculture sector (Section 3.1); and
- Core and additional disclosure indicators and metrics for the food and agriculture sector (Sections 3.2 and 3.3).

Figure 9: TNFD disclosure measurement architecture



Where available, the TNFD's recommended metrics for disclosure draw from a range of existing standards and frameworks including the IFRS Sustainability Disclosure Standards, Sustainability Accounting Standards Board (SASB) Standards – in particular Agricultural Products, Processed Foods, Meat, Poultry & Dairy, Food Retailers & Distributors, GRI Standards – in particular the GRI Sector Standard for Agriculture, Aquaculture and Fishing (GRI 13), the CDP disclosure platform, the Kunming-Montreal Global Biodiversity Framework and other relevant UN frameworks, ESRS and others. A number of organisations, including standard-setting organisations, continue to work on identifying relevant sector-level assessment and reporting metrics. The Taskforce recommends that report preparers stay engaged with year-on-year progress on these developments and implement the latest definitions within their risk management processes and disclosures. The TNFD is working closely with standard-setting organisations and others and will periodically update this guidance on recommended sector metrics for disclosure in line with these ongoing initiatives.

Organisations in the food and agriculture sector should refer to Annex 1 of the TNFD Recommendations for further information on the core global disclosure metrics. As outlined in the TNFD Recommendations, core global disclosure metrics should be reported on a comply or explain basis, with the exception of the placeholder metrics.

Where organisations are unable to report against any of the core global metrics, they should provide a short explanatory statement as to why they have not reported those metrics. An organisation should report on the core global disclosure metrics unless:

- It has not been identified as relevant and material to the organisation, e.g. not relevant to business activities or the location the organisation is operating in, or not found to be a material issue for the organisation; or
- It has been identified as relevant and material, but the organisation is unable to measure it due to limitations with methodologies, access to data or because the information is commercially sensitive. In this case, organisations should explain how they plan to address this in future reporting periods.

Companies should report on the same basis for the core sector disclosure metrics outlined in Section 3.2.

Organisations are also encouraged to draw on the TNFD additional sector disclosure indicators and metrics outlined in Section 3.3 and any other relevant metrics to represent most accurately the organisation's nature-related dependencies, impacts, risks and opportunities.

1 Core global metrics

3.1. Guidance on the application of the core global disclosure metrics

This section provides guidance, where relevant, on how to apply the TNFD core global disclosure metrics in the food and agriculture sector. If no further sector specific guidance is provided, organisations should refer to the core global disclosure metrics.

As outlined above, core global disclosure metrics should be reported on a comply or explain basis following the guidance for the food and agriculture sector where provided.

For the placeholder indicators on invasive alien species and the state of nature, the TNFD encourages organisations to consider and report against these indicators where possible, but are not expected on a comply or explain basis. There are not yet widely accepted metrics for these indicators, but the Taskforce recognises their importance, and will continue to work with knowledge partners to develop further guidance on these metrics.

Table 10: Guidance on the application of the core global disclosure metrics

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
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 disturbed area (km^2); and • Total rehabilitated/restored area (km^2).	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** In reporting this core global disclosure metric, an organisation should include: • Total surface area controlled/managed or sourced from (km^2); • Total disturbed area (km^2); and • Total rehabilitated/restored area (km^2).	TNFD

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Land/ freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ ocean-use change	Extent of land/freshwater/ ocean ecosystem use change (km^2) by: • Type of ecosystem;[35] and • Type of business activity.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** In reporting this core global disclosure metric, and organisation should include: • Agriculture-driven terrestrial natural ecosystem conversion, including, at least, conversion of primary forests, other naturally regenerating (second growth) forests, savannahs, grasslands, and freshwater natural ecosystems, linked to land owned, leased, operated, financed or sourced from. An organisation may provide information additional to the IUCN Global Ecosystem Typology (GET) to define the type of ecosystem they refer to, such as regional or local classifications.	TNFD

35 When disclosing on extent of ecosystem types users should refer to the International Union for Conservation of nature Global Ecosystem Typology.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Land/ freshwater/ ocean-use change	C1.1	Extent of land/ freshwater/ ocean-use change	Extent of land/freshwater/ ocean ecosystem conserved or restored (km^2), split into: • Voluntary; and • Required by statutes or regulations.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** In reporting this core global disclosure metric, an organisation should include: • Area of forest conserved and/or reforested in direct operations and in the supply chain of the organisation, noting if it is in a way that is likely beneficial to wildlife (e.g. with native plantations); • Area of wetlands conserved and/or rewetted in direct operations and supply chain of the organisation; • Area of savannah conserved and/or restored in direct operations and supply chain of the organisation; and • Area of grassland conserved and/or restored in direct operations and supply chain of the organisation. An organisation should report area conserved and restored separately, if data is available.	GBF Target 1 and Target 2 (2022); GBF Target 10 (2022); SBTN (2023); Adapted from CDP (2022) F15a; AFi (2022)

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Land/ freshwater/ ocean-use change	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;[36] and • Type of business activity.	**Agricultural products; Meat, poultry and dairy; Processed foods; Food retailers and distributors; Restaurants.** In reporting this core global disclosure metric, an organisation should include: • The extent covered by landscape-level initiatives that the company contributes to, including the financial contribution of the company; and • Land managed or sourced from that deploys practices with measurable regenerative outcomes, including the definition of regenerative agriculture used for disclosure. Regenerative agricultural practices may be considered to have started when a baseline has been undertaken for the corporation to track regeneration of environmental assets.	GBF Target 1 and Target 2 (2022); GBF Target 10 (2022); SBTN (2023); Adapted from CDP (2022) F15a; AFi (2022)

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

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/ pollution removal	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.** Downstream actors can use estimated figures based on volume purchased and public factors of calculation. Public factors of calculation cover data points of average impacts e.g. average pesticide use per crop for a given jurisdiction, using data from national statistical offices or international agencies such as FAO FAOSTAT data. In reporting this core global disclosure metric, an organisation should 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[37]: • Nitrogen input from livestock manure and fertilisers; and • Nitrogen output. • Phosphorus balance: • Phosphorus input; • Phosphorus output; and • If relevant, balances for potassium and other nutrients (e.g. micronutrients). **For meat, poultry and dairy,** include use and release of antibiotics including disclosure of antibiotics type. **Processed foods; Food retailers and distributors; Restaurants** No further sector specific guidance; refer to the core global disclosure metric.	GBF Target 7 (2022); GRI 13 (2022); WHO (2017); OECD (2023)

37 It is recognised that N and P are nutrients and only become pollutants when applied in excess.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/ pollution removal	C2.1	Wastewater discharged	Volume of water discharged (m^3), split into: • Total; • Freshwater; and • Other.[38] 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** In reporting this core global disclosure metric, an organisation can use estimated figures based on volume purchased and public factors of calculation. Public factors of calculation cover data points of average impacts e.g. average pesticide use per crop for a given jurisdiction, using data from national statistical offices or international agencies such as FAO FAOSTAT data. In reporting volume of wastewater discharged for this core global disclosure metric, an organisation should include water discharged from crop product processing facilities and/or animal processing facilities. Pollutants to report under this core global disclosure metric include: • Nutrients (nitrogen and phosphorus);[39] • 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)

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

39 Agricultural water pollutants in wastewater should only include pollutant concentrations measured in cleaning and operations wastewater discharged from farms, livestock cleaning operations, processing plants, factories etc., and should not include agricultural runoff concentrations.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/ pollution removal	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. Weight 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 this 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 Standard (2023) Disclosure FB-FR-150a.1; FAO (2021); GBF Target 16 (2022); UNEP (2021)

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/ pollution removal	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 the raw material content.[40] For plastic packaging, percentage of plastics that is: • Re-usable; • Compostable; • Technically recyclable; and • Recyclable in practice and at scale.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

40 When disclosing on raw material content users should use: % of virgin fossil-fuel feedstock; % of post-consumer recycled feedstock; % of post-industrial recycled feedstock; % of virgin renewable feedstock.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Pollution/ pollution removal	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** In reporting this core global disclosure metric, an organisation can use estimated figures based on volume purchased and public factors of calculation. Public factors of calculation cover data points of average impacts, using data from national statistical offices or international agencies such as FAO FAOSTAT data.	TNFD
Resource use/ replenishment	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** Reporting of water withdrawal and consumption under this core global disclosure metric should include: • Water withdrawal from areas of high water scarcity to produce a tonne of crop and/or product dry matter and/or animal protein; and • Consumption of recycled wastewater. An organisation should separately state the volume of water used for irrigation.	TNFD

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.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Resource use/ replenishment	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 sector specific guidance; refer to the core global disclosure metric.	SASB Standard (2023) Disclosures FB-AG-250a.2, FB-MP-440a.1, FB-PF-440a.1; GBF Target 11 (2022)
Resource use/ replenishment	C3.1	Quantity of high-risk natural commodities sourced from land/ ocean/ freshwater	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.** In reporting this core global disclosure metric, an organisation should also express the metric as a percentage of all agricultural products, by certification programme.	SASB Standard (2023) Disclosure FB-AG-250a.2; GBF Target 11 (2022)

43 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL), species listed as vulnerable, endangered or critically endangered on the IUCN red list, and species listed in appendix I, II and III of CITES.

44 Users should refer to the Science Based Targets Network (SBTN) High Impact Commodity List (HICL), species listed as vulnerable, endangered or critically endangered on the IUCN red list, and species listed in appendix I, II and III of CITES.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Invasive alien species and other	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.	No further sector specific guidance; refer to the core global disclosure metric.	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'.

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
State of nature	C5.0	Placeholder indicator: Ecosystem condition	For those organisations that choose to report on state of nature metrics, the TNFD encourages them to report the following indicators, and to refer to the TNFD additional guidance on measurement of the state of nature in Annex 2 of the LEAP approach: • Level of ecosystem condition by type of ecosystem and business activity; • Species extinction risk. There are a number of different measurement options for these indicators. The TNFD does not currently specify one metric as there is no single metric that will capture all relevant dimensions of changes to the state of nature and a consensus is still developing. The TNFD will continue to work with knowledge partners to increase alignment.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
State of nature	C5.0	Placeholder indicator: Species extinction risk	For those organisations that choose to report on state of nature metrics, the TNFD encourages them to report the following indicators, and to refer to the TNFD additional guidance on measurement of the state of nature in Annex 2 of the LEAP approach: • Level of ecosystem condition by type of ecosystem and business activity; • Species extinction risk. There are a number of different measurement options for these indicators. The TNFD does not currently specify one metric as there is no single metric that will capture all relevant dimensions of changes to the state of nature and a consensus is still developing. The TNFD will continue to work with knowledge partners to increase alignment.	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

Driver of nature change/Other metric category	Metric no.	Core global indicator	Core global metric	Guidance for sector	Source
Climate change		GHG emissions	Refer to IFRS S2 Climate-related Disclosures	No further sector specific guidance; refer to the core global disclosure metric.	TNFD

2 Core sector metrics 

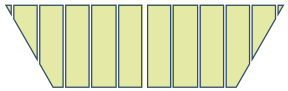
3.2. Core sector disclosure indicators and metrics

The TNFD core sector disclosure metrics for the food and agriculture sector are outlined below. These metrics are recommended by the TNFD to be disclosed by all report preparers in the sector on a comply or explain basis.

Table 11: Core sector disclosure indicators and metrics

Metric category	Metric subcategory	Metric no.	Indicator	Core sector metrics	Source
Impact driver	Land/freshwater/ ocean-use change	FA.C1.0	Deforestation and conversion-free products	Proportion (%) of production volume from land controlled, managed or sourced from that is determined to be deforestation- and conversion-free (DCF), by product.	AFi, CDP, CGF FPC, SCF, Soy 1.5c Roadmap
Impact driver	Resource use/ replenishment	FA.C3.0	Products from areas of water scarcity	Proportion (%) 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-PF440a.1 (2023)
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	FA.C23.0	Food waste repurposed	Proportion (%) of food waste repurposed into by-products and/or co-products.	Adapted from SASB FB-FR-150a.1 (2023); FAO (2021); GBF Target 16 (2022); UNEP (2021)

3 Additional metrics



3.3. Additional sector disclosure indicators and metrics

The TNFD additional sector disclosure metrics for the food and agriculture sector are outlined below. The TNFD encourages all report preparers in the sector to draw on these and any other relevant metrics where relevant to best represent an organisation's material nature-related dependencies, impacts, risks and opportunities.

Table 12: Additional sector disclosure indicators and metrics

Metric category	Metric subcategory	Metric no.	Indicator	Additional sector metrics	Source
Impact driver	Invasive alien species and other	FA.A4.0	Medically important antimicrobials in animal production	Proportion (%) of animal production or animal protein sourced that receives 1) medically important antimicrobials and 2) not medically important antimicrobials, by animal type.	*Meat, Poultry & Dairy* SASB Standard (2023)
Impact driver	Land/freshwater/ ocean-use change	FA.A1.0	Land use efficiency	Land use efficiency (ha land/kg of product).	SBTN (2023)
Impact driver	Land/freshwater/ ocean-use change	FA.A1.1	Supply chain area with native vegetarian	Proportion (%) of supply chain area with native vegetation over sourcing areas from sensitive locations.	TNFD
Impact driver	Pollution/pollution removal	FA.A2.0	Food loss/waste	Food loss and/or waste as a proportion of total food produced/ handled (%). Proportion of food loss and/or waste diverted from landfill (%).	Adapted from *Restaurants* SASB Standard (2023)

Metric category	Metric subcategory	Metric no.	Indicator	Additional sector metrics	Source
Impact driver	Pollution/pollution removal	FA.A2.1	Nitrogen use efficiency	Nitrogen use efficiency (NUE), ratio of total N inputs and total N outputs to produce a crop, animal product or agrifood product.	Adapted from GRI 13 (2022); WHO (2017)
Impact driver	Pollution/pollution removal	FA.A2.2	Waste	Weight (tonnes) of non-plastic packaging (primary, secondary and tertiary packaging) for food products by entity by packaging type.	Adapted from *Processed Foods* SASB Standard (2023)
Impact driver	Pollution/pollution removal	FA.A2.3	Water pollutant loading rate	Water pollutant loading rate (tonnes of pollutant/month). Reporting should include 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)
Impact driver	Pollution/pollution removal	FA.A2.4	Water pollution	Volume of wastewater reused (m^3).	Adapted from *Agricultural Products* SASB Standard (2023)
Impact driver	Pollution/pollution removal	FA.A2.5	Water pollution	Volume of water discharged (total, freshwater, other) per tonne of crop and/or product dry matter and/or animal protein (m^3/tonne).	TNFD
Impact driver	Pollution/pollution removal	FA.A2.6	Water use efficiency	Water Use Efficiency (WUE) calculated as net value added per volume of water use (currency/m^3).	FAO (2021)
Impact driver	Resource use/ replenishment	FA.A3.0	Crop yield	Actual and potential yield (kg/km^2), and yield gap, by type of crop.	GYGA (2022)

Metric category	Metric subcategory	Metric no.	Indicator	Additional sector metrics	Source
Response	Dependency, impact, risk and opportunity management: Value chain	FA.A22.0	Products sourced using environmental life cycle assessment	Proportion (%) of products sourced that have an environmental life cycle assessment.	TNFD
Response	Dependency, impact, risk and opportunity management: Changes to nature (dependency and impact): mitigation hierarchy steps	FA.A23.0	Recycled, renewable and compostable non-plastic packaging	Proportion (%) of total sourced and purchased non-plastic packaging made from 1) recycled materials, 2) renewable materials, 3) compostable materials. For each material used, proportion (%) that is recycled, reused and composted according to local laws and regulations.	Adapted from *Processed Foods* SASB Standard (2023)
State of nature	Ecosystem condition	FA.A5.0	Coastal and freshwater eutrophication	Coastal and freshwater eutrophication; plastic debris density; Chlorophyll-A concentration; In-situ concentration of nitrogen, phosphate and silica.	GBF draft monitoring Framework (2022)
State of nature	Ecosystem Condition	FA.A5.1	Cropland with natural vegetation	Prorportion (%) of cropland controlled, managed and/or sourced from with at least 10% natural vegetation per 1 km^2 cultivated area. Proportion (%) of such land with more than 20% natural vegetation per 1 km^2 cultivated area.	GBF Target 10 (2022); Jones et al. (2021)
State of nature	Ecosystem condition	FA.A5.2	Land with soil degradation	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)

Metric category	Metric subcategory	Metric no.	Indicator	Additional sector metrics	Source
State of nature	Ecosystem condition	FA.A5.3	Litter in the water column	Volume (tonnes) of litter in the water column and on the seafloor, including microplastics.	TNFD
State of nature	Ecosystem condition	FA.A5.4	Pesticide toxicity levels	Volume (kg) and concentration (kg/m^3) of pesticides, by pesticide and toxicity level (1, 8, 16 and 64 for low risk, normal, more hazardous and non-approved substances).	UNEP WCMC (2021); GBF draft monitoring Framework (2022)
State of nature	Ecosystem condition	FA.A5.5	Soil antimicrobial residue	Antimicrobial residue in the soil (nano/milligrams per kilogram of soil).	TNFD
State of nature	Ecosystem condition	FA.A5.6	Soil compaction	Soil bulk density, measured as the ratio of a soil's dry mass and its volume (g/cm^3).	FAO (2023)
State of nature	Ecosystem condition	FA.A5.7	Soil organic carbon stocks	Soil organic carbon (tC).	GBF draft monitoring Framework (2022)

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Annex 1: High deforestation risk derived products

Table 13: 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 2: Pollinator dependency ranking

Table 14: 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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